



Business Dynamics and Productivity



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Preface

A dynamic business environment plays an important role not only as a key driver of job creation but also as an engine of productivity growth. A growing body of research highlights significant differences in business dynamics across countries and over time, in particular over the different phases of the business cycle. However, our understanding of these differences remains patchy, and this makes it more difficult for policy makers to implement economically efficient policies.

This collection of studies aims to fill this gap by providing new evidence on business dynamics from a cross-section of countries of different sizes, with different market and structural characteristics, and which are at different stages in their development process. The studies focus in particular on Belgium, Brazil, Canada, Costa Rica, Japan, New Zealand, Norway and the United Kingdom, shedding new light on how firms which differ in terms of their size, age, sector and other characteristics, respond to economic shocks, with a particular focus on differences in their responses to the last decade's global financial crisis. Evidence collected in this volume also aims to provide a better understanding of the contribution of business dynamics to aggregate productivity and of the effects of economic policies across different firms and countries. Thus, it will help policy makers design better policies, harnessing productivity and employment growth in support of more inclusive and sustainable societies.

The work presented here is part of a broader effort by the OECD to provide evidence on business dynamics and productivity from firm-level data, drawing on a variety of methodologies. In particular, the OECD is leading two projects – DynEmp and MultiProd – that use countries' representative firm-level data to conduct comparable cross-country analysis on employment dynamics and productivity. This study draws on the insights of this research, providing not only cross-country comparability but also the opportunity to dig deeper than aggregate or sectoral averages to uncover differences across firms, describe productivity and employment distributions, and analyse heterogeneous impacts of policies. At the leading edge of these new approaches, the OECD has a valuable role to play in helping to strengthen the empirical analysis in support of better policies.

The pages which follow are an important step in that direction, which leverages the expertise of the DynEmp and MultiProd network members. This collaborative and forward-looking work will help policymakers design better policies by harnessing productivity and employment growth in support of more inclusive and sustainable societies.



Angel Gurría
OECD Secretary-General

Foreword

This volume is part of a wider effort led by the OECD Directorate for Science, Technology and Innovation to provide new cross-country evidence on employment dynamics and productivity based on firm-level micro-data. In this context, the OECD is co-ordinating two distributed micro-data projects – DynEmp and MultiProd – that rely on micro-aggregated data from a broad cross-section of countries for comparable cross-country analyses on employment dynamics and productivity, respectively (see www.oecd.org/sti/DynEmp.htm and www.oecd.org/sti/ind/MultiProd.htm). The innovative methodology applied by the OECD allows for the collection and analysis of harmonised data based on confidential administrative sources or official representative surveys. Both DynEmp and MultiProd rely on the active participation of a network of national experts who have expertise in these different areas and who have access to the relevant micro-data sources in their respective countries.

The projects allow for the assessment of the effects of national policies and framework conditions on different firm-level outcomes. On the one hand, the cross-country dimension of the project overcomes one of the great shortcomings of studies which rely on data from a single country, namely the relatively limited variation in policy settings. On the other hand, unlike cross-country studies that concentrate on outcomes at higher levels of aggregation, the methodology allows for the analysis of the heterogeneous responses of different economic actors to the very same policy settings. The OECD has a particularly important role to play in helping to bridge this gap. The distributed micro-data approach offers a unique chance for building and exploiting longitudinal databases, and for going beyond cross-sectional cross-country comparisons or aggregate industry-level analysis. In this framework, DynEmp and MultiProd allow for the generation of data suitable for analysing specific economic policy questions at different levels of aggregation (sectoral, geographical, or based on the size and age of firms).

However, DynEmp and MultiProd, by their very nature and to ensure comparability, have to combine the availability of data in the majority of the participating countries with a shared interest in the policy questions under investigation. For this reason, this book builds upon the great expertise of the DynEmp network's members in order to push further the boundaries of the DynEmp project, focusing on three different directions: data needs, methodology, and – most importantly – policy questions.

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Table of contents

Executive summary	15
List of acronyms and abbreviations	18
Chapter 1. Assessing the links between business dynamics and policy settings	21
Introduction.....	22
Going beyond the average firm paradigm.....	24
Organic versus non-organic growth.....	27
The impact of the crisis on employment stocks, flows and business dynamics ..	28
The role of sectors, ownership and trade status for job creation and destruction and business dynamics	30
Business dynamics, reallocation and productivity	31
References	33
Chapter 2. Employment growth of establishments in the Brazilian economy:	
Results by age and size groups	35
Introduction.....	36
Data.....	38
The plant employment dynamics over their life cycle	39
The “missing middle” and establishment size distribution in Brazil	46
Conclusions	54
Notes.....	55
References	56
Annex 2.A1. Complementary data	57
Annex 2.A2. Methodological details	58
Chapter 3. The role of mergers and acquisitions in employment dynamics in Belgium ..	59
Introduction.....	60
Data section.....	61
Organic growth versus growth through acquisition	65
Employment effects of M&As	69
The probability of acquisition.....	77
Conclusions	82
Notes.....	83
References	85
Chapter 4. Firm and job dynamics in the United Kingdom before, during and after the global financial crisis: Getting in under the hood	87
Context, motivation and approach	88
Data sources and construction.....	89

Accounting for continuing firms and their jobs.	90
The facts of firm and job dynamics, 1998-2014	93
Some counterfactual calculations for the GFC period.	102
What have we learned?	106
Notes.	107
References	108
Chapter 5. Cyclical labour market adjustment in New Zealand: The response of firms to the global financial crisis and its implications for workers.	111
Introduction.	112
Labour market resilience.	113
Recent cyclical variation in New Zealand	115
Data.	122
Microeconomic sources of aggregate adjustment	124
Conclusions	137
Notes.	138
References	139
Chapter 6. Employment dynamics in Costa Rica after the global financial crisis.	143
Introduction.	144
A stable economy relying on open markets, still adapting to new industrial dynamics	145
Data and methodological approach.	150
Findings	155
Conclusions	160
Notes.	162
References	162
Annex 6.A1. Unemployment rate by skills level, 2010-15	164
Annex 6.A2. Technical note: Estimation of long-term or structural unemployment rate ..	165
Annex 6.A3. Estimated values and statistic tests from unemployment equation.	166
Annex 6.A4. Unemployment structure by type, 2011-15	167
Annex 6.A5. Resulting final sample	168
Annex 6.A6. List of variables	169
Annex 6.A7. Share of employment by economic activity	170
Chapter 7. The growth of Canadian firms: Evidence using different growth measures ..	171
Introduction.	172
Models of firm growth	173
Data.	175
Methodology	177
Results	178
Conclusions	185
Notes.	186
References	187
Annex 7.A1. Full median VAR regressions by size and age	188

Chapter 8. Employment dynamics and labour productivity growth in the Norwegian economy: Evidence from firm-level data	191
Introduction.....	192
Productivity growth decompositions.....	192
Data.....	196
Productivity growth in the Norwegian mainland economy 1996-2014.....	196
Conclusions.....	203
Notes.....	204
References.....	204
Annex 8.A1. Proofs and supplementary figures	205
Chapter 9. Employment and productivity dynamics during economic crises in Japan ...	211
Introduction.....	212
Economic crises in Japan over three decades.....	213
Firm-level reallocation and crises.....	215
Conclusion.....	222
Notes.....	222
References.....	222

Tables

2.1. Actual minus predicted shares of the establishment size distribution for the whole formal sector for 2013.....	52
2.2. Actual minus predicted shares of the establishment size distribution: Manufacturing sector, 2013.....	52
2.3. Actual minus predicted employment shares for the whole formal sector for 2013.....	53
2.4. Actual minus predicted employment shares for the manufacturing sector for 2013.....	53
2.5. Actual minus predicted shares of establishment size and employment share distributions for the whole formal sector and the manufacturing sector for 2013.....	54
3.1. Top ten industries with the highest share of firms involved in a deal, 2001-14.....	64
3.2. Share (% of total number of firms/employment) of target and acquiring firms, 2001-14.....	64
3.3. Age distribution of target and acquirer in M&A deals involving Belgian firms in percentage, 1997-2015.....	65
3.4. Net job creation (absolute values and as share of total employment) of Belgian firms by age and M&A status, 2002-14.....	67
3.5. Belgian firms involved in acquisitions as a share of high growth Belgian firms in percentage.....	68
3.6. Status of Belgian target firms, 1997-2015.....	70
3.7. Employment growth of Belgian target firms, 2001-14.....	72
3.8. Employment growth of Belgian target firms (not dissolved) by type of deal, 2001-14.....	72
3.9. Employment growth of Belgian target firms before and after acquisition by age group.....	73

3.10. Employment growth of Belgian target firms before and after acquisition by Pavitt category	74
3.11. Employment growth of Belgian acquiring firms before and after acquisition, 2001-14.	76
3.12. Employment growth of Belgian acquiring firms before and after acquisition, 2001-14.	76
3.13. Probability of a Belgian firm being acquired, 2006-14.	79
3.14. Probability of a Belgian firm acquiring another firm, 2006-14	80
5.1. Maximum cumulative decline in output and employment.	117
5.2. Grouping of ANZSIC96 industries	121
5.3. Changes in job and worker flows	125
5.4. Decomposition of growth in employment and wages	128
5.5. Changes in industry means	132
5.6. Modelling worker flows conditional on employment growth: Regression results	132
5.7. Modelling the response to output shocks: Regression results	133
5.8. Firm and industry characteristics conditional on output shocks.	134
5.9. Firm and industry characteristics conditional on employment change	135
6.1. Descriptive statistics of firms by size	152
6.2. Average age and condition of activity of firms, by size and year	152
7.1. Unconditional growth rates: summary statistics	178
7.2. Quantile regression: results at the median, all firms	179
7.3. Select median regressions, by firm employment	181
7.4. Select median regressions, by firm age	182
7.5. Select regressions at the 10th and 90th quantile, by firm employment	183
7.6. Select regressions at the 10th and 90th quantile, by firm age.	184
9.1. Number of firms: manufacturing industries	217
9.2. Number of firms: non-manufacturing industries	218
9.3. Reallocation effects and economic crisis	220
9.4. Reallocation effects and economic crisis by sector.	221

Figures

1.1. Young firms have higher employment growth rates	25
1.2. Average employment level by firm age.	26
1.3. Across countries the average start-up employs less than ten employees.	26
1.4. Most micro start-ups remain micro-firms five years after entry	27
1.5. Job creation, job destruction and churning rate	29
2.1. Average employment level by age of establishment.	39
2.2. Average employment level by age of establishment and size of establishment at birth	40
2.3. Age effect on plant size using decomposition method	41
2.4. Year and cohort effects on plant size using the decomposition method	41
2.5. Age effect on plant size according to decomposition method: Results by establishment birth size	42
2.6. Average employment level by age of establishment: Surviving and closing plants.	43

2.7. Average employment level at birth and death by age of establishment at death	43
2.8. Mortality rate by age of establishment	44
2.9. Age effect in the relative number of plants according to decomposition method: Results by establishment birth size	44
2.10. Average employment growth rate	45
2.11. Unimodality and missing middle	48
2.12. Distribution of establishment size by number of employees, 2013	49
2.13. Employment share by establishment size, 2013	50
3.1. Number and value of worldwide M&As and Standard and Poor's index	61
3.2. Number of completed acquisitions involving Belgian firms, European firms and worldwide	63
3.3. Net job creation by firm age group in 18 countries, 2001-11	66
3.4. Net job creation by age group of Belgian firms not involved in M&As by percentage, 2002-13	66
3.5. Log odds for Belgian firms acquiring foreign firms by earnings before interest and tax (EBIT) rate and debt rate	81
3.6. Log odds of acquisition by level of market concentration (HH index)	82
4.1. Births: firms (thousand) and jobs per firm (jperf)	94
4.2. Births: firms and jobs (thousand)	95
4.3. Deaths: firms (thousand) and jobs per firm (jperf)	96
4.4. Deaths: firms and jobs (thousand)	97
4.5. Death ratio	97
4.6. Contributions to change in continuing firm numbers	98
4.7. Continuing firms (million) and jobs per firm (jperf)	99
4.8. Continuing firms and jobs (million)	100
4.9. Contributions to change in continuing firm jobs	100
4.10. Contributions of births and continuing firms to net job creation	101
4.11. Exogenous variables for counterfactual	104
4.12. Counterfactual results, jobs and firms	105
5.1. New Zealand output and employment cycles	116
5.2. Labour adjustment around the 2008 recession	118
5.3. Job and worker flows by industry	120
5.4. Variable definition: data timing	124
5.5. Heterogeneous adjustment	126
5.6. Post-peak changes conditional on output shock	129
5.7. Post-peak changes conditional on employment growth	130
6.1. Structure of exports of goods and services	147
6.2. Unemployment rate, estimated trends and GDP growth	148
6.3. Costa Rica, employment structure by industry	149
6.4. Share of employment by economic sector and exporting condition of businesses	153
6.5. Employment growth rate by exporting and non-exporting group, according to economic sector, 2010-12	156
6.6. Relative creation, destruction and net variation of employment in businesses according to economic sector and exporting condition	156

6.7. Total employment according to firm age, by economic sector and exporting condition	157
6.8. Share of agriculture businesses by employment growth, size and exporting condition	158
6.9. Share of manufacturing businesses by employment growth, size and exporting condition	159
6.10. Share of services businesses by employment growth, size and exporting condition	160
6.11. Share of businesses by employment growth rate, size, exporting condition and economic activity	161
8.1. Annual productivity growth in mainland economy decomposed into contributions by industry	197
8.2. Decomposition of productivity growth into five sources: within- and between-industry reallocation; entry- and exit-effects; and non-reallocation	199
8.3. The contribution from non-reallocation to productivity growth, by industry. . .	200
8.4. The contribution from between-firm reallocation to productivity growth, by industry	201
8.5. The contribution from entry/exit dynamics to productivity growth, by industry	202
8.6. Decomposition of employment flows, by industry	202
9.1. Economic crises in Japan (market economy; index: 1991 = 1)	214
9.2. Crises and job loss by job status (index: first year of each crisis = 1)	215
9.3. Crises and decomposition of the gross-output growth rate to final demand factors	215
9.4. Number of listed companies	216
9.5. Share of sample firms in total economy	216
9.6. Employment growth rate by TFP class	219

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Executive summary

Business dynamics plays an important role not only as a driver of job creation but also as an engine of reallocation and productivity growth. This book aims at providing new evidence on business dynamics from different countries and at shedding new light on the heterogeneous responses of firms to economic shocks, with a particular focus on the impact of the last decade's global financial crisis. All chapters in this book highlight the importance of going beyond the average firm paradigm when analysing business dynamics, accounting for different firm characteristics such as size, age, ownership and trade status.

The analysis of the Brazilian business sector, in Chapter 2, focuses on the statistical properties of establishment-level employment dynamics and highlights that younger businesses are characterised by both disproportionately high employment growth rates and high exit rates. This corroborates empirical evidence found for other countries that participate in a cross-country distributed microdata project on business dynamics co-ordinated by the OECD: the DynEmp project. Furthermore, the findings show that small establishments in Brazil are born very small and are not able to reach the scale of mid-sized establishments, even though they may grow fast at the beginning of their activity, and they tend to die early. Relatedly, the authors also show the existence of a “missing middle” in the Brazilian formal sector, i.e., the middle part of the business size distribution is thinner. The magnitude of this phenomenon appears larger in Brazil than in other Latin American or Asian countries for which comparison in the manufacturing sector is available. For policy makers it is important to understand the role of a country's framework conditions and the effectiveness of targeted support policies can explain these patterns. For these reasons, in depth policy evaluations within countries and cross-country analysis in the lines of the OECD DynEmp project are key for providing the relevant evidence base.

To fully understand the dynamics of business creation and growth, one needs to know whether businesses grow through the creation of new jobs within the firm (organic growth) or whether their expansion relies on mergers or acquisitions (non-organic growth). Chapter 3 focuses on this issue and quantifies the role of mergers and acquisitions for employment dynamics in the country. Findings suggest that domestic acquisitions and intra-industry acquisitions have negative effects on employment in target firms, which are partially offset by job creation in Belgian acquiring firms. However, in the case of inter-industry acquisitions, the acquisition of a Belgian target by a foreign firm appears to have a positive impact on employment in the Belgian target. Thus, acquisitions seem instrumental in achieving high growth, but young Belgian firms appear to be less inclined to acquire other firms than young foreign firms to acquire domestic firms.

The DynEmp project has documented a change in the patterns of business dynamics over the business cycle. The sharp increase in gross job destruction and the drop in gross job creation that occurred in the 2008-09 biennium contracted only partially over the 2009-10

biennium, with creation and destruction rates eventually aligning to pre-crisis levels during the following two-year period. Forthcoming OECD evidence demonstrates that only a few countries have shown a strong resilience to the global financial crisis, suggesting that the crisis' effects on start-ups are probably long-lasting.

Results for the United Kingdom concentrate on the dynamics of the stocks of firms and jobs, using an intuitive but very effective decomposition framework that allows separately analysing births, deaths and "continuing" firms. The findings highlight the importance of the variation in firm births, especially over the global financial crisis, and the relatively limited variation in average jobs per firm. The distinctive feature of the global financial crisis in the United Kingdom has been a collapse in business entries, which negatively affected the stock of continuing firms in the following year, leading to job destruction. Results suggest an important policy message: "today's start-ups are tomorrow's continuing firms".

New Zealand's results focus on the dynamics of employment adjustments during the 2000s, concentrating in particular on the aftermath of the global financial crisis in the country. Findings highlight the existence of significant heterogeneity across firms, both before and after the crisis, not only in the size of output shocks but also in the amount of employment adjustments and in the size of worker flows resulting from such adjustments. The analysis links the labour market policy settings in a given country and the level of that country's resilience to cyclical shocks of different intensity, with a particular focus on the effects of the financial crisis on worker flows and firm exit rates. Results confirm that worker flows significantly lowered during the crisis in New Zealand, but do not find support for higher exit rates. The chapter provides evidence that a labour market that is resilient to cyclical shocks – thanks to smoothing policies – may not be suited to respond to shocks that require significant reallocation of employment, which would need a policy mix facilitating retraining, job turnover and reallocation, as well as geographic and industry mobility.

Costa Rica's evidence focuses on the labour market adjustments in the country in the aftermath of the global financial crisis, where increased unemployment seems to reflect structural change and a mismatch between labour supply and demand. Despite Costa Rica being still characterised by high shares of employment in manufacturing and agriculture, the country is increasingly transforming into a service-oriented economy. The analysis highlights that business dynamics for firms of different ages and sizes in Costa Rica depends on their sector of activity and on whether they are engaged in international trade. Exporting micro, small and medium-sized enterprises (MSME) are growing faster than those focusing on the domestic market; and those operating within the Free Trade Zone regime are more likely to grow than firms outside the regime. Most exporting MSMEs in services increased employment, while this share has been more limited in agriculture and manufacturing.

Results for Canada concentrate on the complex process of firm growth, analysing simultaneously how different dimensions of such a process – namely employment, sales, profits and productivity – interact. Exploiting a unique database that allows focusing on organic growth, the results highlight that the median firm grows very little according to all outcome variables considered. The findings also suggest that sales growth appears to drive subsequent growth in all other variables. Profits present a similar pattern but at a lower level. When one focuses on different firm size and age classes, profits seem to have a comparatively greater effect on growth for smaller and younger firms, but such effect remains small.

By applying a novel decomposition methodology, results for Norway quantify the contributions to employment and labour productivity growth from different sectors and

different firms. The authors find that the decline in productivity growth observed at the beginning of the 2000s is related to the strong employment growth via entry in some services sectors with low initial productivity levels. An explanation for the productivity slowdown in the country may be sought in the growing role of wholesale and retail trade and information and communication, combined with the decline of manufacturing. Large continuing firms are the main contributors to labour productivity growth, but they contribute little or negatively to employment growth, with new jobs being created mainly by entrants and SMEs. Exporters contribute similarly to aggregate productivity growth and employment growth, whereas non-exporting firms tend to contribute gradually less to productivity growth but remain the largest contributors in terms of employment growth.

Finally, the evidence for Japan focuses on the cleansing effects of economic crises during the last 20 years of the country's economic cycle. By considering four crisis periods, the findings show that during these crises labour inputs and productivity decreased sharply, while in the recovery periods following the crises labour inputs did not increase despite productivity increases. The results further focus on the effect of the crises on within-industry reallocation and show that the labour inputs reallocation has been productivity-enhancing in Japan. Only in the case of the global financial crisis the productivity-enhancing reallocation mechanism was not strengthened by the downturn. Interestingly, the universal nature of the global financial crisis is considered a possible explanation of this result for Japan.

List of acronyms and abbreviations

ALU	Average labour unit
AUC	Area under the curve
BCCR	Central Bank of Costa Rica
BOS	Business Operations Survey
BSD	Business Structure Database
CES	Constant elasticity of substitution
COMEX	Ministry of Foreign Trade of Costa Rica
DBJ	Development Bank of Japan
EBIT	Earnings before interest and tax
ECLAC	Economic Commission for Latin America and the Caribbean
EFTA	European Free Trade Association
ERA	Employment Relations Act
EU	European Union
FDI	Foreign direct investment
FTA	Free trade agreement
FTZ	Free trade zone
GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
GFC	Global financial crisis
GST	Goods and services tax
HH	Herfindahl-Hirschman
HLFS	Household Labour Force Survey
IMAA	Institute for Mergers, Acquisitions and Alliances
ISIC	International System of Industrial Classification
IT	Information technology
ITA	Information Technology Agreement
JCR	Job creation rate
JDR	Job destruction rate
JIP	Japan Industrial Productivity
LBD	Longitudinal Business Database
LCI	Labour Cost Index
LEED	Linked employer-employee data
LR	Likelihood ratio
M&A	Merger and acquisition
MSME	Micro, small and medium-sized enterprise
NA	National Accounts
NACE	Nomenclature générale des activités économiques dans les communautés européennes

NEG	Net employment growth
OLS	Ordinary least squares
PAYE	Pay as you earn
QES	Quarterly Employment Survey
R&D	Research and development
ROC	Receiver operating characteristic
S&P	Standard and Poor
SME	Small and medium-sized enterprise
TFP	Total factor productivity
TiVA	Trade in Value-Added
UK	United Kingdom
US	United States
VAT	Value-added tax
VCE	Variance-covariance matrix of the estimator
WTO	World Trade Organization

Chapter 1

Assessing the links between business dynamics and policy settings

This chapter presents an overview of the chapters included in this volume and relates them with the cross-country evidence gathered by the OECD Dynemp project, highlighting common trends and differences. Based on analyses of data from Belgium, Brazil, Canada, Costa Rica, Japan, the United Kingdom, Norway and New Zealand, the studies illustrate how firm characteristics (age, size, sector) and economic conditions (market conditions, stage in the business cycle and in economic development) affect employment growth, firm performance, resource allocation and productivity growth. The results shed new light on the important role played by the recent global financial crisis on OECD countries and emerging economies.

Introduction

Business dynamics is an important driver of job creation and productivity growth. A growing body of evidence shows large differences in business dynamics across countries and over time, in particular over the business cycle. However, our understanding of these differences remains limited, adversely affecting efficient policy design. The purpose of this book is to fill this gap by providing new evidence from countries at different stages of development and of different sizes. It also tries to provide evidence of firms' heterogeneous responses to shocks and to investigate the impact of one of the biggest shocks that firms have had to face in the last decade: the global financial crisis. The hope is that the evidence collected in this volume will help readers to better understand business dynamics and the heterogeneous impact of policies and framework conditions across different firms and countries and help policy makers to design better policies that can foster both employment and productivity growth.

The book is part of a larger effort by the OECD Directorate for Science, Technology and Innovation to provide new evidence on employment dynamics and productivity across countries exploiting firm-level data. As part of the same strand of work, the OECD is leading two projects, DynEmp and MultiProd, that have relied on countries' confidential micro-data to conduct comparable cross-country analysis on employment dynamics and productivity, respectively (see also www.oecd.org/sti/DynEmp.htm and www.oecd.org/sti/ind/MultiProd.htm). The two OECD projects collect and analyse harmonised cross-country micro-aggregated data from administrative data or official representative surveys, such as business registers, social security and corporate tax records or national statistics offices' surveys of production. Both projects rely on the active participation of a network of national experts who have access to the relevant micro-data sources in the respective countries.

The value of such exercises rests on the ability to assess the effects of different policy settings on firm-level outcomes. On the one hand, country-specific studies are often constrained by the relatively limited variance of policy settings (except in limited cases such as in federal systems). On the other hand cross-country studies which focus on outcomes at higher levels of aggregation cannot capture the heterogeneity of responses of different actors to the same policy settings. The OECD has a particularly important role to play in helping to bridge this gap. This approach offers a unique opportunity for creating longitudinal data that go beyond cross-sectional cross-country comparisons or industry-level statistics. The projects can generate data designed to answer specific policy questions and at different sectoral or geographical levels. The program codes are modular and can easily be modified to allow for additional categorisation of the micro-data according to firm characteristics not considered in previous analysis (e.g. for ownership or trade status).

In fact, while considerable progress has been made in recent years in providing researchers with secure access to official micro-data on firms at country level, significant obstacles remain in terms of transnational access. The challenges of transnational access are many, starting from locating and documenting information on available sources and their

content (i.e. coverage, variables, classifications, etc.) and on accreditation procedures (i.e. eligibility, rules, costs and timing). There are language barriers, as translated versions of information on data and accreditation procedures seldom exist or are incomplete. In addition, completing country-specific application forms for accreditation procedures is often demanding and different procedures exist for data held by different agencies even within the same country. Finally, data access systems differ across countries, implying that while remote access or execution could be possible in some countries, in others it is only possible to access on site, requiring researchers to travel to the location in question. These are just some of the challenges related to accessing data, before researchers can even begin confronting differences in the content and structure of micro-data themselves, and the time and human capital investment required to become acquainted with the “nitty gritty” of each database.

As a result, multi-country studies requiring the exploitation of micro-data are very difficult to conduct, and often rely on the formation and co-ordination of networks of national researchers, with each team having access to their respective national micro-data. The comparability of the country level results needs therefore to be insured via the use of a common protocol for data collection and aggregation and a common model specification for the econometric analysis.

This methodology followed in the DynEmp and MultiProd project is called distributed micro-data analysis, which involves writing a computer code by OECD and then running this code in a decentralised manner by representatives in national statistical agencies or experts in public institutions who have access to the national micro-level data, who have access to the national micro-level data. At this stage, micro-aggregated data is generated by the centrally designed, but locally executed, program codes, which are then sent back for comparative cross-country analysis to the OECD. These data reduce confidentiality concerns as they aggregate information at a sufficiently high level, and achieve a high degree of harmonisation as the definition of the extracted information is the same, ensured by the centrally written computer routine.

Despite a few instances when a similar approach has been used in the past – in academic circles as well as within the OECD, the World Bank and more recently the European Central Bank – this procedure is still not widely applied today when collecting statistical information. This may have to do with the amount of time needed to set up and manage the network as well as developing a well-functioning, “error-free” program code which is able to both accommodate potential differences across national micro-level databases and minimise the burden on those who have access to the data and run the code.

The DynEmp project is based on a distributed data collection exercise aimed at creating a harmonised cross-country micro-aggregated database on employment dynamics from confidential micro-level sources. The primary sources of firm and establishment data are national business registers and for some countries, such as Brazil, social security records. The first phase of the project was implemented in the first half of 2013 and was called “DynEmp Express”. This first phase was based on a simplified statistical routine which led to the collection of a database covering 18 countries. The second phase of the project, called DynEmp v.2, aims at building a database which contains more detailed data on the within-sector contribution of start-ups and young firms to employment growth, with the aim of analysing the role played by national policies and framework conditions for employment growth (see e.g. Calvino, Criscuolo, and Menon 2015). At the time of writing, 22 countries

have been successfully included in the *DynEmp v.2* database (Australia, Austria, Belgium, Brazil, Canada, Costa Rica, Denmark, Finland, France, Hungary, Italy, Japan, Luxembourg, the Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Turkey, the United Kingdom and the United States).

The advantages of using harmonised micro-aggregated data from business registers for the study of business dynamics and from official surveys for productivity analysis are manifold. First of all, for the study of business dynamics the cross-country use of business registers allows separate identification of the different channels of employment growth, distinguishing between gross job creation and gross job destruction, and between the extensive (firm entry and exit) and the intensive (post-entry growth) margins. Furthermore, the role of firm age and size can be examined separately and jointly. Finally, each of these elements can be compared across countries, sectors and over time. Similarly, when analysing productivity, being able to use official survey data that cover an (often stratified) random sample of firms over time and can be reweighted using business registers in order to be made representative allows for the reliable and comparable analysis of productivity distributions; the description of trends in productivity dispersion over time, etc. and the estimation of entry and exit contribution to growth, and so on.

However, the DynEmp and MultiProd projects, by their very nature and in order to ensure comparability, rely on an approach based on a minimum common denominator where both the policy questions are of interest and the data needed to answer those questions are available in the large majority of participating countries. For this reason, this volume leverages on the great expertise of the network members for the chapters in the book to push the boundaries that contain the DynEmp project in three directions: policy questions; methodology and data needs. The rest of this introduction will therefore provide an overview of the different contributions, highlighting where they confirm evidence found in the cross-country analysis and where they are novel in terms of methodology and/or findings. This introduction will, hopefully, provide a good account of how each of the chapters of the book contributes to building a solid evidence base for policy making.

Going beyond the average firm paradigm

The importance of the process of creative destruction and of post-entry growth and the ability to document these processes are pointing to the paramount importance of going beyond the average firm paradigm and embracing firm heterogeneity in the analysis of business dynamics. All chapters in the book are examples of how looking at firms characteristics, such as size, age, ownership and trade status are important in shedding further light on the process of job creation and destruction in the economy.

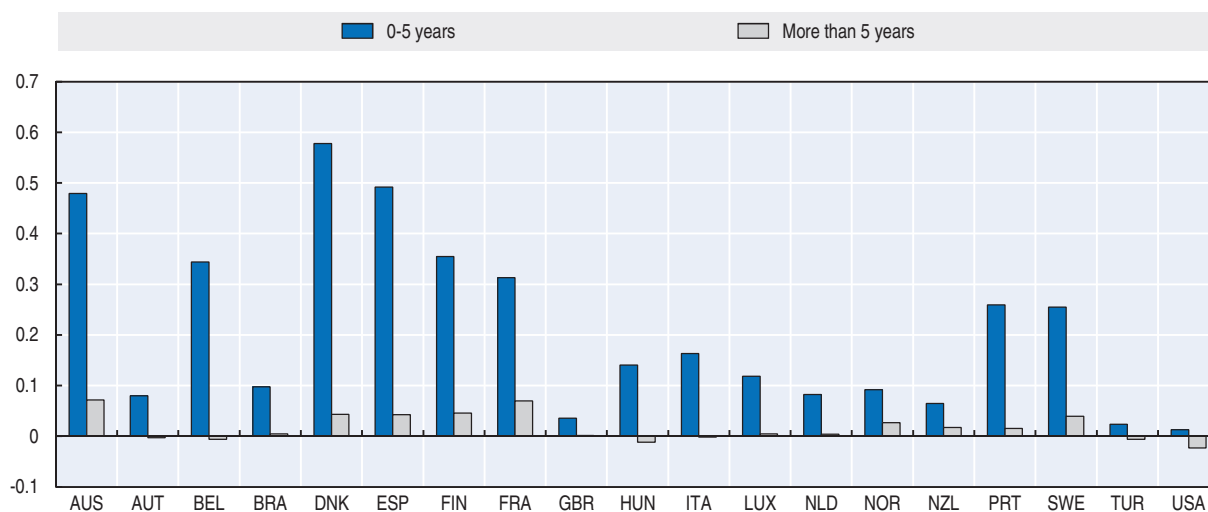
Chapter 2, by Danilo Coelho, Carlos Henrique Corseuil and Miguel Nathan Foguel from the Instituto de Pesquisa Econômica Aplicada (IPEA), analyses the statistical patterns of employment dynamics across establishments with different characteristics (e.g. size) and at different points in their life cycle.

The chapter studies employment dynamics in the Brazilian formal sector using *Relação Anual de Informações Sociais (RAIS)* data, which is a survey of all formal establishments in Brazil collected by the labour ministry, *Ministério do Trabalho e Emprego (MTE)* containing information on wages, workers and employers' characteristics, from 1995 to 2013. The analysis provides new empirical evidence on two main issues. Firstly, the authors examine in

detail the firm-level employment distribution by age and size class separating age, cohort and macro effects and the role of exit thanks to a decomposition method first proposed by Deaton and Paxson (1994). Secondly, the authors assess the extent to which the Brazilian formal sector suffers from a “missing middle” issue, i.e. to what extent it is characterised by lower employment shares in the middle part of the firm and employment distribution. The evidence confirms the existence of a “missing middle” problem in the Brazilian manufacturing sector, and its magnitude appears larger than in other countries in Latin America and Asia for which comparison is possible.

In order to provide evidence on this issue the authors focus on the growth performance of small establishments at entry: the results confirm evidence found for other countries in the DynEmp project, as outlined in Figures 1.1 and 1.2, respectively: younger businesses are characterised by both disproportionally high employment growth rates and higher exit rates (particularly within the first three years of their lives).

Figure 1.1. **Young firms have higher employment growth rates**

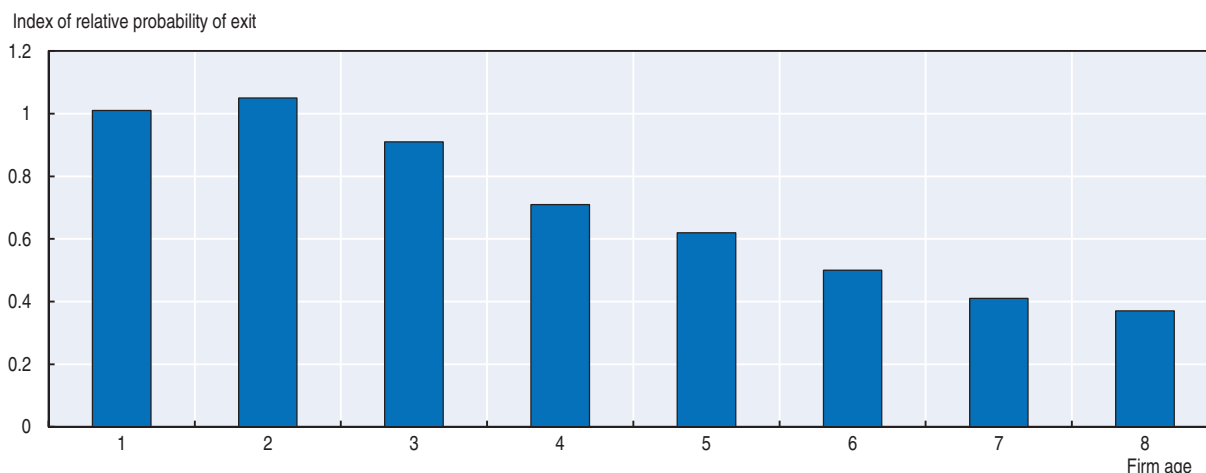


Notes: Figures report the average employment growth index by country and age class. Units with missing age classes are not reported. Figures report yearly averages conditional on the availability of data. The sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics. Source: OECD (2016b), DynEmp v.2 database, www.oecd.org/sti/dynemp.htm. Data for some countries are still preliminary.

The results for Brazilian businesses show that employment dynamics are mainly driven by pure age effects, with cohort and macro effects playing a limited role. Small establishments are born very small, and are able to exhibit high growth rates at the beginning of their activity, but they do not grow enough to increase their scale to that of mid-sized establishments and tend to die early.

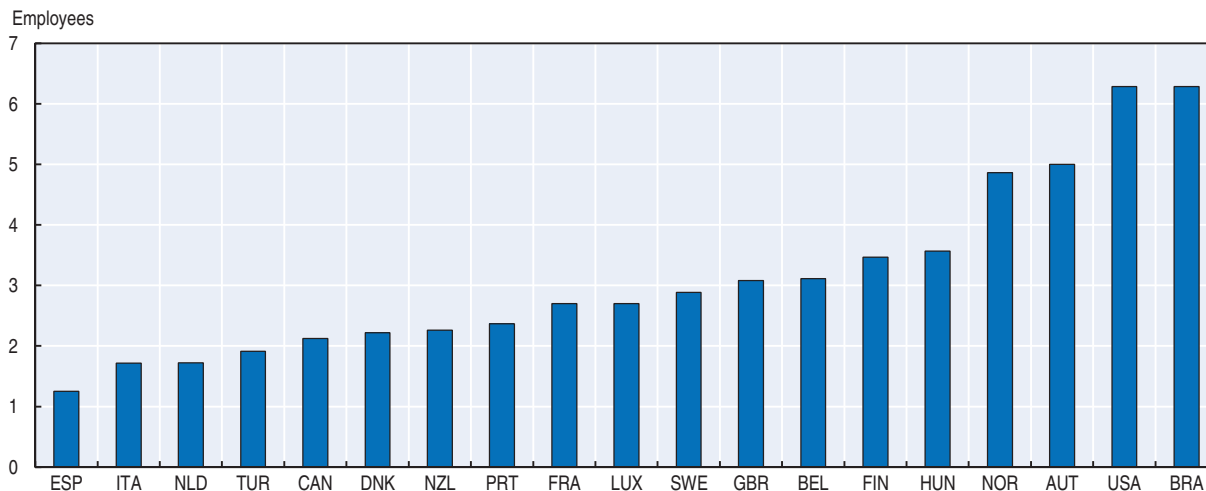
This evidence is in line with cross-country evidence from the DynEmp project showing that average size at entry in most countries is not higher than six (See Figure 1.3). Also most micro-firms (i.e. firms that start with less than ten employees) remain micro even after five years after entry, while a very tiny proportion grows beyond the ten employee threshold and account for most of the job creation from this group of firms (Figure 1.4).

Chapter 2 shows that these patterns lead to a “missing middle” in the plant size distribution in Brazil. The problem can be the result of a large set of factors such as entry

Figure 1.2. **Average employment level by firm age**

Notes: The graph reports the age coefficients of the exit “distributed regression” (which has as response variable an exit dummy and as explanatory variables age, size, three-digit sector and year dummies). Regression coefficients are normalised by country (subtracting the country minimum value and dividing by the country maximum value) and then averaged out across available countries. Norway has been excluded due to ongoing checks on unusual dynamics in the underlying data. Exit regressions are not available for the United Kingdom. Firm age is reported on the horizontal axis (1 to 8 years old). Owing to methodological differences, figures may deviate from officially published national statistics.

Source: Calvino, Criscuolo and Menon (2016a), “No country for young firms?: Start-up dynamics and national policies”, <http://dx.doi.org/10.1787/5jm22p40c8mw-en>, based on the OECD DynEmp v.2 database, www.oecd.org/sti/dynemp.htm. Data for some countries are still preliminary.

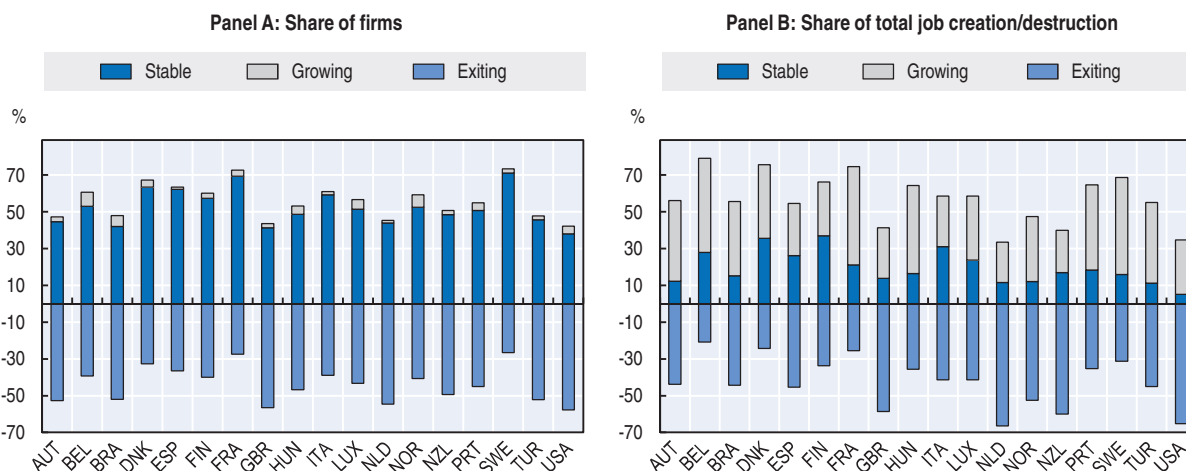
Figure 1.3. **Across countries the average start-up employs less than ten employees**

Notes: The graph shows the average size of surviving entrants expressed as total employment of surviving entrants over number of surviving entrants. Figures report the average for different time periods $t = 2001, 2004$ and 2007 , conditional on the availability of data. Sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

Sources: Calvino, Criscuolo and Menon (2016), “No country for young firms?: Start-up dynamics and national policies”, <http://dx.doi.org/10.1787/5jm22p40c8mw-en>; OECD (2016b), DynEmp v.2 database, www.oecd.org/sti/dynemp.htm.

costs, the tax system, the level of development of financial markets, the regulatory environment, and the scale and composition of market demand.

The chapter provides two very interesting methodological contributions: the first is the use of the Deaton Paxson decomposition (Deaton and Paxson, 1994) to isolate pure age

Figure 1.4. **Most micro start-ups remain micro-firms five years after entry**

Notes: Figures report the average for different time periods $t = 2001, 2004$ and 2007 , conditional on the availability of data. Panel A represents the share (in terms of number of units) of micro (0-9 employees) entrants at time t by their size class at time $t + 5$. Panel B represents the net contribution to aggregate flows (defined as net job creation by the group over the sum of the net job variations by all groups in absolute values) for micro (0-9 employees) entrants at time t by size class at time $t + 5$. Size classes are aggregated as follows: stable (0-9 employees), growing (10 or more employees) and exiting units. Firms with missing employment at the beginning or at the end of the period are excluded. The sectors covered are: manufacturing, construction, and non-financial business services. Owing to methodological differences, figures may deviate from officially published national statistics.

Source: OECD (2016a), "No country for young firms?", based on the OECD DynEmp v.2 database, www.oecd.org/sti/dynemp.htm.

effects from period-specific shocks and birth cohort idiosyncratic characteristics. The methodology also corrects for a composition effect towards larger establishments arising over time due to the higher exit probability of start-ups. Secondly the authors follow the methodology first proposed by Tybout (2014) to uncover the presence of a missing middle in the size distribution of plants, based on a comparison of the observable plant size distribution with a Pareto one, i.e. analysing differences between empirical and theoretical distributions. These could be interesting avenues for methodological extensions of the next phase of the DynEmp project.

As in many other countries, the segment of micro and small establishments has received a great deal of attention from public policy in Brazil which has a large and diversified institutional framework to support this type of establishment: programmes that provide credit at low interest rates and credit guarantees to micro and small establishments, tax subsidies for establishments whose revenues are below a defined threshold, a large programme of government procurement targeted at micro and small establishments, and training courses and technical assistance dedicated to helping potential entrepreneurs and already established small businesses to improve their operations. The chapter draws attention to the fact, as often happens, that the programmes have not been evaluated, and so their effectiveness and the optimality of their design remains unknown.

Organic versus non-organic growth

For policy makers it is important to understand how firms grow; i.e. whether they grow through the creation of new jobs within the firm (organic growth) or whether their expansion relies on acquisition of, or merger with, existing firms (mergers and acquisitions [M&As] non-organic growth). The two types of growth strategies at the micro level translate to very different outcomes at the macro level: while organic growth translates into an

increase of aggregate employment figures, non-organic growth might translate, at best, into no change and, in the case of consolidation between firms, in a decrease in aggregate employment growth. Policy concerns have been raised especially over the potential negative impact of foreign acquisitions on domestic employment in host countries. In addition, if the M&A activity results in an increase in market power, rents and super-normal returns on capital, M&As might have a negative impact on aggregate economic growth, and possibly, to rising inequality.

Unfortunately, data that allow for the distinction between organic and non-organic growth are rarely available. Thus, the contribution of Chapter 3 is very important for building the evidence base in this area. Contributed by Michel Dumont, Chantal Kegels, Hilde Spinnewyn and Dirk Verwerft from the Federal Planning Bureau, it assesses the role of M&As in employment dynamics in Belgium and investigates whether the distinction between organic versus non-organic growth matters for analyses of job creation using data from Zephyr (Bureau van Dijk) between 2001 and 2014 linked with additional sources of data on employment and other firms' balance sheet information.

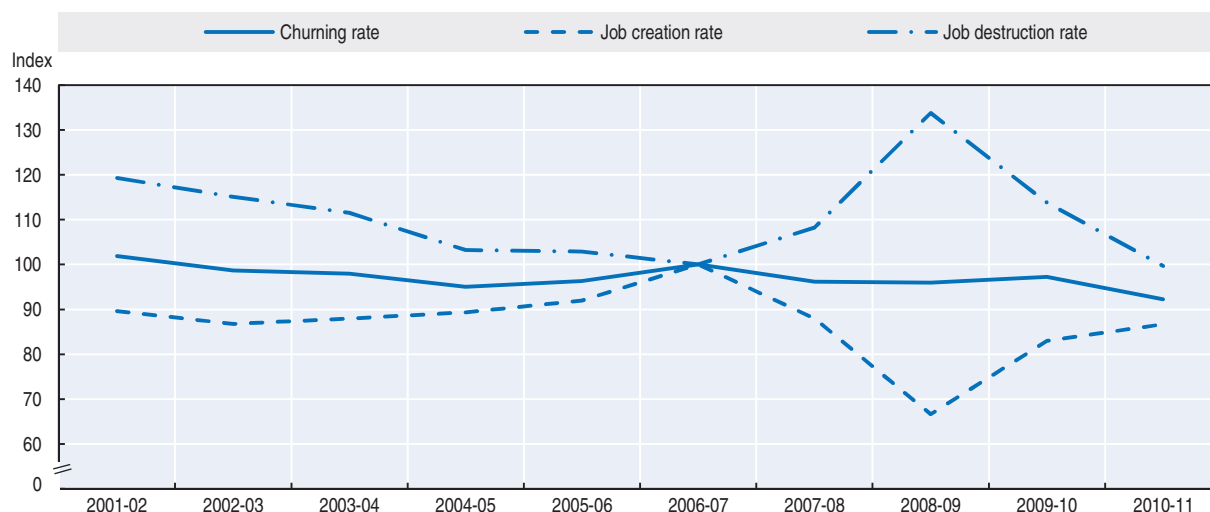
The results suggest that concerns about the negative employment effects of foreign acquisitions are not warranted for Belgium. Domestic acquisitions and intra-industry acquisitions are found to have negative effects on employment in target firms, which are partially offset by job creation in Belgian acquiring firms. But the acquisition of a Belgian target by a foreign firm actually appears to have a positive impact on employment in the Belgian target in the case of inter-industry acquisitions, i.e. when the foreign acquirer does not belong to the same industry as the Belgian target firm.

Thus, for the small group of Belgian firms that are active in M&A deals, acquisitions seem instrumental in achieving high growth, but young Belgian firms appear to be less inclined to acquire other firms than young foreign firms to acquire domestic firms. An interesting policy research agenda is improving our understanding of the causes of the low involvement of Belgian firms in M&A deals, and in particular to what extent financing constraints or share ownership and corporate governance rules play a role in explaining these patterns.

The impact of the crisis on employment stocks, flows and business dynamics

The DynEmp project provides some interesting evidence of business dynamics over the cycle and in particular during the crisis. As shown in Figure 1.5, prior to the crisis, the gap between job creation and job destruction was comparatively small, reflecting a Schumpeterian process of creative destruction which reallocates employment from firms destroying jobs to firms creating jobs. The 2008 economic crisis had a significant impact on this process, resulting in a sharp increase in gross job destruction and a drop in gross job creation. This gap contracted only partially over the 2009-10 biennium, with creation and destruction rates eventually aligning to pre-crisis levels during the following two-year period. Evidence from Blanchenay et al. (forthcoming) shows that only a few countries have shown a strong resilience to the financial crisis and a cohort-level analysis suggests that the effects of the crisis on start-ups are probably long-lasting: entrants and small firms of the "crisis" (year 2007) cohorts are still situated on a lower growth path five years later relative to those of the "boom" (year 2001) cohort.

Chapter 4, by Michael Anyadike-Danes and Mark Hart, investigates employment dynamics in the United Kingdom, using a firm-level longitudinal database that covers the

Figure 1.5. **Job creation, job destruction and churning rate**

Note: Notes available at <http://dx.doi.org/10.1787/888933272807>.

Source: OECD (2015), *OECD Science, Technology and Industry Scoreboard 2015: Innovation for growth and society*, http://dx.doi.org/10.1787/sti_scoreboard-2015-en, based on the OECD DynEmp v.2 database, www.oecd.org/sti/dynemp.htm.

whole private sector, based on the United Kingdom Business Register from 1998 to 2014. Unlike most of the existing literature, this analysis focuses on the dynamics of the stock of firms and jobs – taking advantage of a simple but effective decomposition framework – separately focusing on births, deaths and “continuing” firms. The analysis highlights the important role of variation in firm births, especially over the Great Recession period, and the relatively limited variation in average jobs per firm. In fact the paper highlights that the impact of variations in births on job dynamics is not only immediate but has an impact which persists over many years. The global financial crisis’ (GFC) distinctive feature was a collapse in business entries, which fell by about 25% between 2008 and 2009, causing a “loss” of a quarter of a million jobs. This drop in births affected the stock of continuing firms in the following year leading to a drop in the stock of firms (60 000 firms) and a loss of 170 000 jobs. Thus the drop in entry during the GFC was evident in the following years with additional job losses until 2012 when the recovery started.

The main policy message of this chapter is that “today’s start-ups are tomorrow’s continuing firms”. This message becomes evident thanks to the use of the new approach based on stocks of jobs and firms rather than flows. This approach can lead policy makers and researchers to look at policies from a different perspective, especially in focusing on interventions which improve firms’ chances of survival and their prospects for growth, particularly when targeted at young firms.

Chapter 5, by Richard Fabling and David Maré analyses the dynamics of employment adjustments during the 2000s, with a special focus on the aftermath of the global financial crisis, which was initially less severe in New Zealand but was more prolonged than elsewhere. The authors use a comprehensive firm-level database that spans from 1999 to 2010. The data show that the country’s labour market is characterised by considerable heterogeneity across firms, both before and after the crisis, in the size of output shocks, the amount of employment adjustment in response to any given output shock faced by firms, and in the size of worker flows resulting from the adjustment.

The analysis highlights that the crisis affected the distribution of output shocks and altered the relationship between output shocks. It also caused changes in job and worker flows and levels of employment and wages. For any given output shock and change in net employment growth, worker, job turnover rates and wage growth were lower during the crisis. This could suggest that workers might have been willing to accept lower wages and might not have changed jobs during the crisis as they were worried about not finding suitable alternatives. This in turn might have worsened the outlook for those who were out of the job market or had lost their jobs. The authors argue that this might point to the importance of using active labour market policies for the latter group of workers, (e.g. young workers or workers temporarily out of work) or increased generosity of unemployment benefit levels during recessions to help to fund extended job searches.

A particularly interesting point raised by the chapter is the link between labour market policy settings and the level of resilience to crises of different intensities and natures, e.g. cyclical shocks versus shocks that require a reallocation of employment across industries, occupations, or regions. A labour market that is resilient to cyclical shocks, thanks to smoothing policies, such as long-term contracts, unemployment insurance and benefits, or active labour market policies, may not be suited to respond to shocks that require significant reallocation of employment, which would rather require a policy mix that facilitates retraining, job turnover and reallocation, and geographic and industry mobility.

New Zealand's labour market institutions favour flexibility and work incentives, and offer relatively light levels of support for those out of work. Thus, the financial crisis should have been characterised by lower worker flows (which is evident in the data), and higher firm exit rates, which is not supported by the data, perhaps because this margin of adjustment is typical of very small firms (less than three employees and working proprietors only) that are excluded from the analysis.

In future work the analysis already conducted using the DynEmp data – e.g. in Blanchenay et al. (2016) – could be expanded to analyse the role of different labour market policy mixes in explaining different labour markets' responses to the GFC across countries and further investigate the existence of cleansing or scarring effects following the GFC across different countries.

The role of sectors, ownership and trade status for job creation and destruction and business dynamics

Similarly to Chapters 4 and 5, Chapter 6 – by Catalina Sandoval, Francisco Monge, Tayutic Mena, Arlina Gómez and David Mora from the Ministry of Foreign Trade – looks at adjustments of the labour market after the GFC in Costa Rica, where the structural unemployment rate experienced a significant upward shift of three percentage points following the crisis.

Increased unemployment probably reflects structural changes in the economy and a mismatch between labour supply and demand. Unlike other countries considered in this volume and in the DynEmp project, Costa Rica is still characterised by high shares of employment in manufacturing and agriculture. At the same time, the country is increasingly transforming into a service-oriented economy, is integrating in global markets via international trade and foreign direct investment, and labour demand is growing in higher value-added services and advanced manufacturing. Agriculture is slowly reducing

its absorption capacity of low-skilled labour, which still represents a large share of employment in this sector.

Chapter 3 already raised the importance of distinguishing firms not only according to their age and size, but also according to their ownership. Chapter 6 extends the analysis to Costa Rica to differentiate across firms according not only to their ownership but also to their different trade status and their sector of activity. In fact business dynamics for firms of different ages and sizes differ significantly whether the focus is on manufacturing, services or agriculture, and whether these firms are engaged in international trade or not. Micro, small and medium-sized enterprises (MSMEs) that export are growing faster than those that focus on the domestic market; and those operating within the Free Trade Zone regime are also more likely to experience positive growth than firms outside the regime. But 93% of exporting MSMEs in the services sector increased employment, while in agriculture and manufacturing, this share was only 35%.

Business dynamics, reallocation and productivity

Business dynamics is at the heart of the policy debates because it often reflects a healthy process of Schumpeterian creative destruction which is conducive to long-term growth. The idea is that business entry and exit and job churning mirror the economy's ability to reallocate resources from less to more productive firms, and policies should aim at fostering this reallocation process or at least not to interfere with it while at the same time providing safety nets and compensatory measures that alleviate the costs for those who lose during the reallocation process.

Chapters 7, 8 and 9 extend the analysis of DynEmp in two directions.

Chapter 7, by Jay Dixon, looks at which measures of growth are more likely to be correlated with subsequent growth. DynEmp, like many other studies, is limited by data availability and can focus for most countries only on one dimension of growth, i.e. in terms of employment, even though for a few countries the analysis could be extended to sales, and sales per employee. The work of Dixon highlights the importance of looking at several dimensions of growth at the same time, in employment, sales, profits and productivity, to capture the dynamic and complex process of firm growth, and understand firms' future growth prospects.

The authors focus on continuing firms in three aggregate industry sectors (construction, manufacturing and services) for 2000-13 and on the correlations at leads and lags between the growth rates of employment, assets, sales, profits and labour productivity relying on quantile regression, and comparing firms at the median, at the 10th and 90th percentiles, to investigate asymmetries in the growth distribution. The authors also focus on growth patterns across firms of different sizes and ages to provide a more comprehensive picture of the growth process in Canada to policy makers.

One nice feature of the Canadian analysis is that organic growth can be identified, thanks to a unique database called LEAF developed by Statistics Canada. These data allow the authors to show that there is very little organic growth for the median firm according to all outcome variables considered. High growth in employment, profits and labour productivity does not seem to be a persistent feature of a firm: above-median growth performance (i.e. positive growth) of employment, profits and labour productivity in one year is likely to follow or come before periods of negative growth.

However, growth in sales appears to drive subsequent growth not only in sales but also in all other variables, such as employment; this pattern suggests that demand shocks for firms' products play a significant role in firm's decision and capability to grow. Profits present a similar pattern but at a much lower level. When focusing on different firm size and age categories profits seem to have a comparatively greater effect on growth for smaller and younger firms, although the effect is still small.

The importance of increases in sales for subsequent growth suggests that opening markets and improving access to consumers may be important goals for policy makers seeking to foster firm growth and increase productivity growth, especially for small firms.

Chapter 8, by Arvid Raknerund and Diana-Cristina Iancu from Statistics Norway proposes a new decomposition of employment and labour productivity growth, that extends standard methods to identify three main sources of productivity growth: within-firm productivity growth, between-firm reallocation effects and entry/exit dynamics. The analysis is based on Norwegian firm-level registry data covering all incorporated firms in the Norwegian mainland economy from 1996 to 2014.

The decomposition allows for quantifying the contributions to employment and labour productivity growth from different sectors and from different firms (e.g. small and medium-sized enterprises (SMEs) versus large firms and exporters versus non-exporters).

The data uncovers a strong downward trend in labour productivity during the last decade: with the growth in real value-added per employee dropping from an annual 3.2% during 1996-2004 to an annual 1.3% during 2005-14, confirming a downward trend in Norwegian labour productivity also found in other OECD countries (OECD, 2015).

The authors find that the decline in productivity growth observed at the beginning of the 2000s (2002-07), might be partly related to the strong employment growth via entry of new firms in some services sectors with low initial productivity levels, such as administrative and support services of new firms, that are on average less productive than incumbents. While the results can only partially explain the strong decline in productivity growth observed in Norway in the last decade they highlight an important channel through which employment dynamics can affect productivity growth of a country. The results presented in the chapter suggest that a possible explanation for the productivity slowdown is to be sought in the diminishing role of manufacturing and the growing role of wholesale and retail trade and information and communication as drivers of productivity growth in the mainland Norwegian economy.

The chapter also uncovers some other interesting differences with regard to in the contribution to the sources of productivity and employment growth: e.g. large continuing firms (> 50 employees) are the main contributors to labour productivity growth, but they contribute little, and even sometimes negatively, to employment growth, with new jobs being created mainly by entering firms and SMEs. The latter result confirms that the results of the DynEmp project are robust across many countries. Similarly notable differences also arise when comparing the contribution of exporting and non-exporting firms to productivity and employment growth: exporters contributed during 2002-10 at least as much to aggregate productivity growth (in percentage points) as to employment growth in all periods, whereas non-exporting firms tended to contribute gradually less to productivity growth but remain the largest contributors in terms of employment growth.

Finally, Chapter 9, by Kenta Ikeuchi addresses the empirical question on the cleansing effects of economic crises focusing on the last 20 years of the Japanese economic cycle. The

chapter provides a very interesting overview of the relevant literature focusing on the debate related to the impact of economic crises on business dynamics, reallocation and productivity and highlighting the different empirical results from this strand of research, focusing on existing evidence of the Japanese experience.

Having put his analysis into a broader context, the author then considers the effect of four crisis periods in Japan over the 1980-2012 period on the labour market and on productivity. The evidence uncovered in the chapter shows that during the crises, labour inputs and productivity decreased sharply; in the economic recovery periods following the crises, while productivity increased, labour inputs did not increase. In fact, the labour input composition remained strongly affected by the downturn, with demand for self-employed and regular workers diminished by the crises and demand for part-time workers increased.

The results go further in analysing the effect of the crisis on firm-level within-industry reallocation effects exploiting a comprehensive panel dataset of Japanese listed companies. During the period from 1980-2012, the reallocation of labour inputs was productivity-enhancing in Japan. In line with evidence from the United States, the results show that only in the case of the global financial crisis the productivity-enhancing reallocation mechanism was not strengthened by the downturn. All previous economic crises had reinforced the productivity-enhancing reallocation mechanism, in both the manufacturing and non-manufacturing sectors.

Interestingly, the author points to the global nature of the global financial crisis (GFC) as a possible explanation for this result for Japan. The GFC resulted in a fluctuating global financial market and ultimately in a sharp decline of net Japanese exports. This disproportionately affected more internationalised firms, which are also the most productive in the economy. The chapter concludes with a very interesting suggestion for future research in this area: a comparably rich international dataset that is, for employment and productivity dynamics, linked to global value-chain data. This could be an interesting avenue to pursue in the next phases of the DynEmp and MultiProd projects.

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Chapter 2

Employment growth of establishments in the Brazilian economy: Results by age and size groups

by

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The general objective of this chapter is to analyse the statistical patterns of employment dynamics of establishments in the Brazilian economy. In particular, with the help of large scale longitudinal plant-level data, we study the life cycle evolution of establishments so that we can assess how their age, as well as their entry and exit components, are related to the employment growth process in the country. Considering a representative establishment, the results show that it is born small (perhaps too small) and that the pattern of the growth rate over its life cycle imposes a long time span to surpass the threshold of a mid-sized plant. Further results confirm that the middle part of the size distribution is “missing” in Brazil and apparently this feature is more intense than in other countries for which there are available and comparable results.

Introduction

Maintaining high employment growth rates over long time periods is considered to be desirable for the development process not only because of its direct effect on aggregate employment growth but also because of the connections with other performance indicators such as wage and productivity growth. The pattern of employment growth is thus a key process to be monitored in any economy, in particular economies of developing countries like Brazil.

Typically, the monitoring of employment growth in a country is implemented using household surveys. Though rich in information on workers' characteristics, this type of survey rarely contains information on the characteristics of the establishments where they work, such as their size and age. The process of employment growth is, however, closely connected to the characteristics and performance of establishments over their life cycle. For instance, the entry and exit processes of establishments, as well as their capacity to grow, are important components behind the employment dynamic in an economy. Using establishment-level data is thus a highly valuable source of information for a better understanding of aggregate employment growth.

One of the main theoretical arguments for why aggregate employment and other performance indicators are linked to establishments connects their life cycles to a learning process through which the establishment (decision maker) gradually adjusts to the (new) environment right from the beginning of its operations (Nelson and Winter, 1982). This may be motivated by a learning process not only about the evolving environment but also about its own capabilities (Jovanovich, 1982). According to this view, an important indicator to be monitored is the incidence of establishments closing down according to establishment age, which represents an interruption of the learning process.

Given this background, the general objective of this chapter is to analyse the statistical patterns of employment dynamics of establishments in the Brazilian economy. In particular, with the help of large scale longitudinal plant-level data this chapter studies the life cycle evolution of establishments so it is possible to assess how their age, as well as their entry and exit components, are related to the employment growth process in the country.

This chapter's focus will be on the performance of small establishments at birth. Studying the pattern of growth of this segment is important for at least two reasons. First, because any small improvement in the rate of employment growth of small establishments tends to have a considerable impact on job creation due to their large share in the establishment and employment size distributions of countries, in particular developing countries. Second, it has potential effects on the degree of competition in various industries, which in turn affects price adjustments and the innovation impetus in the economy.

The present chapter bridges two branches of the empirical literature on either firm or plant size dynamics. The first branch encompasses papers exploring large scale, longitudinal firm- or plant-level datasets to reveal basic facts on employment dynamics along the life cycle of the relevant unit of analysis. This literature has two waves of studies, one was

carried out in the 1990s, which includes the important volume edited by Audrescht and Mata (1995) and the survey by Caves (1998), and is centred on analysing data from European countries, while the more recent wave of studies concentrates on data for the United States (see e.g. Haltiwanger, Jarmin and Miranda [2013] and Decker et al. [2014]). One of the main stylised facts revealed by these studies is that the younger plants or firms exhibit higher employment growth rates but also higher death rates. As age and size are strongly related, these findings also hold true for small production units.

This study has analysed and confirmed these stylised facts for Brazil and has built up a comprehensive picture of establishment employment growth. There are at least two methodological challenges for identifying how employment evolves as plants age. The first challenge is a composition effect due to the higher probability of small plants shutting down. This shifts the (conditional on age) distribution of plants (across sizes) towards bigger establishments in any comparison of average employment levels as age advances. The second challenge is to disentangle a pure age effect from confounding effects of time that are related to the occurrence of economic shocks that hit the establishments as they age. For instance, plants tend to experience higher growth rates if their existence coincides with an expansionary phase of the economy. Also, a plant's life cycle pattern may be affected by the prevailing conditions at the time it started operating (for instance, the availability of credit, the costs of registration, the incumbents' market power). Hence one should try to isolate pure age effects from period-specific shocks and birth cohort idiosyncratic characteristics. This chapter deals with both issues using a decomposition method put forward by Deaton and Paxson (1994) that separates age, year and cohort effects.

It demonstrates that raw growth rates across ages are indeed influenced by a composition effect that is related to the above-mentioned high mortality rate of small and young plants. It also reveals that cohort and macro factors have a limited effect on employment dynamics, which are essentially driven by pure age effects.

The second and most recent branch of literature argues that small establishments underperform in developing countries creating a “missing middle” in the plant size distribution. This distorted pattern can be the result of a large set of factors, such as entry costs, the tax system, the level of development of financial markets, the regulatory environment, and the scale and composition of market demand. This issue is still under debate following important contributions by Tybout (2000) and by Hsieh and Olken (2014). This analysis will follow Tybout (2014) who proposes a method to compare the observable plant size distribution with a Pareto distribution with estimated parameters.

Results show that the performance of small establishments in Brazil is relatively poor. In particular, this chapter finds that although this segment is able to exhibit elevated growth rates early on, they do not grow enough to increase their scale to that of mid-sized establishments and tend to die early. Connected to these findings, this analysis' results indicate that the middle part of the size distribution is “missing” in Brazil. This is robust to different partitions of the size distribution and is valid for the whole (formal) economy as well as for the manufacturing sector alone. Comparing the results for the manufacturing sector to those of other developing countries for which there is available evidence, apparently the “missing middle” problem is more evident in Brazil than in those countries.

The second section of this chapter follows with a description of this study's data. The following section contains the results of the overall pattern of employment growth, the decomposition results for the age, cohort and year effects, and evidence on the composition

effects stemming from the process of death of plants. The fourth section describes the method to identify a missing middle, as well as the results of its application to the Brazilian plant size distribution. The last section presents the main conclusions.

Data

This chapter uses a very large restricted-access administrative file collected by the Brazilian Ministry of Employment and Labour (Ministério do Trabalho e Emprego), the *Relação Anual de Informações Sociais* (RAIS). RAIS is a longitudinal matched employee-employer dataset covering by law the universe of formally employed workers in Brazil. Each observation in the dataset consists of contract-worker-establishment data for a given year.

All tax-registered establishments have to report the basic characteristics of the labour contract for every worker formally employed at some point during the previous calendar year.¹ Apart from tax/social security compliance the data has no coverage limitation, as opposed to other similar databases that are limited by geographical region, plant/firm size, or industry.

Apart from information on industry classification, legal form and location at the municipality level RAIS provides a unique identification number (CNPJ) given by the federal tax authority for each establishment. This is a key variable for this study since it is used to: i) aggregate the number of workers within establishments at a particular time period; ii) follow this quantity over time; and iii) define establishment age in a particular year.

All the analyses in this study are based upon information on private non-farm establishments. These filters require harmonised information throughout time on legal form and industry classification, which has been collected since 1995. Hence the sample is restricted to establishments born between 1995 and 2013. This will make it possible to show the plants' life cycle pattern up to their nineteenth year of existence in the formal sector. Results are restricted to the 12 first years of establishment life in the Brazilian formal sector, as some of the results are based on a methodology for which such restriction is necessary, as will be explained later on.

The main variables for this analysis are establishment size and age. Attrition, i.e. firms disappearing from the sample, is a potential source of measurement error for both variables. Some odd patterns follow, possibly due to occasional non-reporting by complier establishments, as some establishments "disappear" from RAIS in a particular year and eventually return in subsequent years.

This analysis' age variable is not affected as it is based on the year of first appearance of the establishment in the data since 1992. If occasional non-reporting occurs between the 1995-2013 interval, the value of the age variable is increased until the establishment is back to the sample. The fact that data are not reported in 1995 will not be a problem as long the establishment has reported in any of the years from 1992 to 1995.

In each year establishment size is measured by the average number of workers employed by establishments over the months in the relevant year. In most plant/firm-level database there is information on the number of employees at a particular point in time. In RAIS this is readily available for the last day of each year. However, there is a significant number of establishments that employ workers throughout the year but that have no employees on the last day of the year, even when this is not their last year in RAIS. Hence the average size was built across the monthly stock of employees, which is based on information on dates of hiring and firing and separations (e.g. resignations or retirements)

for each worker. For episodes of non-reporting as mentioned before, the establishment size is not computed in the non-reported year(s).

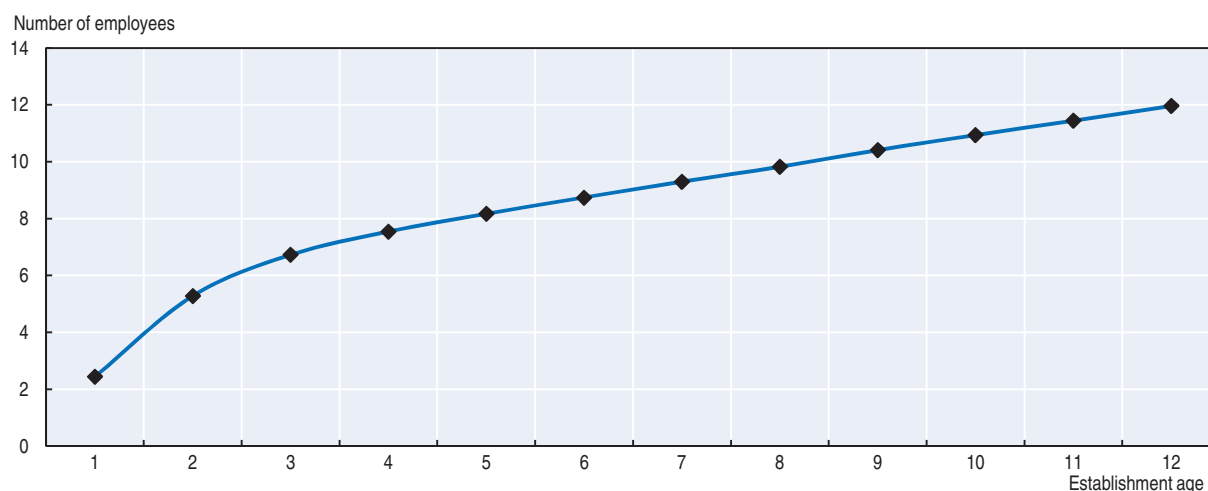
Over the period from 1995-2013 RAIS contains an average of 2.1 million establishment records per year. The number increased in this period, and can be related to the process of increasing formalisation of business records that took place in Brazil. This trend in formalisation encompasses two margins: i) the extensive margin, with an increasing number of new formal plants; and ii) the intensive margin, with an increasing number of formal jobs within a set of formal plants. The results presented in the remainder of this chapter should be interpreted taking into consideration that the first margin may be driven by informal plants switching status to formal plants. Under this scenario this analysis' age variable does not coincide with years of plant existence, but indicates the life cycle under the formal sector environment. Further considerations on this issue will be addressed when discussing specific results in what follows.

The plant employment dynamics over their life cycle

Aggregate life cycle and decomposition results

The aim of this sub-section is to illustrate basic facts on employment dynamics over the life cycle of establishments. It will begin by plotting data on the average number of employees per establishment as shown in Figure 2.1. The first thing to notice is that the average number of employees of plants in their first year is 2.4, which implies that Brazilian formal establishments are typically born small. One can also see that the average number of employees grows almost fivefold in the first 12 years of life (from 2.4 to 12), which corresponds to an average annual growth rate of 15.5%.

Figure 2.1. **Average employment level by age of establishment**



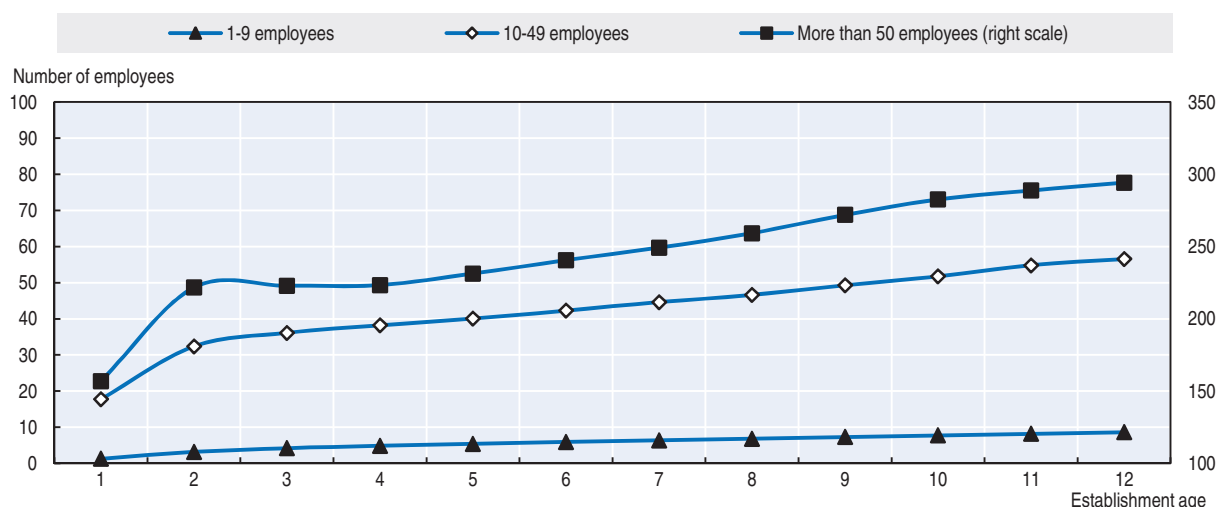
Source: Authors' estimations based on micro-data from RAIS.

Figure 2.1 also shows a great deal of heterogeneity across ages: in the second year the growth rate is very high (116%), then it decreases gradually reaching 4.5% in the 12th year. For future reference, it is worth pointing out that it takes about seven years for the typical establishment born in the Brazilian formal sector (that is, a plant that starts off in business with 2.4 employees) to reach the lower boundary of the range in size associated with middle-

sized establishments (usually taken to be from 9 to 49 employees in the literature, as will be detailed later in this chapter).

Such reference to the “typical” life cycle pattern of an establishment deserves two cautionary notes. First, as attested by Figure 2.A1.1 in Annex 2.A1, a great deal of heterogeneity can also be found across plants within the same age. Second, if the sample is divided into groups of plants according to their size at birth, as done in Figure 2.2, one can see that, on average, the group of smaller plants at birth does not reach the size of nine employees even at the 12th year in the formal sector.

Figure 2.2. **Average employment level by age of establishment and size of establishment at birth**

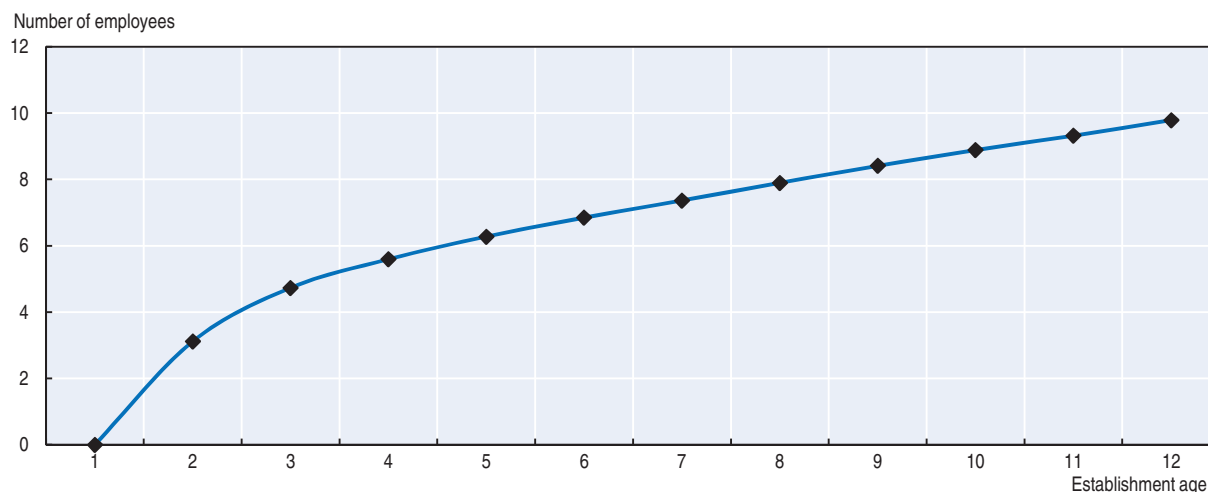


Source: Authors' estimations based on micro-data from RAIS.

As an attempt to isolate the effect of age from other determinants of plant growth, such as the macro environment or cohort-specific conditions, this analysis performs Deaton and Paxson's (1994) decomposition by age, cohort, and year (or macro) effects. The implementation is based on a regression model that uses dummies for ages, birth cohorts, and year of observation to explain the evolution of the establishments' employment levels.² The details of the method are outlined in Annex 2.A2. In principle, it would be possible to estimate cohort effects for every entry year of the establishments in the period of analysis of this study. However, for the decomposition exercise of this section, the choice was made to restrict the sample only to establishments that entered up until 2002 (inclusive). The advantage of doing this is that it guarantees that all plants in the sample can potentially reach at least 12 years of age between 1995 and 2013.

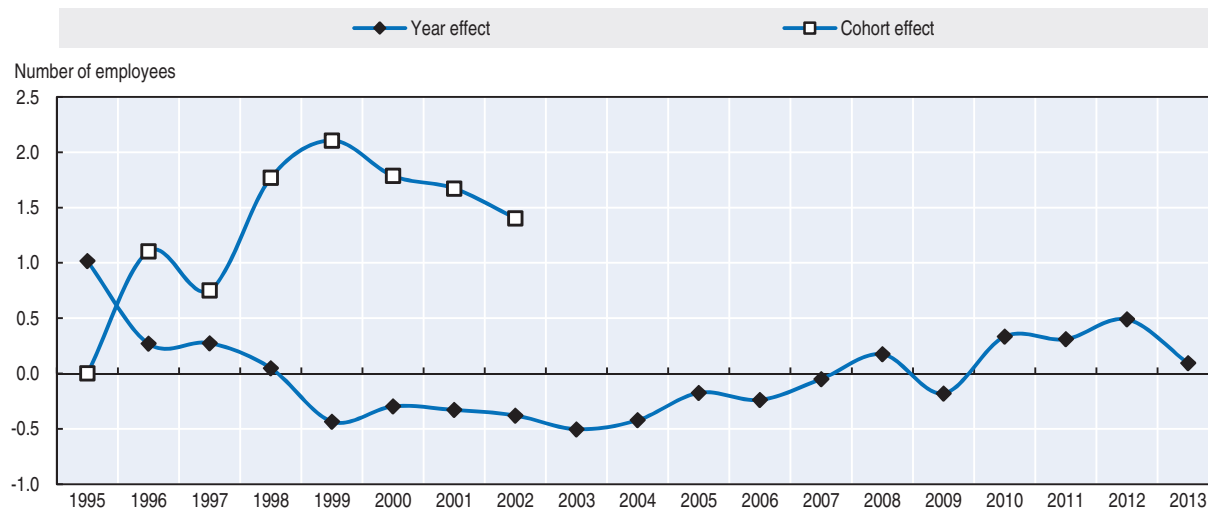
The results of the decomposition are reported in Figures 2.3 and 2.4. Figure 2.3 shows that the age effect is remarkably similar to what this analysis has shown from raw data (Figure 2.1). After removing macro shocks and cohort-specific components, establishment size is an increasing function of age, displaying high growth rates in the initial years of life and a lower rate as establishments get older.

As for the other two components, Figure 2.4 shows that their magnitude is much smaller than for the age dimension. The year effects are similar to the pattern of economic growth in the period, while cohort effects depict an inverted U-shape peaking for the cohort born in 1999.³

Figure 2.3. **Age effect on plant size using decomposition method**

Note: Normalised (age 1 effect = 0) age-dummy coefficients as specified in Deaton and Paxson (1994).

Source: Authors' estimations based on micro-data from RAIS.

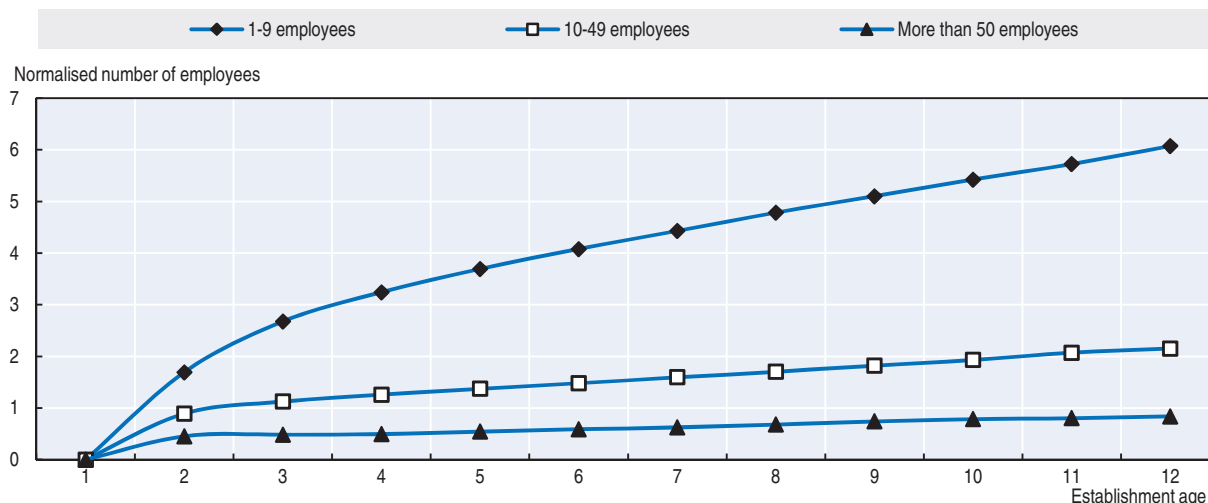
Figure 2.4. **Year and cohort effects on plant size using the decomposition method**

Note: Normalised (age 1 effect = 0) age-dummy coefficients as specified in Deaton and Paxson (1994).

Source: Authors' estimations based on micro-data from RAIS.

This study has also estimated the decomposition model for three different groups of the establishments at birth. The first group consists of establishments with less than nine employees (inclusive), the second by establishments with between nine and 49 employees (inclusive) and, the third by establishments with more than 49 employees. In order to facilitate the comparison across groups, the regression coefficients are divided by the average number of employees in each group when the establishments were born (1.3, 17.8 and 156.9, respectively). This study's estimates, reported in Figure 2.5, reveal that the age effects are higher for the smallest group size, despite an increasing trend for all three groups. For instance, at age 12 the first group's age effect alone would make the establishment grow 607%, while for the second and third groups, this number would be 215% and 84%, respectively. Despite the much higher age effect for the first group, the average plant born in this group

Figure 2.5. **Age effect on plant size according to decomposition method:
Results by establishment birth size**



Note: Normalised (age 1 effect = 0) age-dummy coefficients as specified in Deaton and Paxson (1994).

Source: Authors' estimations based on micro-data from RAIS.

(i.e. a plant born with 1.3 employees) does not surpass eight employees at the twelfth year of existence. Predicting the average size at that point of their life cycle, as a product of their initial size and the predicted growth rate for the first 12 years shown in Figure 2.4, would yield the predicted size of 7.89 ($1.3 \times 607\% = 7.89$). In other words, the pure age effect is not strong enough to transform a typical small plant into a middle-sized establishment.

The composition effect due to establishment deaths

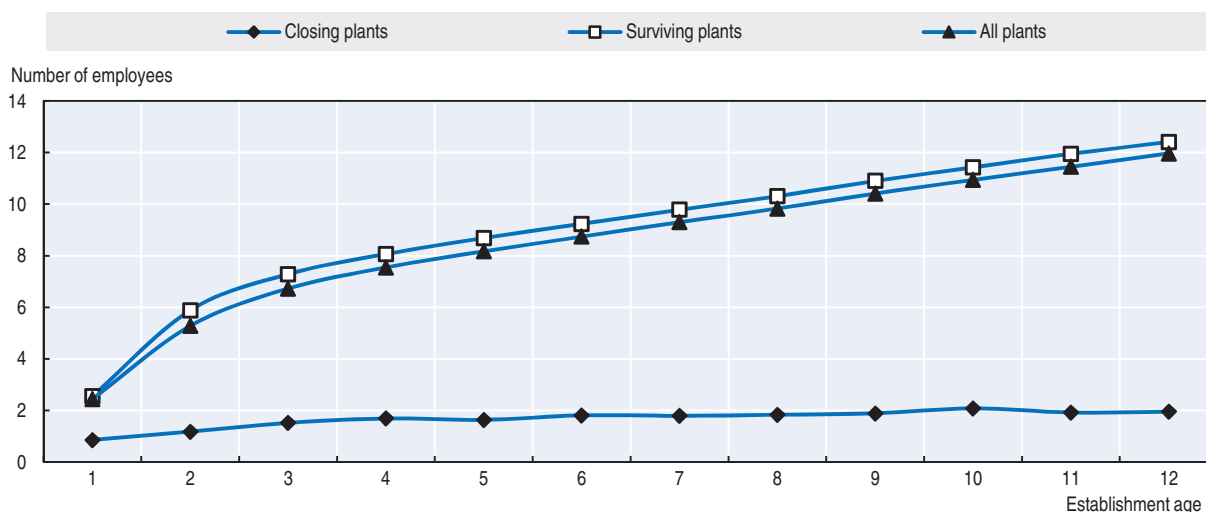
Apart from macro and cohort effects, the pattern of employment growth reported in Figure 2.1 may be affected by the process of establishment death. The observed pattern is reproduced by the line with triangular markers in Figure 2.6. The other two lines represent the average number of employees by age for two parts of the sample. For each age the sample is split into establishments that survive at least one more year (upper line) and establishments that appear for the last time in this study's data at that age (lower line). These last two lines clearly show that the overall pattern is influenced by the death of plants. Indeed, there is a striking contrast between the average number of employees in the two partitions of the sample, and the difference increases with establishment age. In the first year the plants that survive are three times bigger than their non-surviving counterparts (closing plants), while in the twelfth year the average size of the two groups differs by a factor of nine.

It is worth noticing that the average size of closing plants stays around one employee for all considered ages, indicating that a typical closing plant is very small at the moment of its death. Figure 2.7 reinforces this result by comparing the average size of closing plants at the moment of their death with the size of the same group of plants at birth. The results point to a lower average size at death than at birth for the same plants. This may partially explain why closing plants tend to be smaller than surviving ones, as shown in Figure 2.6.

The fact that closing establishments tend to be small at birth and even smaller when they die generates a composition effect on the evolution of the overall average size. The (conditional on age) distribution of plants across sizes shifts towards bigger establishments when smaller plants close and leave the sample. This composition effect will be higher the

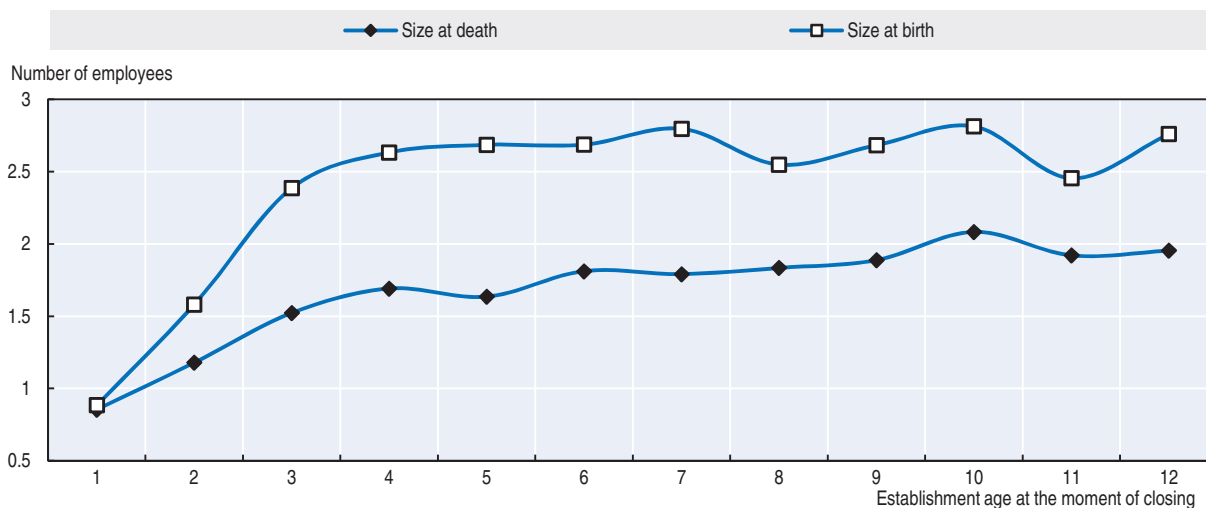
larger the share of closing plants in the sample. Figure 2.8 shows the plant mortality rate by age (the proportion of establishments that die at a given age in relation to the total number of establishments with that age). One can see that this is a critical issue especially in the second (13%) and third (10%) years of plant life, a finding that is in line with evidence for other countries (see Calvino, Criscuolo and Menon, 2015). After the second year the mortality rate trend becomes negative, reaching 4% at age 12.

Figure 2.6. **Average employment level by age of establishment: Surviving and closing plants**



Source: Authors' estimations based on micro-data from RAIS.

Figure 2.7. **Average employment level at birth and death by age of establishment at death**

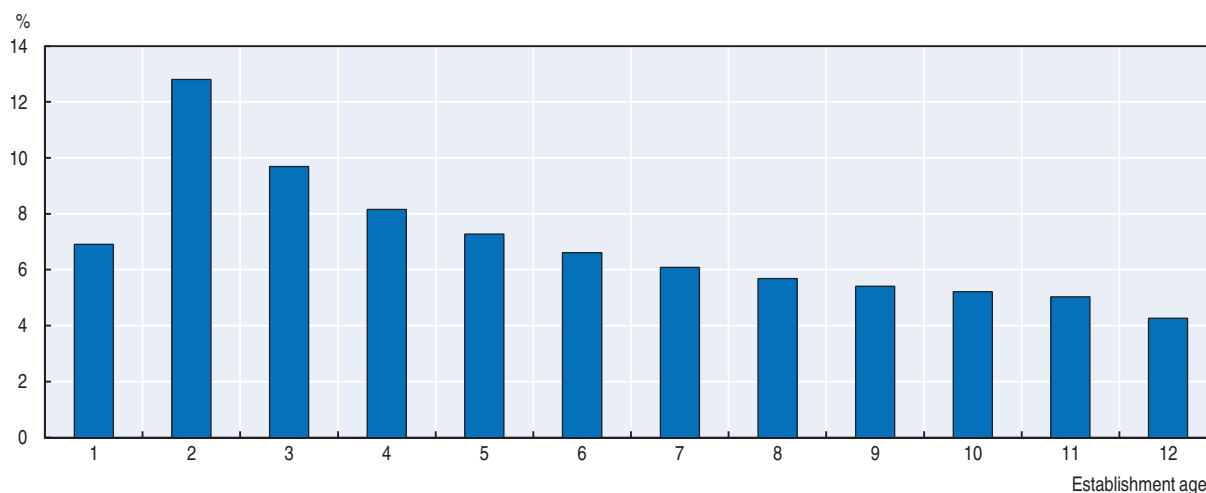


Source: Authors' estimations based on micro-data from RAIS.

The pattern of mortality rate above can also be influenced by macro or cohort-specific shocks. Therefore the evolution of the number of establishments is also decomposed by cohort, time and age effects using the previous decomposition method. This exercise is done for the same three size groups previously used (i.e. establishments born with up to nine employees, above nine but less than 49 employees, and over 49 employees). Figure 2.9 shows

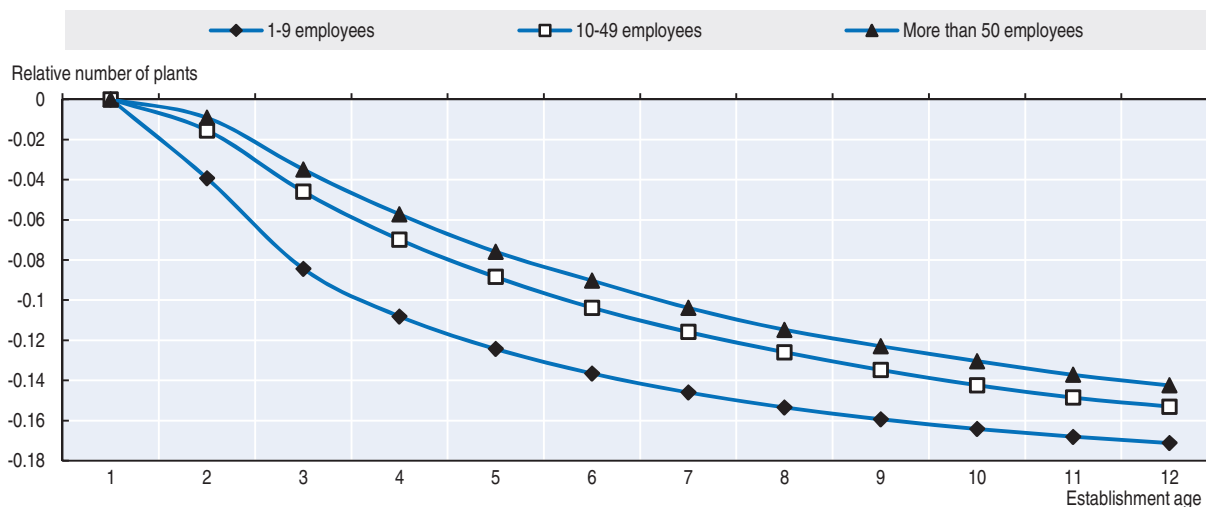
the age effects, which are now normalised with respect to the number of establishments in each size class at age one.

Figure 2.8. **Mortality rate by age of establishment**



Source: Authors' estimations based on micro-data from RAIS.

Figure 2.9. **Age effect in the relative number of plants according to decomposition method: Results by establishment birth size**



Note: Normalised (age 1 effect = 0) age-dummy coefficients as specified in Deaton and Paxson (1994).

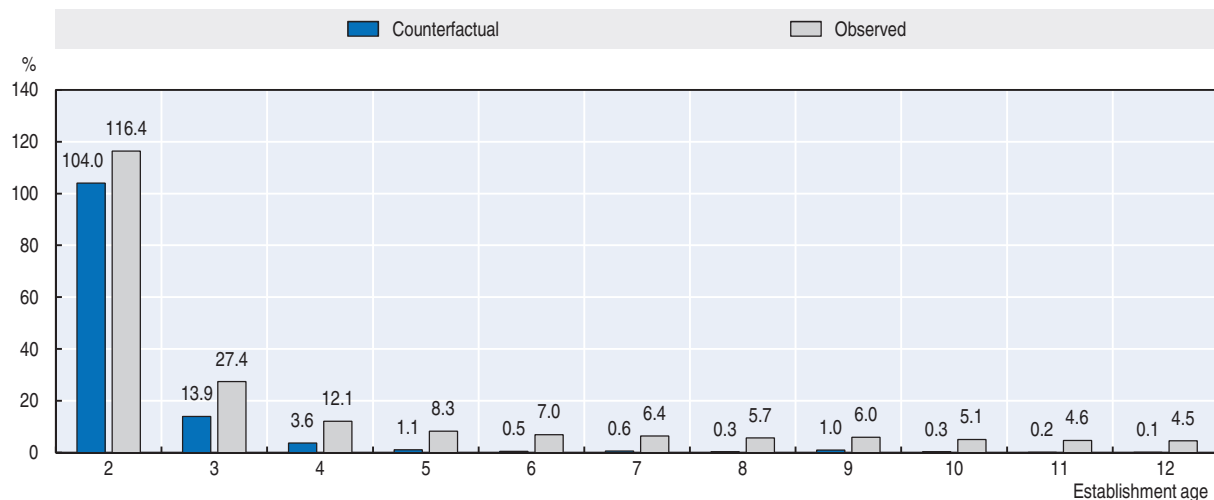
Source: Authors' estimations based on micro-data from RAIS.

This study's results point to negative (normalised) age effects, meaning that the number of establishments diminishes with age, and that their absolute values are higher for the smallest group size. For instance, at age three around 8% of plants that were born small (i.e. below nine employees) would die because of their age, whereas this figure for the middle and upper groups is around 4%. Although the age effect of the smallest class size gets closer to those of the others at higher ages, it is still higher (in absolute value) at age 12 (17% against 15%).

This study made an attempt to measure the importance of the composition effect. For this purpose two average employment growth rates were computed for each of two

consecutive ages. One is the observed growth rate from Figure 2.1 and the other is a counterfactual growth rate that maintains in the sample also those plants that died in the age interval under consideration. Clearly, it is impossible to actually know the employment level of the dead plants had they survived one more year. It is likely that the number of employees would have diminished for a significant fraction of them, but it could also be that many would recover and even increase the size of their labour force. The choice was made to construct the counterfactual by imposing zero growth on dead plants, that is, for those plants the same employment level was imputed as in the year preceding death. Figure 2.10 reports the two employment growth rates by plant age.

Figure 2.10. **Average employment growth rate**



Source: Authors' estimations based on micro-data from RAIS.

Figure 2.10 evinces that the composition effect is quite important, especially after the second year of life. For instance, in the second year, the counterfactual growth rate corresponds to a third of the observed rate and from the third year on the counterfactual rate is virtually zero. This comparison suggests that the observed growth rates for these ages were substantially influenced by the “cleansing” effect of plants’ death. One implication of this counterfactual exercise is that, without the death process, employment growth would be much weaker and the typical establishment born in the Brazilian formal sector would not reach the threshold of middle-sized establishments.

In sum, these results make it possible to draw a picture of the employment dynamics in the formal sector in Brazil with the following characteristics: a typical establishment is born small, grows relatively quickly in the first years but experiences a lower growth rate thereafter. Pure age effects have a much higher impact on the dynamics of employment growth than the macro and cohort effects and they display the same pattern across ages as that observed for a typical establishment. The results also show that plants which close down tend to be small and that a large percentage of establishments that are born small die before reaching the age of three. They further demonstrate that growth pattern of employment is affected by the death process of plants, producing a cleansing effect that arguably inflates the magnitude of the growth rate as age grows.

This analysis’ results clearly evince that the employment dynamics of small establishments in Brazil is quite different from that of larger plants. One may then speculate

that if a large percentage of small establishments die early and the surviving ones do not grow very much, the establishment size distribution in Brazil is likely to display a lower concentration of middle-sized establishments. The following section will address this question.

The “missing middle” and establishment size distribution in Brazil

Tybout (2000) shows evidence of a much higher concentration of employment in small establishments in low-income countries than in industrialised countries. The evidence collected by Tybout (2000) also shows that the employment share of the middle part of the distribution was considerably lower in the former than in the latter group of countries.⁴ These results have been interpreted as evidence that small establishments have more difficulties in growing into mid-sized establishments in developing countries. The thinner middle part of the size distribution for this group of countries has been recognised by the field of development economics and baptised the “missing middle” phenomenon.

Many explanations have been proposed for the higher concentration of small establishments and the missing middle phenomenon in the developing world. A first group of explanations is based on institutional factors such as the regulatory and tax systems of developing countries. Since larger establishments have to cope with more intricate regulations, face higher labour costs (including the minimum wage and payroll taxes), and become more exposed to the enforcement of the law, many entrepreneurs prefer to be informal and remain small. As a response to some of these constraints, tax subsidy programmes have been introduced in many developing countries to stimulate small establishments to formalise their operations and grow in size. But even these initiatives have been criticised because they establish employment or revenue thresholds for tax exemptions that may end up discouraging small establishments from growing. The high licensing costs linked to launching an establishment, which are due to public sector inefficiencies (including corruption) can also hinder some talented but credit constrained entrepreneurs from starting their own businesses.

A second group of explanations is related to the insufficient development of financial markets and the high supply of unskilled labour that characterise low- and mid-income countries. Since poorly developed financial markets lack instruments to provide long-term finance, potential entrepreneurs and established small establishments find it difficult to obtain credit to invest in fixed capital or even to cope with cash flow problems. As a result, many small establishments are not born, do not increase their scale or even die. The relative trade closeness of those countries, e.g. because of high tariff and non-tariff barriers to trade, further hinders the access of small establishments to modern machinery, equipment, and technologies. Compounded with the obstacles to investment in modern fixed capital, the abundant supply of low-skilled labour pushes small establishments to start up and keep operating with labour-intensive, low productive technologies. The lack of supply of training in the basic skills to manage a small business is another factor that diminishes the chances of survival and growth of small enterprises in the developing world.

Another line of arguments has to do with the composition of demand. Most developing countries have a large percentage of low-income families whose consumption expenditure is concentrated on food items and basic goods that can be efficiently produced with small-scale, low-tech plants. This tends to create a production structure with low diversification, so many product and service markets are underdeveloped or missing. The low availability

of wide, good-quality transportation networks is another factor that hampers the growth of small establishments. Lack of this type of public good increases costs and even deters investments to increase the scale of plants.

Despite the arguments for the existence of a missing middle, there are some concerns in the literature on whether it is in fact a characteristic of the establishment size distribution of developing countries. These concerns have been recently expressed by Hsieh and Olken (2014), who present a set of results using data from India, Mexico, and Indonesia that are not entirely compatible with the missing middle phenomenon. First, the authors show that the (average) productivity of establishments is positively related to their size, a finding that calls into question the common view that small establishments are the ones with high potential returns but that they do not to grow because they are somehow constrained (e.g. because of credit constraints). Second, they do not find evidence of kinks in establishment size or establishment revenue distributions around the thresholds established in the tax policy in those three countries. This implies that this type of tax policy does not seem to stop small establishments from growing. Finally, and more importantly for this study, they show that the histograms of establishment size distribution display a monotonic decay, a result that discards a bimodal pattern of high concentration of small and large establishments that would attest the presence of a missing middle.

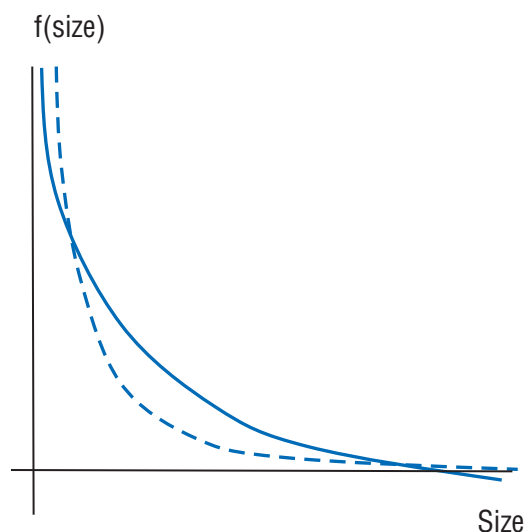
To explain why the previous empirical literature had improperly established the existence of the missing middle (in terms of a presence of bimodality in the size distribution) in developing countries, Hsieh and Olken point to the combination of two issues associated with the use of the available data. The first is the incorrect use of the distribution of employment across plant sizes instead of the distribution of plant sizes. They argue that the theory is focused on the establishments' decisions on whether or not to grow, so the relevant distribution for testing the existence of a missing middle is the distribution of plant sizes, not the distribution of employment. The second issue is that the results obtained in the literature are based on an arbitrary number of size bins (as well as the widths of these bins). Hsieh and Olken show that when the size of bins used in the literature (1-9, 10-49, and 50+ employees) is imposed to the establishment size distribution of India, Indonesia, and Mexico, the bimodal pattern that appears for the employment share distribution vanishes. Hsieh and Olken conclude that "the existing facts about the missing middle seem to come from the combination of these two transformations to the data: the transformation from the distribution of firms to the aggregate employment share, and the arbitrary binning of the employment share distribution" (p. 106).

To circumvent these criticisms, this analysis' results are computed for the establishment size distribution and, for comparability with the results in Tybout (2014), also for the employment share distribution. Since the international evidence is only available for the manufacturing sector, the analysis is conducted separately for the entire formal sector and for the manufacturing sector alone. To deal with the problem of choosing an arbitrary number of size bins and their widths, this analysis also varies both dimensions.

It is not considered that bimodality is the only criterion to evaluate the presence of a missing middle in the (establishment) size distribution. Indeed, the empirical distribution of a developing country can be unimodal and yet its middle part could be thinner than the corresponding middle part of the distribution of a developed country (e.g. the United States distribution). The hypothetical distributions displayed in Figure 2.11 – which is based on Tybout (2014, p.2) – shows this case, where the dashed line represents the density of

establishments in the developing country and the solid line the density of establishments in the developed country. As the comparison of the two lines shows, though both distributions are unimodal, the share of mid-sized establishments in the developing country is smaller than the corresponding share for the developed one.

Figure 2.11. **Unimodality and missing middle**



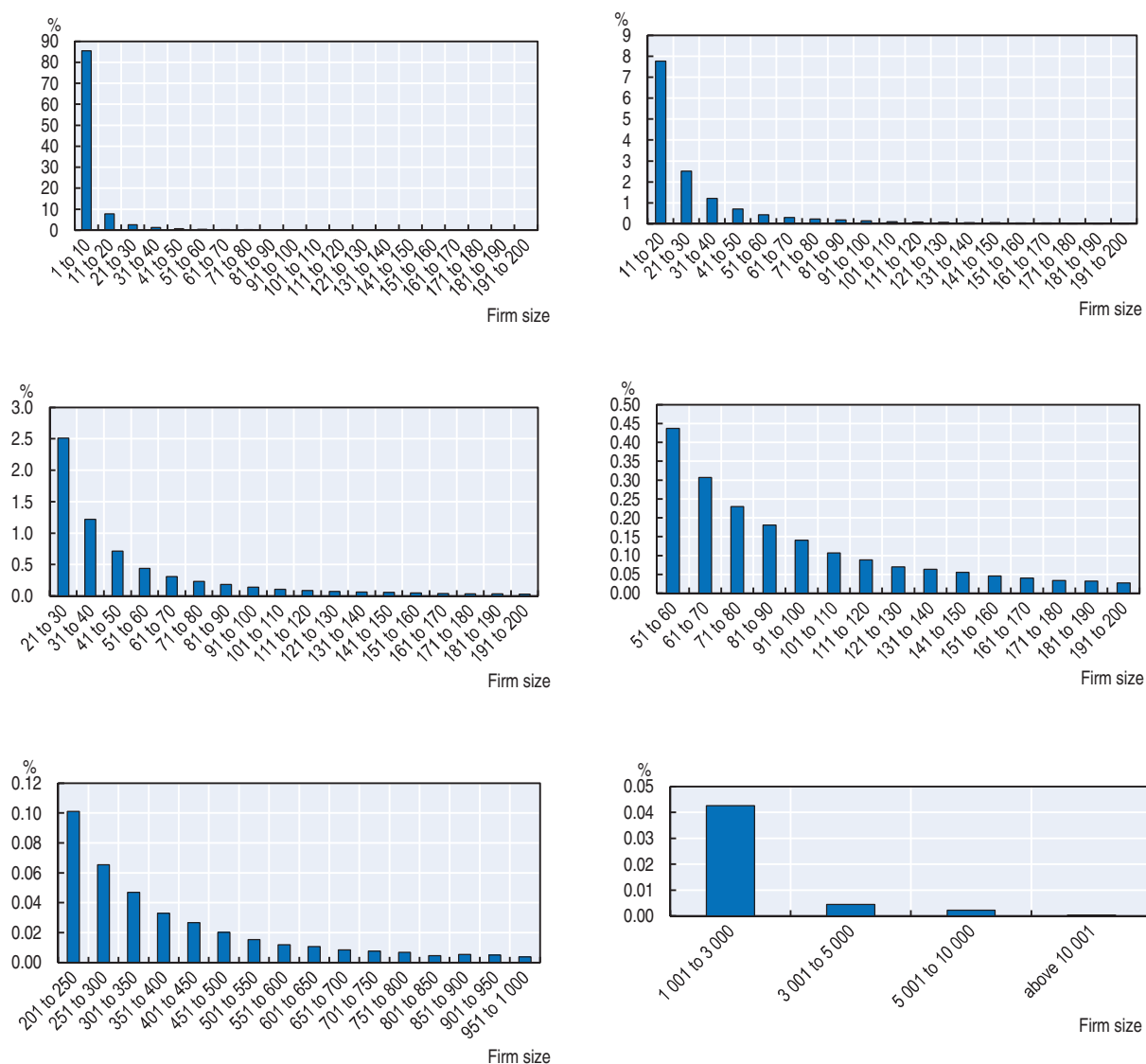
Source: Authors' analysis based on Tybout (2014), "The missing middle, revisited", https://assets.aeaweb.org/assets/production/articles-attachments/jep/app/2804/28040235_app.pdf.

The main objective of this section is to analyse whether the establishment size distribution of the Brazilian formal sector displays a missing middle. This analysis follows Tybout (2014), who proposes a method that contrasts the observed shares of the establishment size distribution with the corresponding predicted shares of what is considered the best description of establishment size distributions in the literature: the Pareto distribution.⁵ The idea is that substantial differences between the theoretical and observed shares constitute evidence of under- or over-representation of the size groups. If the middle part (however defined) of the observed distribution is relatively under-represented, this is considered as evidence that there is a missing middle.

As in the previous section, the data only cover the formal sector in Brazil. Although the share of informal sector employment decreased markedly during the last decade, informal employment still represents around 20% of the labour force in the country. As informal establishments tend to be small, this analysis' results will probably understate their weight in the left tail of the establishment size distribution. As before, this study's universe is the total set of establishments that belong to the private, non-agricultural sector in the Brazilian formal sector. To be compatible with the analysis of other parts of this study, this sample is formed by all establishments that were born from 1995 onwards. If this analysis computed its results only for establishments in their first years of existence, the size distribution would be too heavily influenced by the size profile of young establishments. Hence, the results are obtained using the last year available in this study's data, 2013, for which the size distribution is more stable, as it becomes also influenced by the presence of older establishments. The main conclusions do not change when the exercise is implemented using the whole sample of establishments, and not only those observed in 2013.⁶

This study begins by showing histograms of the size distributions. Figure 2.12 presents the distribution of plant size while Figure 2.13 the distribution of employment shares by establishment size. Following Hsieh and Olken, it uses bins of ten workers up to size 200 and vary the lower cut-off of the range to make the shares more easily visible. It also shows a graph for sizes between 201 and 1 000 using bins of 50 workers and a graph for sizes over 1 001 employees with bins of different widths.

Figure 2.12. **Distribution of establishment size by number of employees, 2013**



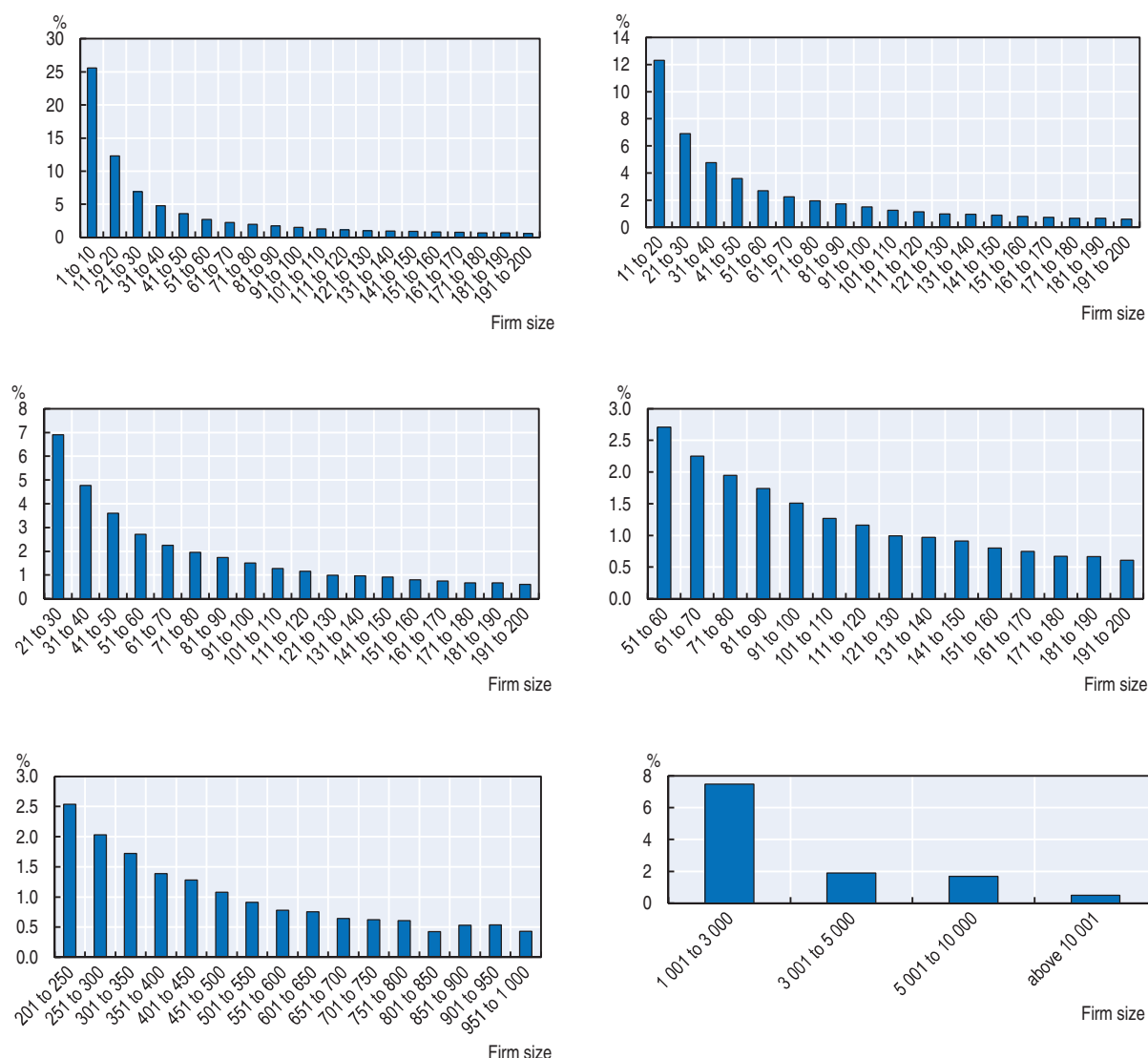
Note: The sample is formed by all private, non-agricultural establishments born since 1995.

Source: Authors' estimations based on micro-data from RAIS.

Figure 2.12 reveals that the plant size distribution is highly right skewed displaying a very high concentration of small plants and a monotonic decline in the shares of larger establishments. This shape is similar to that presented in Hsieh and Olken for India, Indonesia, and Mexico. Although it is not considered that bimodality is the only criterion

to check when deciding whether a distribution displays a missing middle, no evidence is found either of bimodality in the establishment size distribution for Brazil. Figure 2.13 shows that the employment share distribution is also right skewed, although the decline in shares is naturally smoother than for the plant size distribution. No bimodality is evinced in Panel 2 either. Though not shown, these findings are also valid for the manufacturing sector alone.

Figure 2.13. **Employment share by establishment size, 2013**



Note: The sample is formed by all private, non-agricultural establishments that were born since 1995.

Source: Authors' estimations based on micro-data from RAIS.

The Pareto distribution has been established as the best characterisation of establishment size distributions for developed countries.⁷ Following the method proposed by Tybout (2014), this study contrasts the empirical size distribution for Brazil with its closest theoretical Pareto distribution. The idea behind this procedure is that observed deviations between the shares of the predicted and the actual Pareto distributions indicate which parts of the empirical distribution are under or over-represented.

The upper tail of the Pareto size distribution can be written as:

$$\bar{F}(S) = \Pr(S \geq s) = \left(\frac{s_0}{s}\right)^\alpha, \quad s \geq s_0, \quad \alpha > 0, \quad (1)$$

where S denotes establishment size, α is the shape parameter, and s_0 is the scale parameter that represents the minimum possible value assumed by S . It is assumed that the smallest plant employs one single worker, so $s_0 = 1$. Larger values of α imply higher concentration of smaller establishments in the size distribution. From (1), the share of establishments (h^f) in the size range $s_i \leq s \leq s_j$ is given by:

$$h^f(s_i, s_j | \alpha) = F(s_i \leq s \leq s_j | \alpha) = s_i^{-\alpha} - s_j^{-\alpha}. \quad (2)$$

To calibrate the value of α the main approach suggested by Tybout (2014) is used. The method searches for the value of α that minimises the Euclidian distance between the log of vector $\mathbf{s}$ of actual shares given by the Pareto distribution and the log of vector $\hat{\mathbf{s}}$ of predicted shares given by the empirical distribution.⁸

Since the bulk of the literature is based on the employment share distribution across plant sizes, this study also implements the method for this distribution. Given that the employment share in each bin can be obtained by multiplying the number of establishments in each bin with the average employment size of establishments in the bin, expression (2) can be written in terms of employment shares (h^e) as:⁹

$$h^e(s_i, s_j | \alpha) = s_i^{1-\alpha} - s_j^{1-\alpha}. \quad (3)$$

This analysis obtains results for different number of size categories and for different values of the cut-off points that define these categories. It initially defines three bins (called lower, middle, and upper) and varies the cut-off points to verify the sensitivity of the results to different widths of the bins. It employs the usual three bins that appear in the literature: 1 to 9, 10 to 49, and over 50 employees, but as shown in the tables below it uses various distinct cut-offs. Results are obtained for the plant size distribution (Table 2.1 for the entire formal sector and Table 2.2 only for the manufacturing sector) as well as for the employment share distribution (Table 2.3 for the entire formal sector and Table 2.4 only for the manufacturing sector). The second column in these tables reports the calibrated value of α that is retrieved by the method. Columns 3, 4, and 5 display the difference between the actual and predicted shares of the lower, middle, and upper categories respectively. The international evidence is only available for the employment share distribution in the manufacturing sector, so only Table 2.4 contains results that are comparable to those available in the literature. In Table 2.5 the number of bins is increased to six to see whether the results are sensitive to finer partitions of both the establishment size and the employment share distributions.

Table 2.1 presents the results for the plant size distribution for the whole formal sector. It reveals that there is excess concentration of small-sized establishments relatively to the benchmark Pareto distribution. In contrast, the middle size category is less populated than would be predicted by the Pareto distribution for all lower and upper bounds used to define the widths of the bins. As for the upper category, column 3 shows that its share is very close to that predicted by the Pareto. These pieces of evidence thus suggest that the missing middle phenomenon is observed for the Brazilian formal sector. Interestingly, the value of α is very close to one, suggesting that the upper tail of the distribution of establishment size in the formal sector in Brazil is almost exactly inversely related to the size of the establishments.

Table 2.1. **Actual minus predicted shares of the establishment size distribution for the whole formal sector for 2013**

Width of bins	α	Lower (L)	Middle (M)	Upper (U)
L = 1-5, M = 6-49, U = 50+	1.010	0.086	-0.116	-0.004
L = 1-5, M = 6-100, U = 101+	1.010	0.086	-0.119	0.000
L = 1-5, M = 6-200, U = 201+	1.010	0.086	-0.120	0.000
L = 1-6, M = 7-49, U = 50+	1.010	0.078	-0.097	-0.004
L = 1-6, M = 7-100, U = 101+	1.010	0.078	-0.101	0.000
L = 1-6, M = 7-200, U = 201+	1.010	0.078	-0.102	0.000
L = 1-7, M = 8-49, U = 50+	1.010	0.069	-0.083	-0.004
L = 1-7, M = 8-100, U = 101+	1.010	0.069	-0.086	0.000
L = 1-7, M = 8-200, U = 201+	1.010	0.069	-0.087	0.000
L = 1-8, M = 9-49, U = 50+	1.010	0.061	-0.070	-0.004
L = 1-8, M = 9-100, U = 101+	1.010	0.061	-0.074	0.000
L = 1-8, M = 9-200, U = 201+	1.010	0.061	-0.075	0.000
L = 1-9, M = 10-49, U = 50+	1.010	0.053	-0.060	-0.004
L = 1-9, M = 10-100, U = 101+	1.010	0.053	-0.064	0.000
L = 1-9, M = 10-200, U = 201+	1.010	0.053	-0.065	0.000

Note: The sample is formed by all private, non-agricultural establishments that were born since 1995. See text for the methods used to construct the table.

Source: Authors' estimations based on micro-data from RAIS.

Table 2.2. **Actual minus predicted shares of the establishment size distribution: Manufacturing sector, 2013**

Width of bins	α	Lower (L)	Middle (M)	Upper (U)
L = 1-5, M = 6-49, U = 50+	1.010	0.224	-0.225	-0.033
L = 1-5, M = 6-100, U = 101+	1.010	0.224	-0.244	-0.014
L = 1-5, M = 6-200, U = 201+	1.010	0.224	-0.251	-0.006
L = 1-6, M = 7-49, U = 50+	1.010	0.212	-0.203	-0.033
L = 1-6, M = 7-100, U = 101+	1.010	0.212	-0.222	-0.014
L = 1-6, M = 7-200, U = 201+	1.010	0.212	-0.230	-0.006
L = 1-7, M = 8-49, U = 50+	1.010	0.198	-0.183	-0.033
L = 1-7, M = 8-100, U = 101+	1.010	0.198	-0.202	-0.014
L = 1-7, M = 8-200, U = 201+	1.010	0.198	-0.209	-0.006
L = 1-8, M = 9-49, U = 50+	1.010	0.184	-0.165	-0.033
L = 1-8, M = 9-100, U = 101+	1.010	0.184	-0.184	-0.014
L = 1-8, M = 9-200, U = 201+	1.010	0.184	-0.191	-0.006
L = 1-9, M = 10-49, U = 50+	1.010	0.171	-0.149	-0.033
L = 1-9, M = 10-100, U = 101+	1.010	0.171	-0.168	-0.014
L = 1-9, M = 10-200, U = 201+	1.010	0.171	-0.175	-0.006

Note: The sample is formed by all private, non-agricultural establishments that were born since 1995. See text for the methods used to construct the table.

Source: Authors' estimations based on micro-data from RAIS.

Table 2.2 reports the results for the manufacturing sector alone. Compared to the whole formal sector, the over-representation of small establishments is much higher and the under-representation of middle-sized establishments is much deeper. Larger establishments in this sector also appear to be under-represented but much less than the middle category. These figures also evince the presence of a missing middle in the establishment size distribution of the manufacturing sector in Brazil. As in the aggregate formal sector, the value of α is also very close to unity in the manufacturing sector.

Table 2.3. **Actual minus predicted employment shares for the whole formal sector for 2013**

Width of bins	α	Lower (L)	Middle (M)	Upper (U)
L = 1-5, M = 6-49, U = 50+	1.160	0.082	-0.169	0.064
L = 1-5, M = 6-100, U = 101+	1.170	0.094	-0.208	0.090
L = 1-5, M = 6-200, U = 201+	1.185	0.113	-0.234	0.096
L = 1-6, M = 7-49, U = 50+	1.170	0.091	-0.155	0.043
L = 1-6, M = 7-100, U = 101+	1.175	0.098	-0.197	0.079
L = 1-6, M = 7-200, U = 201+	1.190	0.117	-0.225	0.087
L = 1-7, M = 8-49, U = 50+	1.175	0.093	-0.144	0.033
L = 1-7, M = 8-100, U = 101+	1.185	0.107	-0.184	0.059
L = 1-7, M = 8-200, U = 201+	1.195	0.120	-0.215	0.077
L = 1-8, M = 9-49, U = 50+	1.180	0.095	-0.134	0.023
L = 1-8, M = 9-100, U = 101+	1.190	0.109	-0.174	0.050
L = 1-8, M = 9-200, U = 201+	1.200	0.123	-0.206	0.068
L = 1-9, M = 10-49, U = 50+	1.185	0.096	-0.124	0.014
L = 1-9, M = 10-100, U = 101+	1.190	0.103	-0.167	0.050
L = 1-9, M = 10-200, U = 201+	1.205	0.125	-0.197	0.059

Note: The sample is formed by all private, non-agricultural establishments that were born since 1995. See text for the methods used to construct the table.

Source: Authors' estimations based on micro-data from RAIS.

Table 2.4. **Actual minus predicted employment shares for the manufacturing sector for 2013**

Width of bins	α	Lower (L)	Middle (M)	Upper (U)
L = 1-5, M = 6-49, U = 50+	1.090	0.069	-0.174	0.090
L = 1-5, M = 6-100, U = 101+	1.095	0.076	-0.240	0.149
L = 1-5, M = 6-200, U = 201+	1.100	0.083	-0.289	0.191
L = 1-6, M = 7-49, U = 50+	1.095	0.076	-0.166	0.077
L = 1-6, M = 7-100, U = 101+	1.100	0.083	-0.231	0.134
L = 1-6, M = 7-200, U = 201+	1.105	0.091	-0.280	0.176
L = 1-7, M = 8-49, U = 50+	1.100	0.081	-0.157	0.063
L = 1-7, M = 8-100, U = 101+	1.105	0.089	-0.221	0.120
L = 1-7, M = 8-200, U = 201+	1.110	0.097	-0.270	0.161
L = 1-8, M = 9-49, U = 50+	1.105	0.087	-0.148	0.050
L = 1-8, M = 9-100, U = 101+	1.110	0.095	-0.212	0.106
L = 1-8, M = 9-200, U = 201+	1.120	0.111	-0.254	0.132
L = 1-9, M = 10-49, U = 50+	1.110	0.092	-0.139	0.037
L = 1-9, M = 10-100, U = 101+	1.115	0.100	-0.203	0.092
L = 1-9, M = 10-200, U = 201+	1.125	0.117	-0.245	0.118

Note: The sample is formed by all private, non-agricultural establishments that were born since 1995. See text for the methods used to construct the table.

Source: Authors' estimations based on micro-data from RAIS.

The results for the employment share distribution across plant sizes for the formal sector are reported in Table 2.3. Contrary from what was observed in Table 2.1, here there is over-representation of both the smallest and largest categories. Naturally, the middle of the distribution is thinner than would be expected by the Pareto distribution, so the missing middle phenomenon is also apparent when the employment share distribution is used.

Table 2.4 contains the results for the employment share distribution only for establishments in the manufacturing sector. Similar to Table 2.3, there is overconcentration of employment in the lower and upper categories and a thinner middle part than predicted by the benchmark Pareto distribution. Table 1 in Tybout (2014), which is based on the 1-9,

10-49, and 50+ partition, reports that the negative gap for the middle category in the manufacturing sector is -0.084 for India (2011), -0.085 for Indonesia (2006), and -0.030 for Mexico (2006). The corresponding figure for Brazil is -0.139, so taking the employment share distribution as the reference for comparison purposes, the missing middle phenomenon seems to be slightly stronger in Brazil than in the Asian countries and considerably more severe than in Mexico.

Table 2.5. Actual minus predicted shares of establishment size and employment share distributions for the whole formal sector and the manufacturing sector for 2013

Width of bins	α	First	Second	Third	Fourth	Fifth	Sixth
		(1-9)	(10-29)	(30-49)	(50-99)	(100-200)	(201+)
A. Establishment size distribution							
A1. Whole formal sector	1.010	0.053	-0.054	-0.007	-0.004	-0.001	0.000
A2. Manufacturing sector	1.010	0.171	-0.124	-0.026	-0.019	-0.007	-0.006
B. Employment share distribution							
B1. Whole formal sector	1.220	0.145	-0.081	-0.036	-0.045	-0.037	0.033
B2. Manufacturing sector	1.175	0.196	-0.062	-0.043	-0.060	-0.048	-0.002

Note: The sample is formed by all private, non-agricultural establishments that were born since 1995. See text for the methods used to construct the table.

Source: Authors' estimations based on micro-data from RAIS.

In Table 2.5 the number of bins is doubled to six in order to verify whether the patterns of the previous tables are sensitive to way the distribution is partitioned. When using the establishment size distribution (Panel A), an under-representation of the middle part can also be seen, particularly in the second bin, whose upper cut-off is 29 workers (instead of the 49 threshold used before). This is valid for the entire formal sector as well as for the manufacturing sector alone. A similar pattern emerges for the employment share distribution (Panel B) but with the under-representation of the middle part being more spread across the central categories.

In sum, the method applied in this section shows an over-representation of small-sized establishments in the formal sector in Brazil. It also evinces that the middle part of the establishment size distribution is under-represented, with the upper part's share corresponding to what would be expected by the Pareto distribution. Similar results apply when the employment share distribution is used. The result of a relatively thinner middle part provides support for the assertion that the missing middle phenomenon is also observed in Brazil.

Conclusions

This chapter's results confirm that the middle part of the size distribution is "missing" in Brazil and apparently this feature is more intense than in other countries for which there are available results. This analysis of the dynamics of employment over the life cycle of establishments provides some clues on why there is a missing middle in the size distribution. Considering a representative establishment, the results show that it is born small (perhaps too small) and that the pattern of the growth rate over its life cycle imposes a long time span to surpass the threshold of a mid-sized plant.

These results also indicate that most of this life cycle pattern can actually be attributed to age effects, as the application of a novel decomposition method revealed a limited scope

for potential confounding determinants such as the conditions prevailing at the time the plant was born (cohort effects) or the phase of the business cycle through which the plant existed (year effects).

Focusing on establishments that are actually born small, they start very small and, though the age effects are positive and high in their first years of life, they are not strong enough to transform them into plants of middle size. In addition, their mortality rate is quite high, especially within the first three years of their lives.

As in many other countries, the segment of micro and small establishments has received a great deal of attention from public policy in Brazil. Indeed, a myriad of programmes specifically targeted to this segment have been implemented by the national, state, and municipal spheres of government over the last decades. The number of initiatives and their specificities are too extensive to fit in this chapter but among the most important ones are an ample set of national and regional programmes that provide credit at low interest rates and credit guarantees to micro and small establishments, a wide programme that concedes tax subsidies for establishments whose revenues are below a defined threshold, a large programme of government procurement targeted to micro and small establishments, and a broad supply chain of training courses and technical assistance dedicated to help potential entrepreneurs and already established small businesses to improve their operation. As claimed by Nogueira (2016), Brazil is certainly the Latin American country with the largest and most diversified institutional framework to support this type of establishments.

Unfortunately, the effectiveness of these interventions has not been assessed, so it is difficult to say whether and to what extent they have actually affected the performance of the micro and small establishments in the country. Although this chapter's results indicate that the performance of small establishments in the country is relatively poor, it is possible that the situation would be even worse had these programmes not been in place. Nevertheless, they clearly need to be redesigned, in particular towards increasing the articulation of the various initiatives within and between the three spheres of government.

Notes

1. There are incentives for truthful reporting since the main purpose of RAIS is to administer a federal wage supplement (*Abono Salarial*) to formal sector workers.
2. This was originally proposed for the analysis of wages or consumption but can be applied to any other variable affected by these three dimensions.
3. As previously mentioned, all the establishments of cohorts after 2002 are excluded.
4. The evidence presented in Tybout (2000, Table 2.1) was gathered from different studies, in particular from Leidholm and Mead (1987). Most of the figures were only available for three bins of the employment share distribution, namely: 1-9, 10-49, and 50+ employees.
5. See Axtell (2001) and Luttmer (2007).
6. The results are available from the authors upon request.
7. Specifically, the Zipf distribution, a special case of the Pareto, is considered the best description of the firm size distribution. See Axtell (2001).
8. An alternative method suggested by Tybout (2014) chooses α so that the share of the smallest size category of the actual and predicted distributions matches exactly. This study also implemented this method and, although not shown, the results were qualitatively similar. Since the mean of the Pareto distribution is only defined for values of α higher than unity, it imposed this constraint in the estimation.

9. Letting F be the total number of establishments and using the density of the establishment size distribution:

$$f(S) = \frac{dF(S)}{dS} = \alpha S^{-\alpha-1},$$

total employment in the economy is given by:

$$E(1, \infty | \alpha, F) = F \int_1^{\infty} sf(s) ds = \alpha F \int_1^{\infty} s^{-\alpha} ds = \frac{\alpha F}{\alpha - 1}.$$

Total employment in the size range $s_i \leq s \leq s_j$ is

$$E(s_i, s_j | \alpha, F) = F \int_{s_i}^{s_j} sf(s) ds = \alpha F \int_{s_i}^{s_j} s^{-\alpha} ds = \frac{\alpha F}{\alpha - 1} \left[s_i^{1-\alpha} - s_j^{1-\alpha} \right].$$

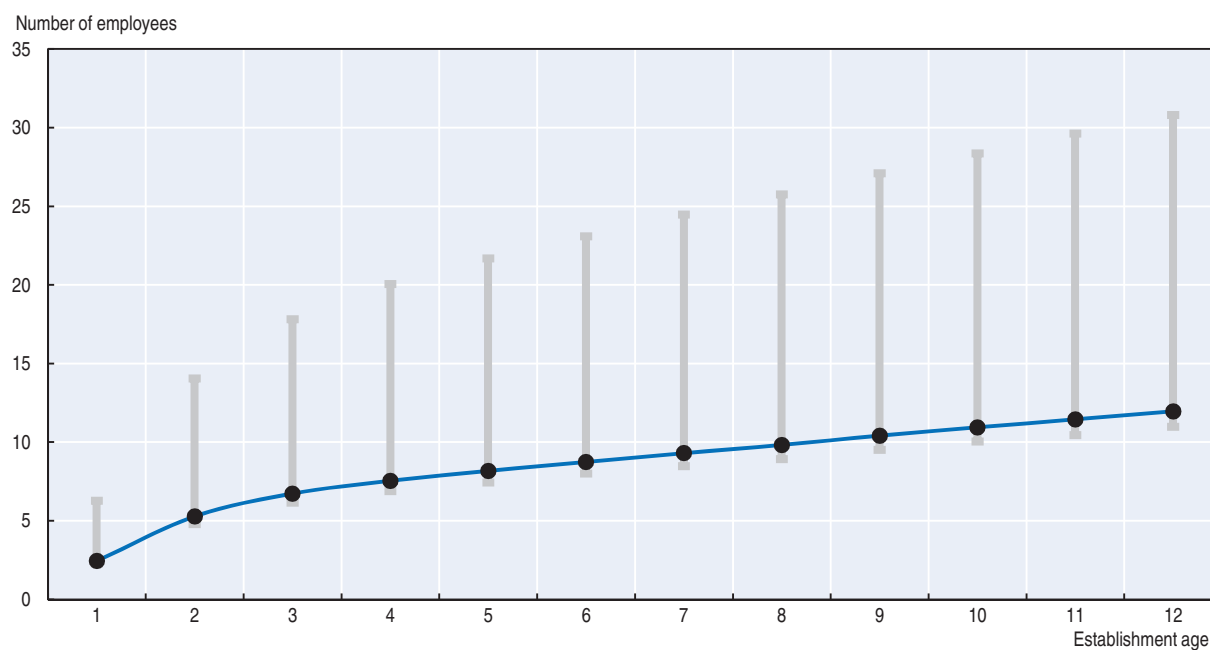
Thus,

$$h^e(s_i, s_j | \alpha) = \frac{E(s_i, s_j | \alpha, F)}{E(1, \infty | \alpha, F)} = s_i^{1-\alpha} - s_j^{1-\alpha}.$$

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ANNEX 2.A1

*Complementary data*Figure 2.A1.1. **Average employment level by age of establishment**

Note: The vertical grey lines represent the interval between P10 and P90 for the size distribution conditioned at the age displayed at the horizontal axis.

Source: Authors' estimations based on micro-data from RAIS.

ANNEX 2.A2

Methodological details

The estimated model is the following:

$$\text{averagesize} = \beta + \alpha_1 \text{age}_1 + \dots + \alpha_{10} \text{age}_{19} + \gamma_{1995} \text{cohort}_{1995} + \dots + \gamma_{2002} \text{cohort}_{2002} + \varphi_{1995} \text{year}_{1995} + \dots + \varphi_{2013} \text{year}_{2013} + u. \quad (1)$$

where *averagesize* is a column vector of the average number of employees of establishments with *m* rows (where *m* is equal to the product of the number of cohorts, ages, and years), (*age*₁, ..., *age*₁₉) are column vectors of age dummies, (*cohort*₁₉₉₅, ..., *cohort*₂₀₀₂) are column vectors of cohort dummies and (*year*₁₉₉₅, ..., *year*₂₀₁₃) are column vectors of year dummies.

The model (1) cannot be estimated due perfect collinearity since the cohort is a linear combination of year and age:

$$\text{cohort} = \text{year} - \text{age} + 1. \quad (2)$$

In order to estimate model (1), Deaton proposes a normalisation that is based on the assumption that year effects capture cyclical fluctuations that have mean zero in the long run. This assumption makes the year effects orthogonal to a time-trend:

$$s_y' \varphi = 0, \quad (3)$$

where *s_y* is an arithmetic sequence {0,1,2,3;...}.

Under assumption (3), Deaton and Paxson (1994) suggest estimating the model (1) by regressing the response vector on cohort dummies (omitting the first cohort), age dummies (omitting the first age) and a set of T-2 years dummies, defined as follows:

$$\text{year}_t^* = \text{year}_t - [(t-1995)\text{year}_{1996} - (t-1996)\text{year}_{1995}] \text{ for every } t=1997, \dots, 2013. \quad (4)$$

The coefficients of the *year*_t^{*} dummies give the coefficients of (*year*₁₉₉₇, ..., *year*₂₀₁₃), the coefficients of (*year*₁₉₉₅ and *year*₁₉₉₆) can be recovered by conditions (4) and from the fact that all year effects add up to zero.

Chapter 3

The role of mergers and acquisitions in employment dynamics in Belgium

by

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This chapter considers data on mergers and acquisitions (M&As) involving Belgian companies to investigate the role of M&As in employment dynamics. Given the low number of Belgian firms that are involved in M&A deals, conclusions from analyses on job creation are very robust for Belgium. Estimations suggest that concerns about the negative employment effects of foreign acquisitions are not warranted for Belgium. Whereas domestic acquisitions and intra-industry acquisitions are found to have negative effects on employment in target firms, which are partially offset by job creation in Belgian acquiring firms, acquisition of a Belgian target by a foreign acquiring firm appears to have a positive impact on employment in the Belgian target, if the foreign acquirer does not belong to the same industry as the Belgian target firm.

Introduction

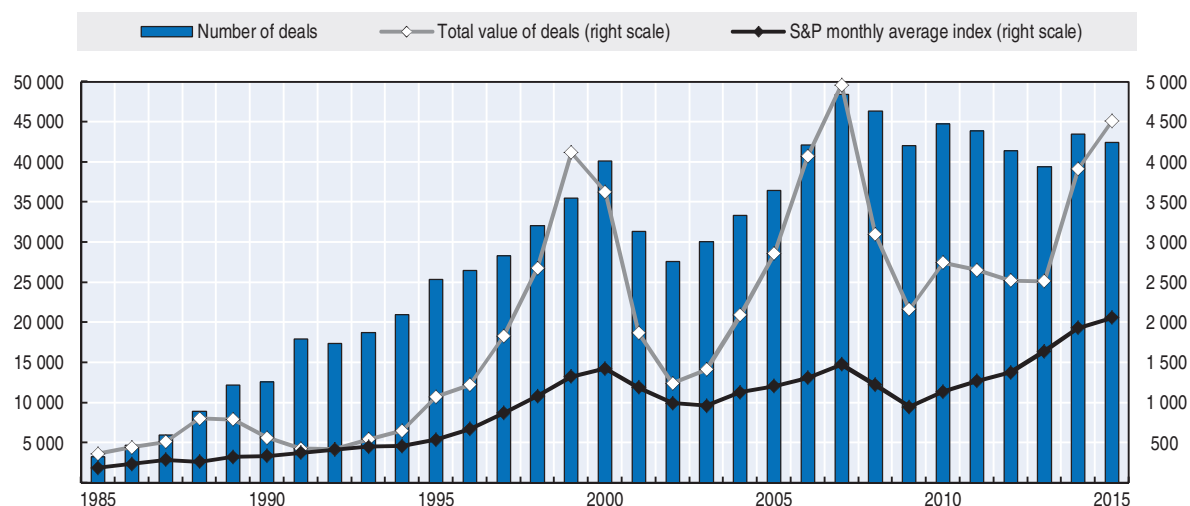
The number and value of mergers and acquisitions (M&As) are known to rise and fall dramatically in consecutive waves. According to financial software company Dealogic, the total value of global M&A deals increased for the third consecutive year in 2015 to a record USD 5.03 trillion, up 37% from 2014 whereas Thomson Reuters reports a slightly lower record value of USD 4.7 trillion and a 42% increase from 2014. Zephyr (Bureau Van Dijk, 2016b) puts the value of global M&As in 2015 at a record high of USD 6.1 trillion although the number of deals dropped to 89 440 from 89 773 in 2014.¹

A vast literature assesses the motives and the performance of M&As from the perspective of target and/or acquiring firms. Gugler et al. (2012) point to the strong correlation between the evolution in M&A deals and financial market valuation and conclude, from an analysis of global M&As over the period 1985-2008, that “aggressive” managers take advantage of optimism in financial markets to pursue M&A deals that often turn out to be unprofitable. This view is supported by the returns of M&As to acquiring firms that are negatively correlated with the degree of optimism in financial markets at the time of the deal. Kim, Halebian and Finkelstein (2011) argue that as financial markets reward high-growth firms, managers may be pressured by shareholders and financial analysts to pursue growth through M&A deals, especially if the potential of internal (organic) growth is limited.

The wave pattern of M&A deals as well as the strong correlation with stock market valuation can be seen in Figure 3.1, which shows the number and the total value of M&A deals worldwide for the period 1985-2015² and the Standard and Poor’s (S&P) 500 stock market index. The correlation between the number – as well as the USD value of worldwide deals – and the S&P index is 0.90.

Although assessing the performance of M&As is obviously complicated, most studies suggest a low success rate, especially for acquiring firms (e.g. King et al., 2004; Puranam and Srikanth, 2007; Bauer and Matzler, 2014; Warter and Warter, 2014). Even M&As that are successful – from the point of view of the employees and shareholders of companies – may be problematic from a general welfare perspective if the advantage for the stakeholders results from an increase in market power and rents. An analysis of M&As in OECD countries by Doytch and Cakan (2011) suggests that M&As have a negative impact on aggregate economic growth, especially due to negative effects in primary and manufacturing industries. Furman and Orszag (2015) posit that consolidation in American industries contributed to rising inequality by increasing the share of firms that earn super-normal returns on capital. The increase in cross-border M&As triggered policy concerns over the potential negative impact of foreign acquisitions on domestic employment in host countries (Bandick and Görg, 2010; Chilton, Milner and Tingley, 2015).

This chapter aims at assessing the role of M&As in employment dynamics in Belgium and at investigating whether the distinction between internal growth and growth through M&As matters for analyses of job creation. Compared to other countries, the number of Belgian firms that are involved in M&A deals, as targets or acquirers, is fairly low and

Figure 3.1. **Number and value of worldwide M&As and Standard and Poor's index**

Note: The number of M&A deals is depicted on the left scale; the value of M&A deals (USD million) and the S&P 500 index are on the right scale.
 Sources: Institute for Mergers, Acquisitions and Alliances (2016), "Mergers & Acquisitions Statistics", <https://imaa-institute.org/mergers-and-acquisitions-statistics>; Yahoo Finance (2016), "S&P 500 historical data", <https://finance.yahoo.com/quote/%5EGSPC/history?p=%5EGSPC>.

– against the worldwide trend – even shows a decline from 2005 onwards. Given the low number of firms in M&A deals in each given year, conclusions from analyses on job creation are very robust for Belgium. Estimations suggest that concerns about the negative employment effects of foreign acquisitions are not warranted for Belgium. Whereas domestic acquisitions and intra-industry acquisitions are found to have negative effects on employment in target firms, which are partially offset by job creation in Belgian acquiring firms, acquisition of a Belgian target by a foreign acquiring firm actually appears to have a positive impact on employment in the Belgian target, if the foreign acquirer does not belong to the same industry as the Belgian target firm (inter-industry acquisitions).

This chapter is organised as follows. In the second section the data that are used for the analysis of M&A deals involving Belgian companies are discussed. The third section compares a number of results of an analysis of employment dynamics without information on M&As to an analysis in which information on M&As for Belgium is used to distinguish between internal (organic) employment growth and external growth through M&As. The fourth section investigates the evolution of employment growth in target and acquiring firms over a period of three years before and up to three years after the completion of a deal. The fifth section looks at potential firm-level and industry-level determinants of the probability that a firm is involved in an M&A deal. Conclusions are provided in the final section.

Data section

The two main sources of firm-level data on M&As used in empirical studies are Thomson Reuters M&A and Zephyr, an online commercial database provided by Bureau van Dijk. Zephyr does not consider a minimum value for M&A deals whereas Thomson Reuters M&A currently uses a USD 1 million minimum threshold. Stiebale and Trax (2011) compare Zephyr with data from Thomson Reuters for M&A deals above USD 10 million – the previous minimum deal value of Thomson Reuters – and find that the coverage of transactions is very similar. Given its larger coverage, the analysis in this chapter is based on Zephyr (Bureau van Dijk, 2016b),³ which contains data on worldwide M&As, initial public offerings, private equity

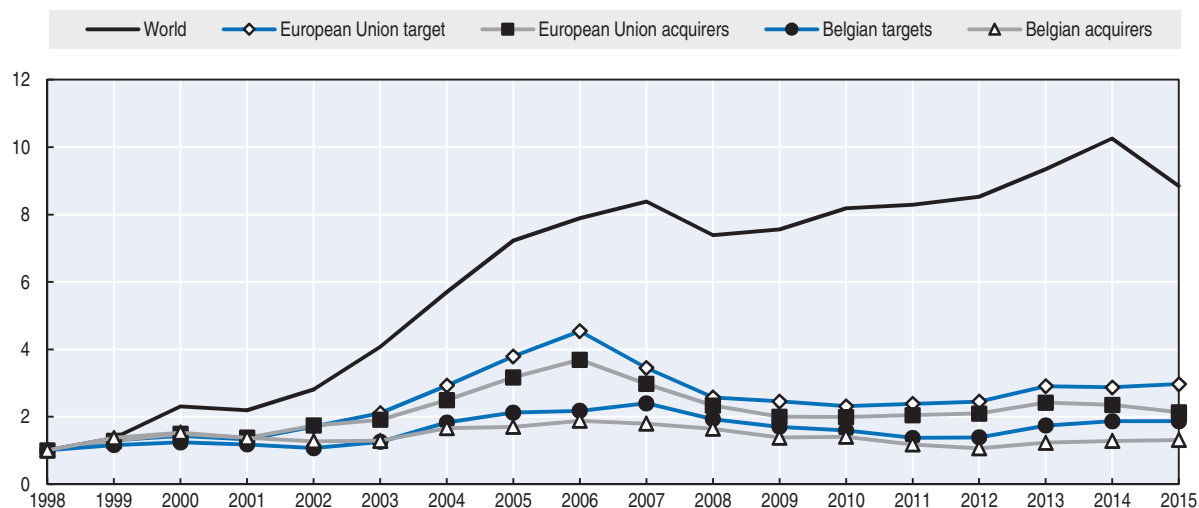
and venture capital deals from 1997 onwards. The information in Zephyr comes from annual reports of companies; private correspondence (letters and phone calls); company websites and media coverage. As mentioned before, there is no limitation on the deals taken into consideration in Zephyr except that all companies involved in a deal need to be identified. By January 2016 the Zephyr database contained information on some 1.4 million deals and rumours.⁴ Company information is available for the target, acquirer and possible vendor firm before, during and after the deal. The database provides the value-added tax (VAT) number, if available, for the companies involved in a deal, which is used to link to other firm-level data for Belgian companies, from the National Social Security Office (Belgian employment data) and from Belfirst (Bureau van Dijk, 2016a), with annual account data of all companies with an obligation to deposit their annual accounts in Belgium.⁵ Only non-financial companies (excluding non-profit organisations) are considered for the analysis which on average account for 98.5% of the total number of employees in the sector of non-financial corporations⁶ over the period 2001-14.

Belfirst contains information on a relatively large number of mergers by acquisition that are not covered by Zephyr. The vast majority of the target firms in these deals are dissolved after acquisition. Over the period 2001-14 these acquisitions involve 0.12% up to 0.25% of the firms but their combined share in total employment only ranges from 0.15% up to 0.22%. Apart from being acquisitions that generally involve small target firms, most deals appear to be part of within-group consolidation. For 26 out of the 28 acquisitions that are reported in Belfirst but not in Zephyr and involve more than 150 employees, the target and acquiring firm can immediately be identified as belonging to the same group. Moreover, for the acquisitions reported in Belfirst but not in Zephyr, neither the identity of the acquiring firm nor any additional information regarding the deal is available. For these reasons the acquisitions that are only reported in Belfirst are not considered for estimation in the fourth and fifth sections of this chapter.⁷ In the next section the data are considered to test the robustness of the analysis of net job creation.

Figure 3.2 compares the evolution, over the period 1998-2015, of completed acquisitions involving a Belgian target or acquirer to completed acquisitions involving a European target firm and acquisitions worldwide.⁸ The number of acquisitions in each year is related to the 1998 level. From the figure it is abundantly clear that acquisitions involving a Belgian target firm or acquirer did not follow the surge in deals worldwide, which more than tripled between 1998 and 2015.⁹ Since the height of 2007, the number of acquisitions with a Belgian target has been dropping almost continuously despite a slight increase in recent years. The number of deals involving a Belgian acquirer started to decrease from 2006 onwards to a level only 31% above the 1998 level.¹⁰ Although acquisitions involving a European target or a European acquirer did not follow the strong worldwide rise either, the number increased more substantially.

A possible explanation for the relatively low number of M&A deals involving Belgian companies is provided by Huyghebaert and Luypaert (2010). Compared to Anglo-Saxon countries, Belgium has a lower share of publicly listed companies. As firms that are not listed face more constraints in financing M&A deals, they probably focus more on internal growth than on growth through acquisitions. Ownership also appears to be more concentrated, on average, in Belgium than in the United States. As a consequence, empire building and managerial hubris, which are found to explain some M&A deals, may occur less frequently in Belgium (Huyghebaert and Luypaert 2010, p. 393).

Figure 3.2. **Number of completed acquisitions involving Belgian firms, European firms and worldwide**



Note: The figure shows the number of completed acquisitions involving a Belgian firm (target or acquirer), European firm (target or acquirer) and the total number of acquisitions worldwide. The number of completed acquisitions in all years is related to the 1998 level.

Source: Authors' calculations based on Bureau van Dijk (2016b), Belfirst (database), www.bvdinfo.com/en-be/our-products/company-information/national-products/bel-first/.

The ten industries (NACE two-digit Rev. 2) with the highest share of firms involved in an M&A deal over the period 2001-14 are listed in Table 3.1, for respectively deals involving a Belgian target firm and a Belgian acquiring firm.¹¹ The manufacture of coke and refined petroleum products and the manufacture of basic pharmaceutical products and pharmaceutical preparations are among the industries with the highest relative involvement in M&As, both for deals with a Belgian target or a Belgian acquiring firm.

Table 3.2 shows the share of Belgian firms involved in acquisitions (2001-14) in the total number of firms as well as their share in total employment.¹² For each given year, a very small number of firms is involved in an acquisition. The share of these firms in total employment is relatively larger, especially for Belgian firms that acquire another firm.

For example, Belgian firms that acquired another firm in 2005 accounted for 6.59% of total employment. As Table 3.2 clearly indicates, the number of employees in firms involved in M&As is substantially above average. Over the period 2001-14, target firms had 3 to 13 times more employees than the average; acquiring firms had from 20 up to 80 times as many employees as the average.

Table 3.3 shows the age distribution of Belgian target and acquiring firms in M&A deals that were completed in the period 1997-2015.¹³ In domestic M&A deals, of the Belgian target start-ups (up to two years), 12% were acquired by another Belgian start-up, 20% by a young firm (three to five years), 17% by firms between six and ten years old and 51% by firms older than ten years. For all domestic deals as well as cross-border deals, acquiring firms are predominantly older than ten years, especially in acquisitions of a foreign firm by a Belgian firm. Foreign start-ups and young firms appear to be more active in acquiring Belgian start-ups and young firms than the other way round. This could indicate that Belgian start-ups are less prone to seize foreign acquisition opportunities although it could also be explained by credit constraints that hamper foreign acquisitions by young Belgian firms. This seems in line with the low level and growth in M&A deals involving a Belgian firm, be it as a target or as an acquirer, as shown in Figure 3.2.

Table 3.1. **Top ten industries with the highest share of firms involved in a deal, 2001-14**

Belgian target firms	
Industry	Share of firms (in %)
Manufacture of coke and refined petroleum products	2.59
Remediation activities and other waste management services	1.96
Electricity, gas, steam and air conditioning supply	1.10
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0.80
Manufacture of tobacco products	0.61
Programming and broadcasting activities	0.59
Manufacture of computer, electronic and optical products	0.54
Manufacture of beverages	0.52
Computer programming, consultancy and related activities	0.50
Telecommunications	0.46
Belgian acquiring firms	
Industry	Share of firms (in %)
Manufacture of basic pharmaceutical products and pharmaceutical preparations	1.38
Manufacture of coke and refined petroleum products	1.04
Telecommunications	0.98
Manufacture of beverages	0.97
Manufacture of chemicals and chemical products	0.83
Financial service activities, except insurance and pension funding	0.79
Manufacture of basic metals	0.74
Air transport	0.67
Publishing activities	0.64
Manufacture of computer, electronic and optical products	0.60

Note: Firms classified by primary two-digit NACE Rev.2 code.

Source: Authors' calculations based on Bureau van Dijk (2016b) for acquisitions involving Belgian firms (target or acquirer).

Table 3.2. **Share (% of total number of firms/employment) of target and acquiring firms, 2001-14**

	Belgian targets		Belgian acquirers	
	Share # firms	Share employment	Share # firms	Share employment
2001	0.04	0.33	0.06	3.08
2002	0.06	0.66	0.06	2.15
2003	0.07	0.53	0.09	4.25
2004	0.08	0.34	0.09	3.39
2005	0.09	1.19	0.09	6.59
2006	0.10	1.20	0.11	4.40
2007	0.08	0.39	0.08	3.87
2008	0.08	0.29	0.09	4.08
2009	0.07	0.34	0.07	1.44
2010	0.08	0.33	0.09	3.65
2011	0.07	0.29	0.07	5.80
2012	0.06	0.31	0.07	2.45
2013	0.07	0.25	0.08	2.84
2014	0.08	0.24	0.09	3.06
Average	0.07	0.48	0.08	3.65

Source: Authors' calculations based on Bureau van Dijk (2016b) for acquisitions involving Belgian firms (target or acquirer) and National Social Security Office (2016).

Table 3.3. **Age distribution of target and acquirer in M&A deals involving Belgian firms in percentage, 1997-2015**

Domestic M&As (target and acquirer are Belgian firm), # identified deals: 928					
Age group acquiring firm (Belgian)					
Age group target firm (Belgian)	0-2 years	3-5 years	6-10 years	> 10 years	Total
0-2 years	12	20	17	51	100
3-5 years	6	19	24	51	100
6-10 years	6	12	19	63	100
> 10 years	3	3	10	84	100
Cross-border M&As (target is Belgian firm, acquirer is foreign firm), # identified deals: 430					
Age group acquiring firm (foreign)					
Age group target firm (Belgian)	0-2 years	3-5 years	6-10 years	> 10 years	Total
0-2 years	7	4	19	70	100
3-5 years	13	14	10	63	100
6-10 years	8	11	15	66	100
> 10 years	7	4	10	79	100
Cross-border M&As (target is foreign firm, acquirer is Belgian firms), # identified deals: 571					
Age group acquiring firm (Belgian)					
Age group target firm (foreign)	0-2 years	3-5 years	6-10 years	> 10 years	Total
0-2 years	0	4	19	78	100
3-5 years	2	10	24	63	100
6-10 years	6	10	15	68	100
> 10 years	5	6	6	83	100

Note: The table shows for each age group the share (in %) of target firms acquired by which age group of acquirer in M&A deals over the period 1997-2015 (most recent deals) in which the target and/or acquirer is a Belgian firm. Some 60% of these deals are domestic (both the target and acquirer are a Belgian firm) and 40% cross-border.

Source: Authors' calculations.

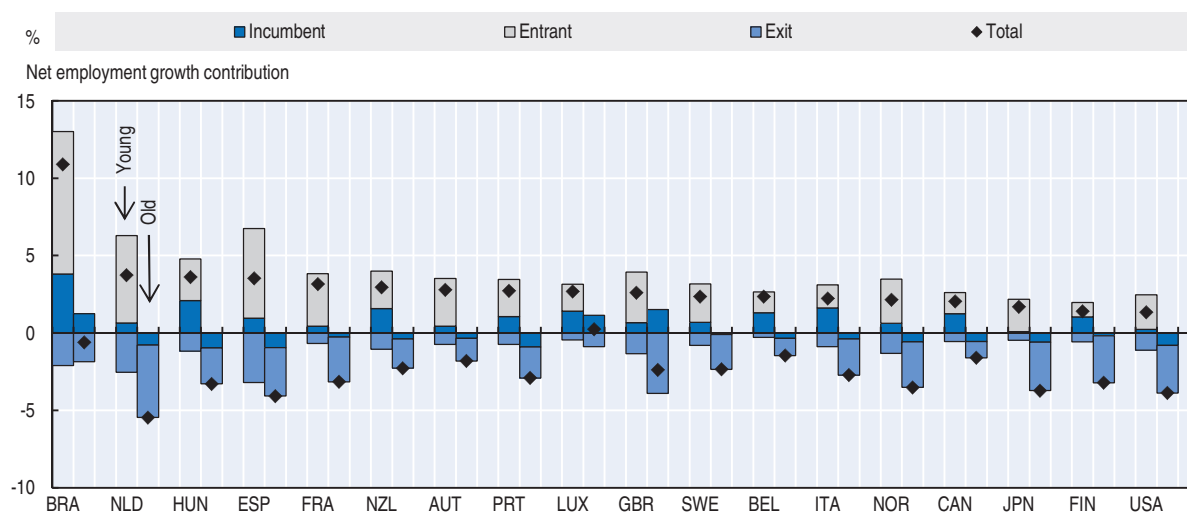
Organic growth versus growth through acquisition

The DynEmp project led by the OECD Directorate for Science, Technology and Innovation clearly demonstrates the importance of young firms – entrants and start-ups – as the main contributors of net job creation in all countries. The crucial role of young firms was reinforced during the crisis. Although less considerable than in the early years of the period studied (2001-11), the net job creation of young incumbents remained positive after 2008 whereas old incumbents contributed to net job destruction over the period 2008-09, especially by shedding jobs through downsizing (Calvino, Criscuolo and Menon, 2015). The important role of young firms in net job creation is confirmed for Belgium, although the extent is more limited than in other countries such as Brazil, the Netherlands, Hungary or Spain, as illustrated by Figure 3.3. The lower contribution of young firms to job creation in Belgium relative to other countries is predominantly explained by a low start-up rate (Criscuolo, Gal and Menon, 2014; Calvino, Criscuolo and Menon, 2015).

As firm-level information on M&A deals is not available for most countries, the cross-country analyses in DynEmp do not distinguish between internal (organic) growth and growth through M&As.

This section uses the additional information on M&As involving Belgian companies to assess to what extent the distinction between internal and external growth affects the results of the DynEmp analysis for Belgium.

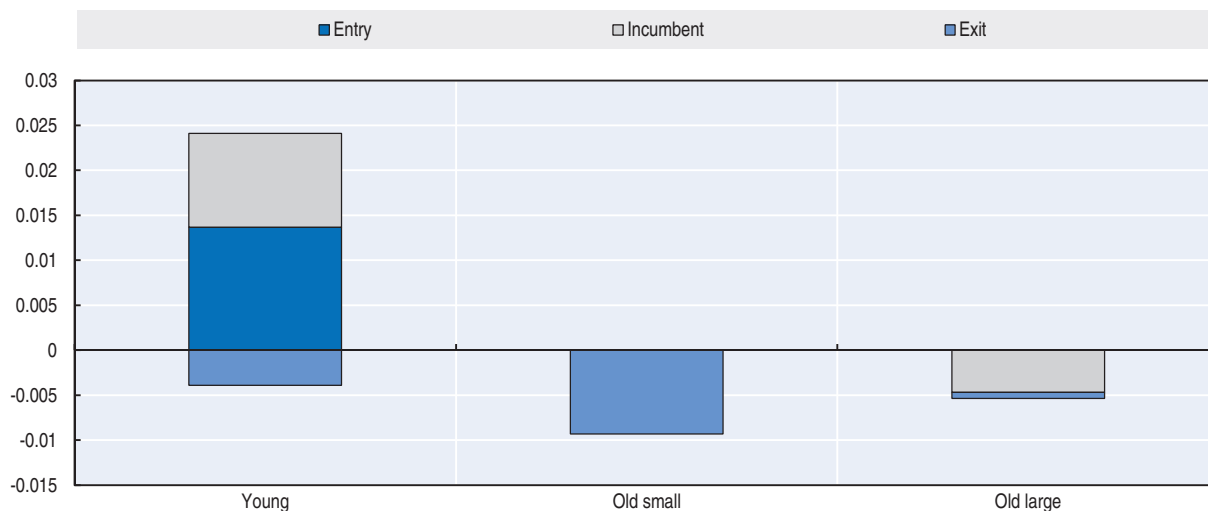
Figure 3.3. Net job creation by firm age group in 18 countries, 2001-11



Note: The figure shows the net employment growth contribution by firm age group, as a percentage of aggregate non-financial business sector employment.

Source: Criscuolo, Gal and Menon (2014), "The Dynamics of Employment Growth: New Evidence from 18 Countries", <http://dx.doi.org/10.1787/5jz417hj6hg6-en>.

Figure 3.4. Net job creation by age group of Belgian firms not involved in M&As by percentage, 2002-13



Notes: The figure shows the net employment growth contribution by firm age-size group, as a percentage of aggregate non-financial business sector employment for firms that were not involved in any M&A deal over the period 2002-13. Young = less than five years old; old = five years old or more; small = less than 250 employees; large = 250 or more employees.

Source: Authors' calculations using data from Bureau van Dijk (2016a), Belfirst (database), www.bvdinfo.com/en-be/our-products/company-information/national-products/bel-first/, and Bureau van Dijk (2016b), Zephyr (database), <https://zephyr.bvdinfo.com/> and National Social Security Office (2016), "National employment data".

Figure 3.4 shows the breakdown by age group of Belgian firms that were not involved in any M&A deal over the period 2002-13. Old firms (five years old or more) are further broken down by size (small firms: less than 250 employees). The latter breakdown confirms the main conclusions of the DynEmp project: young – mostly small – firms strongly contribute to net job creation, through entry and post-entry growth of start-ups, whereas old small firms account for the largest part of net job destruction.¹⁴ Given the low number of Belgian firms

involved in M&A deals in any given year, the net job creation by firms involved in M&As is marginal. There is a very small positive net job creation component of entrants that were involved in an M&A deal over the period 2002-13, most likely as a target, and a small negative job creation component for old large firms that were involved in an M&A deal.

If the information on mergers by acquisition provided by Belfirst, but not by Zephyr, is taken into account, the components depicted in Figure 3.4 change slightly. The entry component is smaller and the two components for old small firms are somewhat less negative. The latter is explained by the fact that many of the targets of the mergers by acquisition in Belfirst are small old firms which are considered as exits whereas they are actually absorbed, as pointed out in the data section, often as part of a within-group consolidation deal.

Table 3.4. Net job creation (absolute values and as share of total employment) of Belgian firms by age and M&A status, 2002-14

	Young: no M&A	Old: no M&A	Young target	Old target
2002	12 330 (0.63)	-27 421 (-1.40)	-222 (-0.01)	-760 (-0.04)
2003	21 969 (1.11)	-3 047 (-0.15)	-397 (-0.02)	-777 (-0.04)
2004	19 648 (0.98)	5 298 (0.27)	-111 (-0.01)	-2 217 (-0.11)
2005	23 987 (1.18)	12 508 (0.62)	-28 (-0.00)	-736 (-0.04)
2006	25 987 (1.25)	17 366 (0.84)	-148 (-0.01)	-3 806 (-0.18)
2007	30 153 (1.41)	30 027 (1.41)	204 (0.01)	-495 (-0.02)
2008	28 753 (1.32)	17 537 (0.80)	190 (0.01)	371 (0.02)
2009	20 195 (0.95)	-60 302 (-2.83)	19 (0.00)	-2 412 (-0.11)
2010	28 805 (1.34)	-12 166 (-0.57)	77 (0.00)	-1 726 (-0.08)
2011	30 111 (1.38)	15 255 (0.70)	103 (0.00)	-167 (-0.01)
2012	6 246 (0.26)	-112 118 (-4.63)	26 (0.00)	-977 (-0.04)
2013	5 676 (0.24)	-1 484 (-0.06)	-181 (-0.01)	-347 (-0.01)
2014	5 827 (0.25)	15 654 (0.68)	-81 (-0.00)	-404 (-0.02)
Average (%)	0.95	-0.33	0.00	-0.05
	Young acquirer	Old acquirer	Exit young target	Exit old target
2002	-26 (-0.00)	641 (0.03)	-17 (-0.00)	-561 (-0.03)
2003	47 (0.00)	2 956 (0.15)		-26 (-0.00)
2004	381 (0.02)	2 177 (0.11)	-9 (-0.00)	-1 (-0.00)
2005	24 (0.00)	380 (0.02)		-453 (-0.02)
2006	86 (0.00)	-3 824 (-0.18)	-3 (-0.00)	-74 (-0.00)
2007	340 (0.02)	-3 139 (-0.15)	-5 (-0.00)	-713 (-0.03)
2008	-108 (-0.00)	-3 679 (-0.17)	-3 (-0.00)	-185 (-0.01)
2009	-73 (-0.00)	-6 410 (-0.30)		-304 (-0.01)
2010	73 (0.00)	3 411 (0.16)	-43 (-0.00)	-15 (-0.00)
2011	213 (0.01)	-507 (-0.02)	-2 (-0.00)	-116 (-0.01)
2012	210 (0.01)	-6 582 (-0.27)	-19 (-0.00)	-1 488 (-0.06)
2013	73 (0.00)	-1 142 (-0.05)		-89 (-0.00)
2014	211 (0.01)	1 130 (0.05)	-5 (-0.00)	-71 (-0.00)
Average (%)	0.01	-0.05	-0.00	-0.01

Notes: The table shows the net job creation in absolute numbers and – in brackets – relative to total employment (%), of different groups of firms with a breakdown by age (young is five years at most and old more than five years) and a breakdown by M&A status (no M&A means that the firm was not a target or acquirer in the three previous years; target means that the firm was a target of an acquisition in the last three years but was not dissolved and acquirer means that the firm acquired another firm in the last three years). Exit young (old) target shows the number of jobs of young (old) firms – prior to exit – that were the target of an acquisition and were dissolved.

Source: Authors' calculations.

Table 3.4 shows a breakdown, over the period 2002-14, of net job creation (in absolute numbers and relative to total employment) with a breakdown by age (young: less than five

years old; and old: five years old or more) and the M&A status of firms (four categories: firms not involved in any M&A deal over the last three years; firms that have been the target of an acquisition over the last three years but that have not been dissolved; firms that have acquired another firm over the last three years; and firms that were acquired and dissolved in the previous year). The results confirm that the positive net job creation of young firms exceeds the job destruction of old incumbents.

Net job creation by young firms involved in M&As, either as a target (not dissolved) or an acquirer is negligible. For old target and acquiring firms, the net contribution is more substantial but in line with old incumbents not involved in acquisitions, and net job creation was on average negative. Net job creation may blur potential differences in the impact of different types of acquisitions (e.g. domestic versus cross-border or intra-industry versus inter-industry deals). These effects are considered in the next section.

Table 3.5 shows for each year over the period 2002-14, the share of Belgian high-growth firms in that year that were involved in an acquisition in one of the three previous years.

Table 3.5. Belgian firms involved in acquisitions as a share of high-growth Belgian firms in percentage

	Young target	Old target	Young acquirer	Old acquirer	Total M&A firms
2004	0.55	1.21	0.11	2.20	4.07
2005	0.10	1.36	0.42	2.20	4.08
2006	0.00	2.23	0.51	2.02	4.76
2007	0.18	1.91	0.00	2.19	4.28
2008	0.40	2.42	0.08	2.50	5.39
2009	0.27	2.17	0.36	3.53	6.34
2010	0.40	1.41	0.40	2.42	4.64
2011	0.45	2.27	0.23	2.72	5.68
2012	0.00	1.63	0.00	2.44	4.07
2013	0.00	1.33	0.12	2.65	4.10
2014	0.13	1.33	0.53	2.52	4.51
Average	0.23	1.75	0.25	2.49	4.72

Notes: The table shows the number of Belgian young (less than five years) and old (more than five years) target and acquiring firms with high growth as a share of all high-growth firms in that year. Target and acquiring firms are considered based on the fact that they were involved in an acquisition in the last three years. High-growth firms are defined as firms with more than ten employees at the beginning of a three-year period with an annual average growth in employment of 20% over that period.

Source: Authors' calculations.

Following Anyadike-Danes, Bonner and Hard (2013), high-growth firms are defined as firms with more than ten employees at the beginning of a three-year period with an annual average growth in employment of 20%. For example, the second column on the first line in Table 5 shows that 0.55% of high-growth firms in 2004 were young firms that were the target of an acquisition in the period 2001-03. Over the period considered, about 1.75 % of high-growth firms in Belgium were old firms that were acquired and about 2.49% were old firms that acquired another firm. For young firms involved in acquisitions, the shares are smaller. The four groups of firms involved in acquisitions have an average combined share of high-growth firms of 4.72%. This corroborates the relatively small contribution to overall employment growth. However, firms involved in acquisitions account for a disproportionate share of high-growth firms. Compared to their share in the total number of firms with an initial employment of more than ten employees, the share in the total

number of high-growth firms is 1.57 times higher for young targets, 1.29 for old targets, 1.82 for young acquiring firms and 1.75 for old acquiring firms. These results indicate that a fairly small number of firms achieve strong growth in employment through acquisition.

Employment effects of M&As

Review of the literature

Theoretical models of the employment effects of M&As generally rely on two countervailing arguments. M&As may reduce employment due to increased efficiency or economies of scale but if the efficiency gains are passed through in lower prices, firms may increase their market share and consequently their employment level (Oberhofer, 2013). Furlan, Oberhofer and Winner (2015) point out the mixed results of empirical studies on the employment effects of M&As, which may be explained by differences across countries in corporate governance regulation (e.g. the position of minority shareholders). The authors argue that most studies consider a discrete variable (0/1) for M&As although the share of ownership is continuous (bounded).¹⁵ For a sample of European M&As from the Zephyr database, covering the period 2003-10, they find that employment growth after an M&A varies considerably over the distribution of the acquired ownership share. For small acquired shares, M&As appear to have a negative impact on employment. Above the 25% of ownership threshold the effect is statistically significant and positive. The effect remains positive above this threshold but the effect decreases above 50%.

Conyon et al. (2002) report that mergers involving United Kingdom firms in the period 1967-96 appear to have had a negative impact on employment. The negative effect is stronger for intra-industry mergers than for inter-industry mergers. Gugler and Yurtoglu (2004) also find that intra-industry mergers reduce demand more than inter-industry mergers in the United Kingdom, but for deals involving firms from continental Europe, the opposite effect is found. Bandick and Görg (2010) find indications of a positive impact on employment of vertical acquisitions of Swedish firms.

Lehto and Böckerman (2008) argue that whereas M&As are generally considered as positive due to their impact on the restructuring of industries, cross-border M&As are viewed less favourably given the perceived negative effects for domestic employment. Data on M&A deals involving Finnish firms suggest that domestic acquisitions have a negative impact on employment in all industries, whereas foreign acquisitions of Finnish target firms only appear to negatively affect employment in manufacturing industries. Gugler and Yurtoglu find that domestic mergers in the United Kingdom reduce employment by more than cross-border deals made by acquiring United Kingdom firms.

Most analyses of the employment effects of M&As focus on target firms. Stiebale and Trax (2011) are of the few that consider the impact of M&As on acquiring firms. Using data on cross-border M&As involving firms from France and the United Kingdom over the period 2000-07, they find a positive impact on domestic employment and provide indications of a connection between the motives and effects of cross-border deals.

The job destruction due to M&As may be overestimated by simply looking at the post-M&A evolution in employment. Lougui and Broström (2015) find indications that, for Swedish firms over the period 2000-09, M&As result in spin-outs which are explained by the deterioration in working conditions after an M&A but even more so by a mismatch between individual aspirations and management strategy, which leaves opportunities for start-ups in market segments and niches that are abandoned by the acquiring firm. The

spin-outs appear only in domestic deals and after some years. Margolis (2006) finds that employees that leave after an M&A deal is completed tend to be young, female and white-collar with low tenure who generally have a good labour market position (high probability of finding another job). Siegel and Simons (2010) find that M&As enhance plant productivity but also result in the downsizing of establishments and firms.

The impact of M&As on the creation of new firms (spin-outs), on working conditions or workforce compositions, on productivity and other measures of firm performance is beyond the scope of this chapter.

Estimation framework

If a target firm is fully absorbed by the acquirer, it can no longer be identified and observed as a separate firm. Without information on M&As, such absorptions may erroneously be reported as firm exit and the number of employees of absorbed firms as jobs lost due to exit. However, as Table 3.6 shows, only 14% of Belgian firms that were the target of an M&A deal in the period 1997-2015 appear to have been absorbed through acquisition (dissolved through merger or takeover).¹⁶

Table 3.6. **Status of Belgian target firms, 1997-2015**

Status	Number	Percentage
Active	1 324	62
Dissolved (merger or takeover)	306	14
Dissolved	155	7
Dissolved (bankruptcy)	141	7
Dissolved (liquidation)	111	5
In liquidation	33	2
Inactive (no precision)	18	1
Active (insolvency proceedings)	14	1
Other (e.g. bankruptcy)	17	1

Note: The table shows the current status of Belgian firms that were the target of an M&A deal over the period 1997-2015.
Source: Authors' calculations based on Bureau van Dijk (2016b), Zephyr (database), <https://zephyr.bvdinfo.com/>.

A majority of 62% are still active and can be identified as a separate unit. As the table shows the current legal situation in 2015, firms that have been acquired in the past may have been dissolved or may have stopped their activities in the years following acquisition. In that case they are not considered to have been dissolved as a result of the acquisition.

To assess the employment growth of Belgian firms involved in M&As a specification similar to Siegel and Simons (2010) is used:

$$\Delta L_{i,t} = \alpha_0 + \sum_{n=-3}^{+3} \beta_n D_{i,t+n} + \alpha_1 \ln L_{i,t-1} + \alpha_2 \ln Age_{i,t} + \alpha_3 (\ln Age_{i,t})^2 + \alpha_4 \ln L_{i,t-1} * \ln Age_{i,t} + \varepsilon_{i,t} \quad (1)$$

$\Delta L_{i,t}$, employment growth, is the log difference between employment of firm i in year t and employment in the previous year. $D_{i,t+n}$ are dummy variables that equal 1 in year $t+n$, if firm i was the target of an M&A deal in year t and 0 otherwise. The coefficients β_n show the extent to which employment growth in $t+n$, of firms that have been the target of a merger or acquisition, differs from employment growth in firms that have not been the target of an acquisition. Following Oberhofer (2013), the log of lagged employment ($\ln L_{i,t-1}$),

a linear and squared term of the log of firm age ($\ln \text{Age}_{i,t}$) and an interaction of firm size and age is included. The inclusion of firm size links the specification to the numerous studies that test the hypothesis of Gibrat (1931) who stated that firm growth is independent of firm size. Empirical studies tend to reject the hypothesis in favour of a negative correlation between initial firm size and employment growth. Firm age also appears to be negatively linked to growth but in a non-linear way. Theories on firm growth generally suggest a specification in which the annual growth rate of firms is linked to the log of initial firm size and the log of firm age (Oberhofer 2013, p. 347). Oberhofer (2013) includes an interaction between firm size and age to account for previous studies in which it is found that differences in firm size increase with age. He finds a statistically significant negative coefficient for the log of firm size and firm age and a statistically significant positive coefficient for the squared term of the log of firm age as well as for the interaction between firm size and firm age. Specification (1) is estimated for Belgian target firms and Belgian acquiring firms separately. Year dummies are included in all estimations to account for business cycle effects and other year-specific factors. Time-independent firm heterogeneity is captured through firm-level fixed effects. In most estimations, the coefficients of the lagged employment level and the firm size and age variables are highly statistically significant and have the same sign as in Oberhofer (2013), corroborating his finding that small and young firms grow faster but that this effect decreases as firms mature and differs across different age cohorts (as indicated by the interaction between employment and age).

Estimation results

Target firms

Table 3.7 shows the results for Belgian firms that were the target in M&A deals over the period 2001-14,¹⁷ distinguishing between target firms that were dissolved through merger or acquisition (see Table 3.6) and target firms that were not fully absorbed after acquisition. By definition, only for the latter the evolution of employment after acquisition can be observed. The results clearly suggest that Belgian target firms witnessed employment growth well above average before acquisition, especially when the target firms were dissolved. Acquisition negatively affects employment in target firms that are not dissolved through acquisition in the year of acquisition or some years after acquisition, although only the coefficient in the year of acquisition is statistically significant.

Previous studies pointed out the differential impact of acquisitions depending on the characteristics of the deal. To account for these possible differences, this analysis distinguishes between domestic and cross-border deals and intra-industry and inter-industry deals.¹⁸ Table 3.8 shows the results for Belgian firms that were acquired over the period 2001-14, for those target firms that were not fully absorbed after acquisition.¹⁹

The upper half of the table shows the results for domestic, foreign, intra-industry²⁰ and inter-industry acquisitions and the lower half the results for respectively domestic intra-industry, domestic inter-industry, foreign intra-industry and foreign inter-industry acquisitions.

In the year of completion of an acquisition the coefficient for target firms is negative in all configurations, except for acquisitions by a foreign company. For foreign inter-industry acquisitions, the coefficient is actually statistically significant positive (10%). This finding is in tune with the results reported for Sweden by Bandick and Görg (2010). The coefficients of the dummy variables in the years after completion indicate that domestic

Table 3.7. **Employment growth of Belgian target firms, 2001-14**

	Target firm dissolved	Target firm not dissolved
<i>t-3</i>	0.18 (9.11)***	0.05 (4.17)***
<i>t-2</i>	0.17 (8.62)***	0.05 (4.31)***
<i>t-1</i>	0.14 (6.16)***	0.01 (4.87)***
<i>t</i>	-	-0.06 (-4.14)***
<i>t+1</i>	-	-0.01 (-0.41)
<i>t+2</i>	-	0.01 (0.93)
<i>t+3</i>	-	-0.01 (-0.85)
<i>Ln L_{t-1}</i>	-0.54 (-254.12)***	
<i>Ln Age_t</i>	-0.37 (-103.88)***	
<i>(Ln Age_t)²</i>	0.11 (61.81)***	
<i>Ln L_{t-1} * Ln Age_t</i>	0.07 (82.33)***	
# observations	1 648 429	
# firms	231 210	
R ²	0.31	

Notes: The table shows the results of a panel estimation with firm-level fixed effects of the employment growth of Belgian target firms, over the period 2001-14, three years prior to acquisition and up to three years after acquisition for target firms that are not dissolved as a result of acquisition. The specification contains year dummies. The z values are reported in brackets; *, ** and *** indicate that the coefficient estimates are statistically significant at respectively 10%, 5% and 1%. Standard errors are heteroscedasticity consistent (VCE(robust) in Stata).

Source: Authors' calculations.

Table 3.8. **Employment growth of Belgian target firms (not dissolved) by type of deal, 2001-14**

	Domestic	Foreign	Intra-industry	Inter-industry
<i>t-3</i>	0.06 (3.82)***	0.03 (2.06)**	0.06 (2.27)**	0.05 (3.82)***
<i>t-2</i>	0.05 (2.89)***	0.06 (3.10)***	0.04 (1.34)	0.07 (4.30)***
<i>t-1</i>	0.06 (3.67)***	0.05 (3.18)***	0.05 (1.48)	0.07 (4.90)***
<i>t</i>	-0.12 (-5.62)***	0.01 (0.33)	-0.15 (-3.53)***	-0.04 (-2.28)**
<i>t+1</i>	-0.04 (-1.87)*	0.03 (1.66)*	-0.05 (-1.17)	0.02 (0.84)
<i>t+2</i>	-0.03 (-1.25)	0.05 (2.65)***	-0.11 (-2.21)**	0.05 (2.63)***
<i>t+3</i>	-0.06 (-2.73)***	0.03 (2.06)**	-0.09 (-2.10)**	0.02 (1.01)

	Domestic		Foreign	
	Intra-industry (13%)	Inter-industry (42%)	Intra-industry (8%)	Inter-industry (37%)
<i>t-3</i>	0.06 (1.66)*	0.06 (3.26)***	0.06 (1.57)	0.04 (2.09)**
<i>t-2</i>	0.01 (0.20)	0.07 (3.11)***	0.10 (1.97)**	0.06 (2.82)***
<i>t-1</i>	0.03 (0.90)	0.07 (3.17)***	0.07 (1.26)	0.07 (3.75)***
<i>t</i>	-0.20 (-3.47)***	-0.11 (-4.20)***	-0.08 (-1.20)	0.04 (1.77)*
<i>t+1</i>	-0.13 (-2.03)**	-0.04 (-1.22)	0.05 (1.03)	0.07 (2.83)***
<i>t+2</i>	-0.12 (-1.98)**	0.01 (0.28)	-0.09 (-1.14)	0.08 (3.61)***
<i>t+3</i>	-0.17 (-2.69)***	-0.03 (-1.12)	0.01 (0.16)	0.06 (3.20)***

Notes: The table shows the results of an estimation with firm-level fixed effects of the employment growth of Belgian target firms that were acquired, but not dissolved, over the period 2001-14, from three years prior to acquisition up to three years after acquisition. The specification contains year dummies. The z values are reported in brackets; *, ** and *** indicate that the coefficient estimates are statistically significant at respectively 10%, 5% and 1%. Standard errors are heteroscedasticity consistent (VCE(robust) in Stata). The coefficients of all control variables, number of observations and R² are equal to the ones reported in Table 3.7.

Source: Authors' calculations.

and intra-industry acquisitions have a more negative impact on employment in Belgian target firms than foreign and inter-industry acquisitions. For foreign inter-industry acquisitions – which account for 37% of acquisitions in the period under consideration – all

coefficients are positive and statistically significant. These results lend support to the finding by Lehto and Böckerman (2008) that the general concern that foreign acquisitions destroy more jobs than domestic acquisitions, is not warranted although the evolution of employment in acquiring firms also needs to be considered to assess the net effect on domestic employment.²¹

Table 3.9 shows the employment growth in Belgian target firms (not dissolved), grouped by firm age (in the year of acquisition), for all categories of acquisitions combined. The results indicate differences across age groups for the year of completion and the three years thereafter. The impact of acquisition on employment in Belgian target firms appears to become more negative the older the target firm although only for mature target firms a statistically significant positive employment effect of acquisition is found, namely after two years. For old firms, the impact in the year of completion of an acquisition is statistically significant negative. To some extent the differences across age groups appear to be explained by differences in the type of acquisition, reported on the four last rows in Table 3.9. Of the four age categories, mature target firms have the highest share of foreign inter-industry acquisitions, for which, as Table 3.8 indicates, employment growth after acquisition is (statistically significant) positive in all three years after acquisition. The negative impact in the year of acquisition for old target firms seems in line with its highest share of domestic intra-industry deals.

Table 3.9. Employment growth of Belgian target firms before and after acquisition by age group

	Start-ups (0-2 years)	Young (3-5 years)	Mature (6-10 years)	Old (> 10 years)
<i>t-3</i>	-	0.13 (1.41)	0.07 (2.12)**	0.04 (3.61)***
<i>t-2</i>	-	0.16 (1.75)*	0.11 (3.29)***	0.03 (2.66)***
<i>t-1</i>	0.12 (0.57)	0.18 (2.19)**	0.09 (2.89)***	0.04 (3.42)***
<i>t</i>	0.08 (0.80)	0.06 (0.76)	-0.01 (-0.31)	-0.08 (-5.21)***
<i>t+1</i>	-0.02 (-0.14)	0.10 (1.57)	-0.03 (-0.64)	-0.01 (-0.65)
<i>t+2</i>	0.02 (0.21)	0.01 (0.19)	0.08 (2.06)**	0.00 (0.29)
<i>t+3</i>	-0.02 (-0.16)	0.02 (0.32)	-0.00 (-0.07)	-0.01 (-0.74)
<i>Ln L_{t-1}</i>	-0.54 (-254.44)***			
<i>Ln Age_t</i>	-0.37 (-103.90)***			
<i>(Ln Age_t)²</i>	0.11 (61.86)***			
<i>Ln L_{t-1} * Ln Age_t</i>	0.07 (82.47)***			
# observations	1 648 429			
# firms	231 210			
R ²	0.31			
Domestic intra (%)	11	12	12	14
Domestic inter (%)	53	38	39	42
Foreign intra (%)	11	11	7	8
Foreign inter (%)	25	39	41	35

Notes: The table shows the results of an estimation with firm-level fixed effects of the employment growth of Belgian target firms that were acquired, but not dissolved, over the period 2001-14, from three years prior to acquisition up to three years after acquisition. Target firms are grouped by firm age (defined in the year of acquisition). The specification contains year dummies. For start-ups, active for up to two years, the coefficient for *t-3* and *t-2* cannot be estimated due to lack of cases. The z values are reported in brackets; *, ** and *** indicate that the coefficient estimates are statistically significant at respectively 10%, 5% and 1%. Standard errors are heteroscedasticity consistent (VCE(robust) in Stata).

Source: Authors' calculations.

Table 3.10 shows the employment growth in Belgian target firms (not dissolved), with firms grouped by Pavitt industry category. Pavitt (1984) classified industries based on the origin and the main sources of technological knowledge and the market structure of industries.

Bogliacino and Pianta (2015) proposed an update of the Pavitt categories by NACE industries (Revision 2, 2008), including a classification for new industries and services. The four Pavitt categories are:

- Science-based: sectors in which innovation is based on advances in science and research and development (R&D).
- Specialised suppliers: sectors producing machinery and equipment that is used in new processes for other industries.
- Scale-intensive: sectors in which scale economies are relevant and a certain rigidity of production processes exists; technological change is usually incremental.
- Supplier-dominated: traditional sectors in which small firms are prevalent and technological change is introduced through the inputs and machinery provided by suppliers from other industries.

Table 3.10. Employment growth of Belgian target firms before and after acquisition by Pavitt category

	Science-based (17%)	Specialised suppliers (22%)	Scale-intensive (12%)	Supplier-dominated (49%)
<i>t-3</i>	0.03 (0.96)	0.07 (2.73)***	0.07 (2.80)***	0.03 (2.08)**
<i>t-2</i>	0.06 (2.24)**	0.07 (2.18)**	0.02 (0.48)	0.04 (2.37)**
<i>t-1</i>	0.06 (1.99)**	0.05 (1.65)*	0.04 (1.51)	0.05 (3.07)***
<i>t</i>	-0.07 (-2.09)**	-0.03 (-0.85)	-0.09 (-2.16)**	-0.08 (-3.60)***
<i>t+1</i>	0.01 (0.26)	-0.02 (-0.56)	-0.05 (-1.47)	-0.02 (-0.77)
<i>t+2</i>	0.01 (0.41)	0.04 (1.02)	-0.06 (-1.39)	0.01 (0.46)
<i>t+3</i>	-0.04 (-0.90)	0.05 (1.59)	-0.04 (-1.12)	-0.02 (-1.02)
<i>Ln L_{t-1}</i>	-0.45 (-47.88)***	-0.56 (-100.67)***	-0.48 (-40.00)***	-0.54 (-195.52)***
<i>Ln Age_t</i>	-0.45 (-21.58)***	-0.29 (-33.70)***	-0.41 (-19.05)***	-0.40 (-86.21)***
<i>(Ln Age_t)²</i>	0.12 (12.25)***	0.10 (19.58)***	0.11 (12.09)***	0.12 (49.04)***
<i>Ln L_{t-1} * Ln Age_t</i>	0.05 (15.59)***	0.07 (29.99)***	0.07 (16.88)***	0.07 (65.33)***
# observations	49 580	271 932	65 698	989 567
# firms	7 893	39 972	8 223	136 730
R ²	0.33	0.32	0.25	0.30
Domestic intra (%)	8	11	15	16
Domestic inter (%)	43	43	45	38
Foreign intra (%)	8	10	8	8
Foreign inter (%)	41	36	33	37

Notes: The table shows the results of an estimation, separately by Pavitt category, with firm-level fixed effects of the employment growth of Belgian target firms that were acquired, but not dissolved, over the period 2001-14, from three years prior to acquisition up to three years after acquisition. The specification contains year dummies. The z values are reported in brackets; *, ** and *** indicate the coefficient estimates are statistically significant at respectively 10%, 5% and 1%. Standard errors are heteroscedasticity consistent (VCE(robust) in Stata).

Source: Authors' calculations.

The effects of acquisitions on employment in target firms differs across the four categories of industries with larger negative effects in the year that a deal is completed in scale-intensive and supplier-dominated industries, which happen to be the type of industries for which the share of domestic intra-industry acquisitions is above average.

A number of robustness tests confirm the main conclusions. Using the share of ownership that is transferred through acquisition as the variable rather than the dummy variable (acquired or not) used in specification (1) – as in Furlan, Oberhofer and Winner (2015) – provides similar but generally less precise results, in effect larger standard errors and worse results for the specification tests.²² Including a squared term for the year of completion of a deal does not support the finding by Furlan, Oberhofer and Winner (2015)

of non-linear employment effects of M&As. Including a variable of the number of deals a firm is involved in, in a given year, does not provide any evidence of a statistically significant effect of the number of deals.²³ The number of different firms involved in an acquisition has a statistically significant positive impact on employment growth in the target firm for domestic and foreign acquisitions but a statistically significant negative impact for intra-industry deals.²⁴

Acquiring firms

Table 3.11 shows the results of an estimation of specification (1) considering employment growth in Belgian acquiring firms, distinguishing between firms that acquire firms that are not dissolved and acquiring firms that dissolve the target firm. The table provides results for respectively domestic, foreign, intra-industry and inter-industry acquisitions. Irrespective of the type of acquisition, firms that acquire another firm without absorbing the target witness employment growth above average in the years prior to acquisition. Firms that acquire another firm that is not dissolved continue to have employment growth above average in the year of acquisition and the following years. For acquiring firms that dissolve the target, the coefficient of employment growth is positive but not always statistically significant in the year of acquisition. This seems to suggest that a substantial number of jobs that disappear in the target firms that are dissolved are lost without contributing much to employment in acquiring firms. In the years after acquisition, employment growth in firms that acquired another firm that is dissolved through acquisition is above average. This is especially true for foreign acquisitions and to a lesser extent also for inter-industry acquisitions.

Apparently, some firms with below-average employment growth succeed in increasing their growth by diversifying through the acquisition and absorption of firms in other markets (foreign or another industry).

An alternative explanation could be that firms intending to grow through acquisition do not increase or even reduce internal employment prior to acquisition.

Table 3.12 shows the results of the evolution of employment growth for firms that acquire another firm without dissolving the target, with a further breakdown by type of acquisition.²⁵

The negative impact on employment of domestic intra-industry acquisitions in target firms (see Table 3.8) is counterbalanced by positive employment effects in domestic acquiring firms. Acquisition of a domestic firm in another industry has a positive impact on employment in the acquiring firm. Foreign intra-industry acquisitions have no statistically significant employment effects in acquiring firms, similar to the absence of effects in target firms (see Table 3.8). Foreign inter-industry acquisitions have a substantial positive impact on employment in acquiring firms. The latter type of acquisition also appears to have a positive impact on employment in target firms. This could indicate that these acquisitions reflect strategies to exploit complementarities between the target and acquirer that are mutually beneficial for employment growth. Estimations by Pavitt category²⁶ for the evolution of employment growth of acquiring firms show that coefficients are positive before acquisition as well as in the year of acquisition and the three following years in all industries. The coefficients are mostly statistically significant in science-based and supplier-dominated industries.

Table 3.11. **Employment growth of Belgian acquiring firms before and after acquisition, 2001-14**

Target firms not dissolved				
	Domestic (26%)	Foreign (74%)	Intra-industry (42%)	Inter-industry (58%)
<i>t-3</i>	0.05 (2.43)**	0.05 (3.86)***	0.06 (2.55)***	0.07 (3.36)***
<i>t-2</i>	0.07 (3.60)***	0.04 (2.79)***	0.09 (4.34)***	0.06 (2.80)***
<i>t-1</i>	0.08 (3.59)***	0.04 (3.21)***	0.08 (3.10)***	0.08 (3.57)***
<i>t</i>	0.10 (4.37)***	0.06 (5.26)***	0.10 (3.85)***	0.09 (4.41)***
<i>t+1</i>	0.11 (4.82)***	0.03 (2.98)***	0.07 (2.73)***	0.09 (4.41)***
<i>t+2</i>	0.06 (2.59)***	0.02 (1.60)*	0.03 (1.19)	0.05 (2.56)***
<i>t+3</i>	0.02 (0.73)	0.02 (1.66)*	0.03 (1.36)	0.02 (1.00)
Target firms dissolved				
	Domestic (60%)	Foreign (40%)	Intra-industry (40%)	Inter-industry (60%)
<i>t-3</i>	-0.03 (-0.94)	-0.01 (-0.35)	-0.02 (-0.52)	-0.03 (-0.66)
<i>t-2</i>	-0.01 (-0.26)	-0.00 (-0.04)	-0.05 (-1.10)	0.02 (0.48)
<i>t-1</i>	-0.00 (-0.05)	0.01 (0.33)	-0.05 (-0.95)	0.04 (1.04)
<i>t</i>	0.06 (1.89)*	0.06 (1.75)*	0.03 (0.62)	0.06 (1.38)
<i>t+1</i>	0.04 (1.06)	0.10 (2.31)**	-0.02 (-0.29)	0.09 (1.95)**
<i>t+2</i>	0.07 (2.05)**	0.09 (2.64)***	0.06 (1.20)	0.07 (1.60)*
<i>t+3</i>	0.07 (2.09)**	0.06 (1.68)*	0.08 (2.07)**	0.06 (1.34)
<i>Ln L_{t-1}</i>	-0.54 (-258.03)***			
<i>Ln Age_t</i>	-0.31 (-93.21)***			
<i>(Ln Age_t)²</i>	0.06 (43.50)***			
<i>Ln L_{t-1} * Ln Age_t</i>	0.07 (86.42)***			
# observations	1 648 429			
# firms	231 210			
R ²	0.30			

Notes: The table shows the results of panel estimation with firm-level fixed effects of employment growth of Belgian firms acquiring another firm, over the period 2001-14, from three years prior to acquisition up to three years after acquisition. The specification contains year dummies. The z values are reported in brackets; *, ** and *** indicate the coefficient estimates are statistically significant at respectively 10%, 5% and 1%. Standard errors are heteroscedasticity consistent (VCE(robust) in Stata).

Source: Authors' calculations.

Table 3.12. **Employment growth of Belgian acquiring firms before and after acquisition, 2001-14**

	Domestic		Foreign	
	Intra-industry (21%)	Inter-industry (32%)	Intra-industry (17%)	Inter-industry (30%)
<i>t-3</i>	0.04 (1.28)	0.07 (2.47)**	0.09 (2.61)***	0.09 (2.67)***
<i>t-2</i>	0.09 (3.48)***	0.06 (1.97)**	0.09 (2.55)**	0.06 (2.18)**
<i>t-1</i>	0.06 (1.81)*	0.10 (3.04)***	0.09 (3.12)***	0.06 (2.11)**
<i>t</i>	0.10 (2.71)***	0.10 (3.32)***	0.10 (3.18)***	0.09 (2.98)***
<i>t+1</i>	0.10 (2.93)***	0.12 (3.81)***	0.04 (0.86)	0.06 (2.32)**
<i>t+2</i>	0.06 (1.71)**	0.06 (2.01)**	0.00 (0.02)	0.04 (1.80)*
<i>t+3</i>	0.02 (0.77)	0.02 (0.52)	0.04 (1.24)	0.03 (1.17)

Notes: The table shows the results of a panel estimation with firm-level fixed effects of employment growth of Belgian firms acquiring another firm that is not dissolved, over the period 2001-14, from three years prior to acquisition up to three years after acquisition. The specification contains year dummies. The z values are reported in brackets; *, ** and *** indicate that the coefficient estimates are statistically significant at respectively 10%, 5% and 1%. Standard errors are heteroscedasticity consistent (VCE(robust) in Stata). The coefficients of all control variables, number of observations and R² are equal to the ones reported in Table 3.11.

Source: Authors' calculations.

The probability of acquisition

Estimation framework

This section investigates which firm-level or industry-level characteristics affect the probability of a firm being involved in an acquisition, either as a target or an acquiring firm.

As a generalised linear model, this method uses as the random component the event of acquisition as a binary (binomially distributed) response variable, in combination with the inverse of the logistic function as the link function: $(\pi) = \log \frac{\pi}{1-\pi}$, with π the probability that a firm is acquired (or acquires). The ratio $\frac{\pi}{1-\pi}$ is referred to as the odds and the logarithm of this ratio as the log odds. The maximum-likelihood estimated coefficient of an explanatory variable can be interpreted as the change in the log odds ratio of acquisition versus non-acquisition due to a unit change in the respective variable, *ceteris paribus*.²⁷

The distinction domestic versus cross-border and intra-industry versus inter-industry acquisitions,²⁸ used in the previous section, is maintained as these dimensions are found to be important for the probability of acquisition in Belgium. For a sample of 484 M&As involving Belgian firms over the period 1997-2007 Huyghebaert and Luypaert (2010) find, for example, that industry concentration only matters for the probability of acquisition for domestic and intra-industry acquisitions.

The literature provides many possible explanations as to why a given firm may be more likely to acquire or be acquired by another firm (e.g. Palepu, 1986; Barnes, 1999; Schoenberg and Reeves, 1999; Huyghebaert and Luypaert, 2010; Gutsche, 2013). Overall, these fall into two broad categories: determinants relating to motivations for acquisitions and constraining factors. To become an acquirer, firm size would be an important constraint since smaller firms presumably have less access to financial resources. For the same reason, more liquidity and higher profitability could be facilitating factors, while a high leverage may have an inhibitory effect. The business cycle may also influence this channel, limiting access to credit during downturns. An important motivation for acquiring other firms could be a firm's growth strategy, where low growth in the past may predict a change from an internal towards an external growth strategy. A similar shift may be predicted by a mismatch between (available) funds and (lacking) internal investment opportunities, the so-called growth-resource mismatch, or even the age of a firm. Other possible motivations include strategic considerations related to industry concentration and market power, diversification of risks and the creation of synergies (facilitated by high levels of immaterial assets on the part of the acquirer). Huyghebaert and Luypaert (2010) find that intangible assets positively affect the M&A decision of Belgian firms.

On the other side, the attractiveness of an acquisition target would be determined by its own growth potential and financial health (past growth, profitability and liquidity, low leverage, age), and by industry and business cycle variables. In particular, a reverse resource mismatch (low funds but high growth potential) may be a facilitating factor (e.g. Palepu, 1986; Gutsche, 2013). Firm size could be both a facilitating and a prohibiting factor since taking over a large firm results in larger growth, yet at the same time requires more financial resources and handling of complexity.

The variables considered in this study's estimation result from the list of possible determinants found in previous studies and data availability.

Turnover and the number of employees are used to proxy firm size (both in logs and including a squared term to allow for non-monotonicity). Profitability and the growth

potential are captured by the growth rates of turnover, employment, profits (defined as earnings before interest and tax [EBIT]), intangible assets and debt (negatively). The EBIT rate, i.e. EBIT relative to total assets, is assumed to indicate internal cash flow generation capacity and hence liquidity. Leverage is represented by the debt rate (debt as a fraction of total assets). An interaction effect between the EBIT rate and the debt rate is included in the analysis to allow for a resource mismatch effect. The size of intangible assets (in logs) is used as a proxy for synergetic potential, whereas the growth in intangible assets is included in the analysis as a measure of (past) growth strategy for acquirers and an extra measure of attractiveness for acquired firms. The term spread and the yield spread should capture potential business cycle effects, and the specification also includes the Herfindahl-Hirschman (HH) index and its square to capture potential effects of concentration within the industry, which is allowed to be non-monotonous. Finally, firm age is included as a demographic factor. In the list above fractions of variables in terms of total assets were used primarily to avoid collinearity with the turnover variables. All variables are from Zephyr and Belfirst. As some of the financial and accounting information is only available from 2006 onwards, estimations cover the period 2006-14.

Inference for the model is based on the likelihood ratio (LR) test both for individual parameters and the model as a whole, which is warranted by the fact that logistic regression models yield estimates with large-sample normal distributions. Under the null assumption, the LR test converges to a chi-squared distribution where each parameter counts as a degree of freedom. It is preferred over the Wald Test since the latter uses less information and suffers from decreasing power with increasing effect size (Hauck and Donner, 1977).

The pseudo R^2 reported here is McFadden's version.²⁹ Although this goodness-of-fit measure has good statistical properties, and is ranged between 0 and 1 like the conventional coefficient of determination in ordinary least squares (OLS), the interpretation of intermediate values is not straightforward. For instance, simulations by Domencich and McFadden (1975) suggest that pseudo R^2 values of 0.2 and 0.4 correspond to R^2 values of around 0.4 and 0.8 respectively.

As a measure for the predictive power of the models, the area under the receiver operating characteristic (ROC) curve, known as the area under the curve (AUC) or the concordance index, is shown. The ROC curve gives the fraction of true positives (sensitivity) as a function of the fraction of false positives (one minus the specificity) predicted by the model, for different values of the probability cut-off point. Obviously, for a cut-off equal to 0, both fractions are 0, while both fractions are 1 for a cut-off equal to 1. If a model yields completely random probability predictions, both fractions equal the cut-off probability, resulting in a linear ROC and $AUC = 0.5$. However, if a model predicts well, increasing the cut-off will result in a large gain in terms of true positives at a small cost in terms of false positives. Consequently, the ROC will rise quickly, leading to an AUC closer to 1 (see e.g. Agresti [2002] for more information).

Estimation results

The probability of being acquired

Table 3.13 gives the estimated coefficients and the relevant statistics for the four logit models predicting the probability of being acquired on the basis of firm characteristics. For all types of acquisition, high turnover and employment initially increase the odds of being subject to an acquisition, although the effect decreases and even becomes negative for very

Table 3.13. **Probability of a Belgian firm being acquired, 2006-14**

	Domestic	Foreign	Intra-industry	Inter-industry
Ln turnover	3.90 (5.98)***	3.25 (5.17)***	3.51 (3.28)***	3.72 (6.29)***
(Ln turnover) ²	-0.11 (-5.47)***	-0.09 (-4.61)***	-0.1 (-2.99)***	-0.1 (-5.67)***
Turnover growth	-0.06 (-0.34)	0.24 (2.00)**	0.36 (2.00)**	0.13 (1.04)
Ln employment	0.69 (4.15)***	1.02 (5.49)***	0.56 (2.14)**	0.81 (5.06)***
(Ln employment) ²	-0.06 (-2.50)**	-0.1 (-4.05)***	-0.04 (-1.05)	-0.08 (-3.6)***
Employment growth	0.12 (0.60)	-0.13 (-0.60)	-0.13 (-0.36)	0.10 (0.60)
EBIT rate	-0.89 (-1.81)*	0.53 (0.96)	-0.42 (-0.38)	0.22 (0.45)
EBIT growth	0.03 (1.37)	-0.02 (-0.75)	-0.03 (-0.64)	0.00 (0.11)
Debt rate	-0.29 (-1.47)	-0.44 (-2.10)**	-0.35 (-1.04)	-0.53 (-2.80)***
Debt growth	-0.24 (-1.65)*	0.22 (2.49)**	-0.43 (-1.61)	0.10 (1.03)
EBIT rate*debt rate	-0.45 (-1.96)**	-0.72 (-2.85)***	-0.18 (-0.22)	-0.82 (-4.17)***
Ln intangible assets	0.14 (5.77)***	0.16 (6.87)***	0.10 (2.36)**	0.16 (7.49)***
Intangible assets growth	0.03 (0.86)	-0.01 (-0.32)	0.06 (0.98)	-0.03 (-0.63)
Term spread	-0.13 (-1.68)*	-0.14 (-1.90)*	-0.02 (-0.17)	-0.18 (-2.64)***
Yield spread	0.17 (1.30)	0.36 (2.78)***	0.12 (0.54)	0.37 (3.10)***
Herfindahl-Hirschman	0.76 (0.79)	1.29 (1.21)	2.36 (1.62)	0.88 (0.92)
Herfindahl-Hirschman ²	0.51 (0.38)	-1.38 (-0.77)	-0.21 (-0.11)	-0.73 (-0.46)
Age	-0.02 (-2.28)**	-0.03 (-4.47)***	0.02 (0.73)	-0.03 (-4.27)***
Age ²	0.00 (1.91)*	0.00 (3.56)***	0.00 (-1.04)	0.00 (4.37)***
Constant	-40.99 (-8.13)***	-37.05 (-7.54)***	-39.01 (-4.73)***	-40.18 (-8.72)***
Number of observations	711 280			
LR chi2 (p value)	625.64 (0.00)	721.57 (0.00)	202.88 (0.00)	812.34 (0.00)
Pseudo R ²	0.11	0.13	0.09	0.13
Concordance index	0.85	0.88	0.84	0.87

Notes: The table shows the results of a logit estimation of the probability of acquisition on target firm characteristics. The data relate to the period 2006-14. Rendered values indicate the effect on log odds, not probabilities, and corresponding z values are reported in brackets. *, ** and *** indicate that the coefficient estimates are statistically significant at respectively 10%, 5% and 1%. The Pseudo R² statistic is McFadden's. For the interpretation of the concordance index, see the fifth section of this chapter.

Source: Authors' calculations.

large firms through the significant coefficient of the squared logs for domestic, foreign and inter-industry acquisitions. Given this non-monotonicity, the level of employment that maximises the odds of being taken over can be derived. For foreign and inter-industry acquisitions, the optimal level amounts to 164 and 158 respectively, while the level is considerably higher for domestic acquisitions: 314 employees. For intra-industry acquisitions, a higher number of employees always increases the odds. The lower optimum for the foreign and inter-industry models may point to a difference in motivation underlying these types of acquisition, with perhaps a greater emphasis put on the investment value or growth potential of the target firm. The amount of intangible assets also has significant positive effects on all the odds.

The effect of growth variables is less straightforward. Turnover growth increases the odds of being taken over intra-industry or by a foreign firm. Growth of debt has a negative influence on the probability of domestic acquisition, yet influences the probability of acquisition by a foreign firm positively. Other growth variables and sector concentration do not seem to matter.

For inter-industry and foreign acquisitions, term spread and yield spread have significant effects (respectively negative and positive), adding evidence for a greater prominence of investment considerations in these types of acquisition. For the same types (and to a lesser extent also for domestic acquisitions), increasing firm age initially has a negative effect on the odds, although this effect reverses for very old firms.

The debt rate also has a negative effect for both types, and this effect becomes more pronounced for firms with a higher profit rate (interaction effect). The profit rate, on the other hand, has no significant effect on its own: although conditional on debt rate, it actually decreases the acquisition probability. This seems to contradict the resource mismatch hypothesis, which implies that buying firms are especially looking for targets with great opportunities in combination with low resources. Of course, given the absence of a positive effect from profits, the latter variable may be a bad proxy to measure opportunity (other specifications with employment growth and turnover growth did not provide a fundamentally different picture).

The probability of acquiring

Table 3.14 shows the estimated coefficients and the relevant statistics for the four estimated models using a logit regression, from the point of view of the acquiring firm. Hence, the second column contains the estimates for the probability that a firm, given its characteristics, will acquire a domestic firm, while the third column model estimated the probability of acquiring a foreign firm. The last two columns show the results for intra-industry and inter-industry acquisitions respectively.

Table 3.14. Probability of a Belgian firm acquiring another firm, 2006-14

	Domestic	Foreign	Intra-industry	Inter-industry
Ln turnover	2.41 (3.73)***	2.31 (7.20)***	2.95 (4.28)***	1.56 (2.76)***
(Ln turnover) ²	-0.06 (-3.29)***	-0.05 (-5.81)***	-0.07 (-3.71)***	-0.04 (-2.22)**
Turnover growth	0.25 (1.87)*	0.30 (3.38)***	0.29 (1.96)**	0.21 (1.46)
Ln employment	0.92 (4.42)***	0.36 (3.29)***	0.55 (2.46)**	0.78 (3.81)***
(Ln employment) ²	-0.06 (-2.72)***	-0.01 (-1.24)	-0.04 (-1.65)*	-0.06 (-2.69)***
Employment growth	0.46 (2.42)**	0.12 (0.79)	0.26 (1.04)	0.31 (1.40)
EBIT rate	-1.40 (-1.54)	-3.62 (-4.59)***	-2.04 (-1.87)*	-4.28 (-5.61)***
EBIT growth	0.05 (1.81)*	0.01 (0.59)	0.02 (0.54)	0.04 (1.19)
Debt rate	-0.27 (-1.04)	-1.65 (-9.54)***	-0.68 (-2.15)**	-1.25 (-4.51)***
Debt growth	0.01 (0.09)	0.19 (2.67)***	0.11 (0.79)	0.17 (1.50)
EBIT rate*debt rate	1.43 (1.89)*	2.36 (1.92)*	2.09 (1.96)**	3.02 (3.29)***
Ln intangible assets	0.19 (6.82)***	0.20 (12.35)***	0.22 (7.43)***	0.24 (8.25)***
Intangible assets growth	0.01 (0.27)	0.02 (0.55)	0.05 (1.06)	0.04 (0.85)
Term spread	0.06 (0.62)	-0.08 (-1.23)	0.15 (1.32)	-0.02 (-0.23)
Yield spread	0.31 (1.98)**	0.12 (1.16)	0.04 (0.21)	0.29 (1.70)*
Herfindahl-Hirschman	-1.62 (-1.38)	-1.74 (-2.43)**	3.29 (2.39)**	-2.99 (-2.32)**
Herfindahl-Hirschman ²	2.9 (2.06)**	2.52 (3.01)***	-4.39 (-1.90)*	4.52 (3.15)***
Age	-0.00 (-0.32)	-0.02 (-3.97)***	0.00 (0.10)	-0.02 (-2.60)***
Age ²	-0.00 (-0.22)	0.00 (5.6)***	-0.00 (-0.65)	0.00 (3.20)***
Constant	-32.42 (-6.26)***	-30.1 (-11.26)***	-37.86 (-6.69)***	-24.53 (-5.38)***
Number of observations	711 310			
LR chi2 (p value)	664.94 (0.00)	2457.71 (0.00)	617.65 (0.00)	679.26 (0.00)
Pseudo R ²	0.18	0.28	0.21	0.21
Concordance index	0.91	0.94	0.93	0.92

Notes: The table shows the results of a logit estimation of the probability of acquisition on acquiring firm characteristics. The data relate to the period 2006-14. Rendered values indicate the effect on log odds, not probabilities, and corresponding z values are reported between brackets. *, ** and *** indicate that the coefficient estimates are statistically significant at respectively 10%, 5% and 1%. The Pseudo R² statistic is McFadden's. For the interpretation of the concordance index, see the fifth section of this chapter.

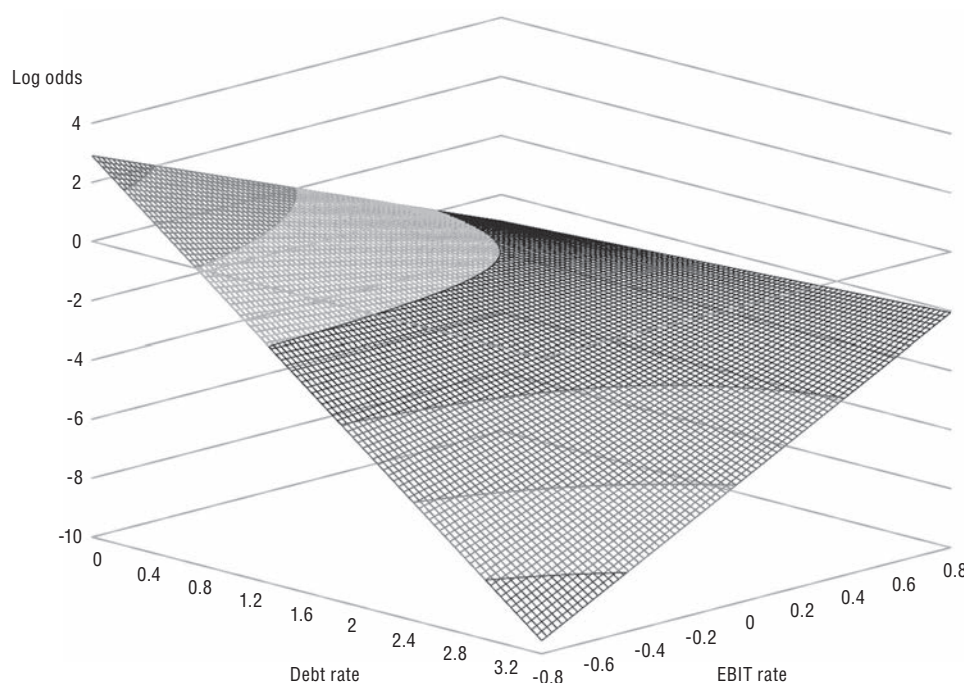
Source: Authors' calculations.

The size of turnover and employment has a highly significant positive effect on the probability of every type of acquisition, but the magnitude of the positive effect decreases with size. Only for Belgian firms engaged in a foreign firm acquisition, the employment level has a monotonic positive effect on the odds. For domestic, intra- and inter-industry acquisitions, the optimal employment levels, maximising the odds of acquisition, are 2 136; 968 and 665 respectively.

The amount of intangible assets also affects the probability of all types of acquisition positively. This result may give some support to the synergetic potential hypothesis. Growth of profit and employment predict a higher chance of acquiring domestic firms, while the same goes for growth in debt, only now for international acquisitions.

The profit and debt rates are particularly influential for foreign and inter-industry acquisition probabilities and, to a lesser extent, intra-industry acquisitions. All effects are negative. Yet the significant interaction effect for these models reveals a more complex picture, as represented in Figure 3.5: lower levels of debt increase the probability of acquisition, as one would expect, yet this effect is higher for firms with lower profits.

Figure 3.5. **Log odds for Belgian firms acquiring foreign firms by earnings before interest and tax (EBIT) rate and debt rate**



Note: The logit for inter-industry and intra-industry acquisitions yields similar graphs.
Source: Authors' calculations.

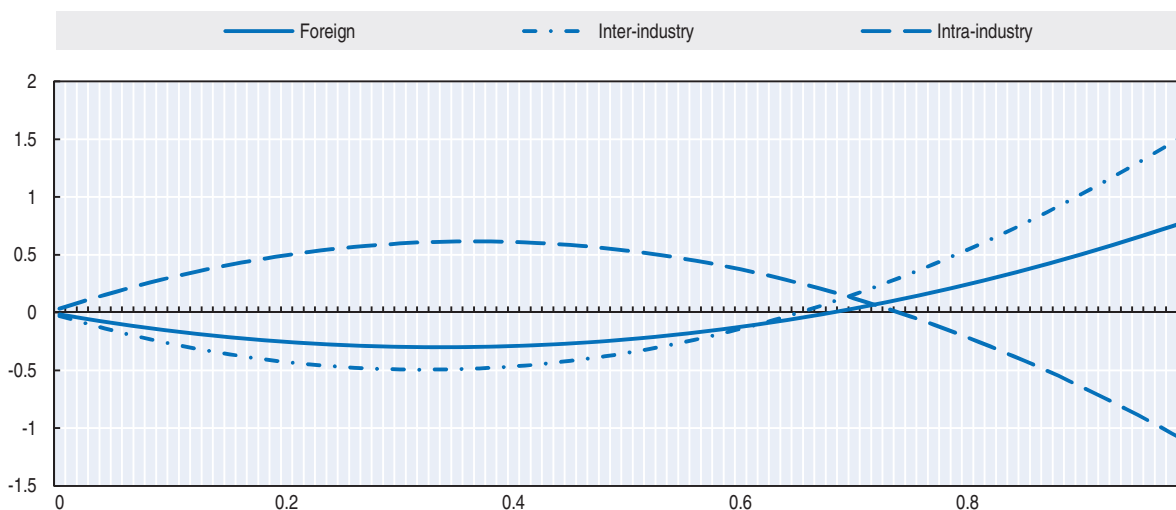
Mirroring this, firms with lower profits are more likely to perform an acquisition, but the increase is more important for firms with low debts. These findings conform to the growth-resource mismatch hypothesis. Interestingly, the HH index and its square have a significant effect on foreign, intra-industry and inter-industry acquisitions, but the signs of the coefficients differ.

Finally, older firms have lower odds of taking over foreign firms or firms in other industries, although this negative effect is decreasing. Hence, for the supposedly more diversifying

foreign and inter-industry acquisitions, the odds are negatively affected by low levels of concentration and even more so by intermediate levels, while the odds are positively affected for companies in very concentrated industries.

However, for intra-industry acquisitions, the odds are actually positively affected by low levels of concentration, even more so by intermediate levels of concentration, and negatively by higher levels of concentration. The relation between log odds and the HH index according to the three models is depicted in Figure 3.6.

Figure 3.6. **Log odds of acquisition by level of market concentration (HH index)**



Note: The solid and dash-dot lines depict the log odds of foreign and inter-industry acquisitions respectively, while the dashed curve shows the log odds for intra-industry acquisition.

Source: Authors' calculations.

Conclusions

Belgian firms do not appear to be very active in M&A deals, whether as targets or as acquirers. Against the worldwide trend, the number of acquisitions involving Belgian firms has even decreased over the last decade. This finding calls for future assessment of the causes of the low involvement of Belgian firms in M&A deals. Possible factors to take into account are financing constraints, differences with regard to other countries in share ownership and rules of corporate governance, but also the fact that multinational enterprises have had high stakes in the Belgian economy for a long time.

Given the low number of M&As with Belgian firms in each given year, the results of analyses of business demographics and job creation are very robust for Belgium and confirm the important role of young firms in net job creation and the substantial net job destruction of small old firms. The disproportionate share of firms involved in M&A deals in Belgian high-growth firms suggests that for the small group of Belgian firms that are active in M&A deals, acquisitions are instrumental in achieving high growth.

Young Belgian firms appear to be less inclined to acquire other firms than young foreign firms to acquire Belgian firms. Although the DynEmp project established a low start-up rate in Belgium, it also indicated that surviving start-ups witness substantial post-entry growth. It would be interesting to investigate the reasons for the apparent preference of young firms for organic growth as opposed to external growth through acquisition and

the impact of this choice on resource allocation efficiency within industries. Factors that explain the overall low involvement of Belgian firms in M&A deals may be especially relevant for young firms.

Estimation of employment growth after acquisition indicates that concerns about possible job destruction through foreign acquisitions are not warranted for Belgium. For foreign inter-industry acquisitions there are actually positive effects on employment growth of target firms in the years after acquisition. Domestic intra-industry acquisitions, on the other hand, negatively affect post-acquisition employment growth in target firms, an effect that is partially moderated by job creation in domestic acquiring firms. These results show the importance of accounting for potentially different motives for acquisition (e.g. consolidation or efficiency versus diversification), which should be further investigated.

Growth in turnover appears to be a more important indicator than employment growth for the attractiveness of firms as a target of acquisition. For all types of acquisitions, intangible assets positively affect the probability of acquisition. The probability of a Belgian firm acquiring another firm is determined by industry concentration, mostly in a non-linear way.

Future research could extend the focus of this chapter by taking into account more characteristics of M&A firms, such as the nationality of the target and acquiring firms in cross-border acquisitions or the share of ownership. From a general welfare perspective it would also be interesting to investigate other effects of acquisitions, such as the potential creation of spin-outs due to the mismatch between the aspirations of individual employees and the management strategy in the post-acquisition integration period or the impact on productivity growth and within-industry reallocation. Given the important role of industry concentration in the decision of acquisition, an assessment at the industry level of the impact of M&As on competition, innovation and efficiency growth could also be envisaged.

Notes

1. Zephyr does not impose a minimum value for M&A deals to be included. Thomson currently applies a USD 1 million minimum threshold (previously USD 10 million).
2. The reported number and value of M&As differs depending on the data provider. Although the overall pattern is comparable with other sources, the time series of the Institute for Mergers, Acquisitions and Alliances (IMAA) used in Figure 3.1 does not show a record high for the value in 2015, as reported by Dealogic, Thomson Reuters and Zephyr.
3. Zephyr data are used in several firm-level M&A studies (e.g. Huyghebaert and Luypaert, 2010; Stiebale and Trax, 2011; Oberhofer, 2013; Furlan, Oberhofer and Winner, 2015).
4. www.bvdinfo.com/en-gb/our-products/economic-and-m-a/m-a-data/zephyr.
5. Nearly all legal entities active in Belgium have an obligation to deposit an annual account at the Central Balance Sheet Office which makes these accounts available for the public.
6. Sector S.11, following the European System of National and Regional Accounts (ESA 2010).
7. From Belfirst, over 2001-14, 13 610 mergers by acquisition can be identified involving a Belgian company, 6 335 of which are not considered by Zephyr. The acquisitions reported in Belfirst are based on information regarding the legal situation as provided by the Crossroads Bank for Enterprises (CBE), a register that contains all basic data regarding enterprises and their individual business locations in Belgium. The deals recorded in Zephyr involving Belgian companies represent, on average, 76% of the employment (per head) in companies involved in acquisitions reported in Belfirst.
8. For most countries the number of M&A deals involving a national company as a target is very close to the number of deals involving a national company as an acquirer.
9. This dramatic increase can to some extent be explained by acquisitions involving firms from emerging economies.

10. Data by the Institute for Mergers, Acquisitions and Alliances (IMAA) confirm the generally low number and decline in M&As involving Belgian firms.
11. The top 10 of industries in terms of the total number of firms involved in acquisitions differs from the ranking in Table 3.1 as the total number of firms involved depends on the total number of firms in each given industry. For example, wholesale trade, except for motor vehicles and motorcycles (NACE 46) has the largest number of firms involved in an acquisition, both for deals involving a Belgian target and deals involving a Belgian acquirer, but relative to the total number of firms in this industry the ratio is only 0.12 for target firms and 0.10 for acquirers.
12. Total employment is defined as the sum of persons employed by all companies that have deposited their annual account and balance sheet (Belfirst data).
13. Only firms for which the age of the target and the acquiring firm are known are considered in this table. These firms account, on average, for 85.4% of the total number of employees in the sector of non-financial corporations (S.11 ESA 2010) over 2002-14.
14. Over the period 2002-07, the contribution of non-exiting old small incumbents that were not involved in any M&A deal was slightly positive, as was the contribution of non-exiting old large incumbents.
15. For the majority of deals considered by Furlan, Oberhofer and Winner (2015) the acquired share equals 100%.
16. Firms that were not dissolved through merger or acquisition may have been dissolved or stopped activities in the years after acquisition. As pointed out in the data section, Belfirst contains a relatively large number of mergers by acquisitions not considered in Zephyr, in which target firms are dissolved. As the vast majority of these acquisitions can be identified as intra-group deals, they are not considered for further analysis.
17. Due to data availability the years 1997 up to 2000 as well as 2015 are not included in the estimations.
18. Over the period 2001-14, for acquisitions with a Belgian target the median deal value of domestic acquisitions was USD 11 million, for foreign acquisitions USD 22 million, for intra-industry acquisitions USD 26 million and for inter-industry acquisitions USD 13 million. For deals with a Belgian acquiring firm the median deal value of domestic acquisitions was – by definition – also USD 11 million, for foreign acquisitions USD 18 million, for intra-industry acquisitions USD 27 million and for inter-industry acquisitions USD 12 million. The average deal value is much larger but highly skewed by a small number of very large deals.
19. The number of acquisitions in which targets are dissolved is too small for a meaningful further breakdown than the one in Table 3.7.
20. A deal is labelled as intra-industry if all target and acquiring firms have the same four-digit primary activity NACE code.
21. Estimations in which the three-digit level, instead of the four-digit-level, is considered to define intra-industry versus inter-industry deals provide very similar results. These results are not reported but available upon request.
22. For the majority of acquisitions of Belgian target firms 100% of ownership is transferred.
23. Some firms are the target of more than one acquisition in the same year.
24. The results of the robustness tests are not reported but available upon request.
25. The number of acquisitions in which targets are dissolved is too small for a more detailed breakdown than the one in Table 3.11.
26. Results not reported but available upon request.
27. In particular, the estimates depend on the relative variance of unobserved characteristics, so that differences in coefficients across models (e.g. logit versus probit) and across different samples may primarily reflect differences in normalisation or in the relative importance of observed versus unobserved variables. See, for example, Train (2003).
28. Industries are, as in the fourth section, considered at the NACE four-digit level (Rev. 2).
29. That is $\rho^2 = 1 - \frac{L(\hat{\beta})}{L(\bar{\beta})}$ with $\hat{\beta}$ the log likelihood function, $\bar{\beta}$ the maximum likelihood estimate and R^2 a vector containing zeroes for the predictor coefficients. This value can be interpreted as a maximum likelihood analogue for the coefficient of determination R^2 in OLS, so that is also known as pseudo- R^2 .

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Chapter 4

Firm and job dynamics in the United Kingdom before, during and after the global financial crisis: Getting in under the hood

by

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Since the pioneering work of the OECD in the mid-1980s considerable work has been done using job creation accounts to describe job flows. Whilst the conventional approach to job creation accounting focuses on flows, here, by contrast, stocks are centre stage. Using UK firm-level records, the stock of firms and its dynamics are combined with the average number of jobs per firm to track the evolution of the stock of jobs. By separating the stock of firms (and jobs) into start-ups and continuing firms, the relationship between them can be exploited to interpret events. After all, new additions to the stock of continuing firms are just the survivors of previous years' start-ups. Following start-ups into the population of continuing firms reveals an important channel of influence from falling firm births to job losses during the global financial crisis.

The statistical data used in this chapter is from the Office of National Statistics (ONS) and is Crown copyright and reproduced with the permission of the controller of Her Majesty's Stationery Office (HMSO) and the Queen's Printer for Scotland (QPS). The use of the ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. The analysis upon which this report is based uses research datasets which may not exactly reproduce the Office of National Statistics' aggregates.

Context, motivation and approach

The OECD pioneered the compilation of job creation and destruction accounts from large scale firm-level datasets in the mid-1980s (see OECD, 1987 (Chapter 4, especially Chart 4.1 for a diagrammatic representation). The accounting was further developed by Davis and Haltiwanger in the early 1990s in their detailed study of data from the United States (see Davis and Haltiwanger, 1990; Davis, Haltiwanger and Schuh, 1996).¹ From the outset the focus was on flows, most particularly the magnitude of gross job flows – gross job creation and destruction – and their connection with the operation of labour markets² and the parallel accounts for the stock of firms were left implicit. This analysis' focus is rather different. Using the same basic data, it puts the stock of firms centre stage, highlighting its dynamics and combining it with data on the average number of jobs per firm to account for the evolution of the stock of jobs.

Its focus provides a rather different perspective on firm and job dynamics over the period of the global financial crisis (GFC). Viewing the data through this lens highlights the key role of firm dynamics in general, and births in particular, in accounting for the loss of jobs. Firm births dropped about 25% in 2009 which depressed net job creation in that year but, almost as significantly, the fall in births meant that the stock of continuing firms in the following year was also lower by about the same amount and this “missing stock”, in turn, was (by its absence) responsible for about half the net job destruction in 2010. Births fell again in 2010 and this fed forward too into 2011. The “collapse” of births directly, and through its subsequent effect on the stock of continuing firms, overshadowed the slowdown in continuing firm job growth, and there was little obvious influence of a rise in business failure. Likewise, a return of firm births towards their pre-GFC level played a key role in the recovery.

There are a few studies taking a broadly similar approach to the United States experience over the GFC period and the subsequent recovery, notably Gourio, Messer and Siemer (2015), Sedláček (2015) and Moreira (2015); and in this (small) literature it is common to refer to the longer term effects of the fall in births as having created a “missing” or “lost” generation of firms.

Of these three the paper by Gourio, Messer and Siemer (2015) is the most similar to this chapter's analysis (and see other related papers by the same authors: Siemer [2014], Gourio, Messer and Siemer [2014] and Gourio, Messer and Siemer [2016]), since it takes the fall in births as “given” (i.e. not trying to explain its cause); and, on the empirical side, they find that there was no post-GFC “overshoot” of births to replace those which were “lost”, and that the average size of births remained broadly unchanged. This leads them to a counterfactual calculation: “As of March 2011, we find that there would be 1.7 million more jobs had entry stayed at its historical average.” (Gourio, Messer and Siemer, 2015, p.8). Sedláček's argument is slightly different because, in his model, the impact of the fall in births on jobs is “cushioned” by continuing firms which take on more workers. Nonetheless there is still a “missing generation” effect: “in future years the missing entrants generate fewer older firms

(which on average account for the bulk of aggregate employment). This creates a very persistent dent in the employment potential of the economy” (Sedláček, 2015, p. 3).

His argument implies that, while a variation in births might initiate a process of change, the longer term effects on the national jobs total show up in the average size of firms.³ Finally, the paper by Moreira (2015) presents an argument of a similar character to Sedláček (2015), though her underlying model differs. Here, too, the effects of recessions on entry (her data period extends back before the GFC period) have longer term effects: “I provide new evidence that businesses born in downturns start on a smaller scale and remain smaller over their entire life cycle... My current model simulations indicate that the impact of the crisis on the 2008-09 cohorts reduces aggregate employment by at least one percentage point in the following ten years.” Moreira (2015, p.1).

Although each of these three papers relies on differently formulated models (and, indeed, take slightly differing views of the “facts” about average firm size) this study’s key conclusion is that the dramatic decline in firm birth associated with the onset of the GFC had significant and long-lasting effects on employment.

The analysis here is tackled in a series of stages, peeling back layers of data. Following a short description of data sources, the first analytical section is brief and is methodological. It draws attention to the rather shadowy role played by “continuing firms” – firms more than a year old – in the conventional job creation and destruction accounts. The next step shows how the accounts can be articulated slightly differently so that the role of continuing firms in the job creation process becomes more transparent. This also allows a clearer picture to emerge of the progress of firms from “start-up” to “continuing” and its implications which, in turn, provides some insight into the inter- relationship between firm and job dynamics. The following section deals with the facts; it starts with the data on firm births.⁴ The analytical strategy involves decomposing the stock of start-up jobs into the number of start-up firms and the number of jobs per firm. The rationale here is simple: in the United Kingdom start-up numbers fluctuate, average start-up size rather less, so this decomposition makes it possible to more easily see the differing scale of their contributions to job creation. This study adopts the same approach to investigating the contribution of deaths and continuing firms to job creation, distinguishing the effect of changes in the stock of firms from changes in average size. It completes the data analysis by bringing together start-ups and continuing firms to account for overall net job creation. The final analytical section of the paper reports a simple data-based counter- factual decomposition which illustrates the quantitative importance of start-ups in accounting for the dramatic decline in jobs in the GFC.

Data sources and construction

This analysis uses the United Kingdom *Business Structure Database* (BSD) (compiled by the Office for National Statistics)⁵ which records annual data on employees for the entire population of firms in the United Kingdom. This data is compiled from a series of annual “snapshots” of the Inter-Departmental Business Register, an administrative database which captures information from a range of sources, among them VAT returns and employer pay as you earn (PAYE) tax and social security records. The unit of analysis is an “employer enterprise” – a business with at least one employee⁶ – which is also referred to as a firm. Firms may comprise a number of distinct local units (workplaces, establishments or plants) but this analysis’ data refer to firm-level employee numbers.

The annual “snapshots” from the BSD using firm-level identifiers have been linked together to form a longitudinal firm-level database for the United Kingdom and algorithms have been devised to produce firm-level demographic markers for “birth” and “death”. The birth of a firm is dated by the first appearance of non-zero employment and its death is treated symmetrically and dated by the disappearance of the last employee. The data do not distinguish between *de novo* births and those which result from the break-up of an existing firm, similarly the data do not distinguish between the closure of a firm and its disappearance due to a merger. Although the data start in 1997, firms alive in 1997 could have been born in any previous year, so the first birth year that can be identified with certainty is 1998.⁷

Firms are classified as either “private” or “public” sectors and this split is made using the classification by industrial sector. All employees in – public administration and defence; education; and health and social work – as public sector (SIC92⁸ sections L, M, N) – are classified as public sector. Of course, some firms in these sectors (e.g. in health and education) are private, and some firms in the private sector are government-owned, but this chapter offers a reasonable approximation that ensures that, most typically, longer lived public sector entities (like schools and hospitals) do not distort calculations. In essence, the business population is all employer enterprises in the non-agricultural private sector.

Before proceeding further, there is an important caveat about dating. The data used here are compiled from annual snapshots taken of a “live” register each March. This analysis has adopted the convention of referring to the date of observations by the date of the snapshot, so for example the data labelled 2014 are from the March 2014 snapshot.⁹ Those used to working with conventional annual time series may find this labelling potentially misleading for two reasons. First, the data on the register in March are not likely to refer to activity as at March or the period end-March; data entered onto the register in March are very likely to refer to some previous time. Second, the administrative processes underpinning the data collection make it likely that the period to which the data refer varies, at least to some extent, across firms. However, since there are more than 1 million firm-level records, these deficiencies are treated as “noise” when the analysis focuses on trends.¹⁰ Here, though, one particular period is of special interest: the GFC. In practice, as shown below, this period seems clearly visible in the behaviour of the firm and job aggregates: between 2008 – the last pre-GFC year – and 2012 – the first year of the upward move into recovery.

Accounting for continuing firms and their jobs

Firms

This analysis starts with the conventional accounting relationship which connects the closing stock of firms between two periods, where births and deaths are (during period) flows (the superscript *f* denotes firms):

$$\text{closing}_t^f \equiv \text{closing}_{t-1}^f - \text{deaths}_t^f + \text{births}_t^f.$$

This can be re-organised to yield the usual stock/flow relation:

$$\Delta \text{closing}_t^f \equiv \text{closing}_t^f - \text{closing}_{t-1}^f \equiv -\text{deaths}_t^f + \text{births}_t^f. \quad (1)$$

In its treatment of job creation and destruction this analysis tracks the contribution of continuing firms: firms which were born before the beginning of a year and survive to the end of that year. It follows that the stock of continuing firms at the end of a year can be written as:

- the stock of continuing firms inherited from the previous year
- plus the firms born in the previous year, because at the beginning of the current year all last year's births are "re-labelled" continuing firms
- less the firms which die in the current year:

$$\text{continuing}_t^f \equiv \text{continuing}_{t-1}^f - \text{deaths}_t^f + \text{births}_{t-1}^f,$$

and the corresponding stock/flow relation is:

$$\Delta \text{continuing}_t^f \equiv -\text{deaths}_t^f + \text{births}_{t-1}^f. \quad (2)$$

It is worth emphasising that the current change in the number of continuing firms depends on the previous year's start-ups. As shown later, this dependence has important implications in accounting for job creation dynamics in the GFC period.¹¹

The relationship between the overall closing stock of firms and the end-year stock of continuing firms can be written as:

$$\text{closing}_t^f \equiv \text{continuing}_t^f + \text{births}_t^f,$$

and the stock/flow relation (Equation (1)) can be rewritten as:

$$\Delta \text{closing}_t^f \equiv \Delta \text{continuing}_t^f + \Delta \text{births}_t^f. \quad (3)$$

Jobs

This study's creation and destruction accounts for jobs (the *j* superscript denotes jobs) include one more term than the corresponding firm accounts: the (net) addition to jobs in continuing firms (continuing net). This is a during period flow equal to jobs added by expanding firms less jobs lost by contracting firms – the difference between two terms from the conventional flow accounts:

$$\text{closing}_t^j \equiv \text{closing}_{t-1}^j - \text{deaths}_t^j + \text{births}_t^j + \text{continuing_net}_t^j.$$

This term fits quite naturally into the job creation accounts for continuing firms, since job growth during the year has the same effect as start-up jobs:

$$\text{continuing}_t^j \equiv \text{continuing}_{t-1}^j - \text{deaths}_t^j + \text{births}_t^j + \text{continuing_net}_t^j, \quad (4)$$

from which follows immediately:

$$\Delta \text{continuing}_t^j \equiv -\text{deaths}_t^j + \text{births}_t^j + \text{continuing_net}_t^j.$$

The relationship between the (overall) closing stock of jobs and the closing stock of jobs in continuing firms parallels the firm relationship, and the stock/flow relation which defines net job creation can then be written as:

$$\Delta \text{closing}_t^j \equiv \Delta \text{continuing}_t^j + \Delta \text{births}_t^j.$$

So overall net job creation can be written as the sum of two components: the change in jobs in continuing firms, and the difference between jobs in the current cohort of start-ups and start-ups in the previous period. As shown below, this alternative presentation provides some rather sharper insights than does the conventional framework into the process of change, particularly over the GFC period.

Jobs per firm

As mentioned earlier, this analysis' primary focus is the stock of firms, and it generates the associated stock of jobs as the product of the stock of firms and the number of jobs per firm. In order to keep track of the evolution of jobs per firm in continuing firms (even though, as will soon become apparent, it shows relatively little variation) a further accounting

relationship is required. The simplest place to start is with an identity which links the current stock of jobs to its constituent components. The first step is to define jobs per firm by dividing the expression for continuing jobs by the current stock of continuing firms:

$$\frac{\text{continuing}_t^j}{\text{continuing}_t^f} = \frac{\text{continuing}_{t-1}^j + \text{births}_{t-1}^j + \text{continuing_net}_{t-1}^j - \text{deaths}_t^j}{\text{continuing}_t^f} \quad (5)$$

Next the terms on the right hand side are turned into a weighted sum of the separate job-per-firm ratios for each component:

$$\frac{\text{continuing}_t^j}{\text{continuing}_t^f} = \frac{\text{continuing}_{t-1}^j}{\text{continuing}_{t-1}^f} \times \frac{\text{continuing}_{t-1}^f}{\text{continuing}_t^f} + \frac{\text{births}_{t-1}^j}{\text{births}_{t-1}^f} \times \frac{\text{births}_{t-1}^f}{\text{continuing}_t^f} + \frac{\text{continuing_net}_{t-1}^j}{\text{continuing}_{t-1}^f} \times \frac{\text{continuing}_{t-1}^f}{\text{continuing}_t^f} - \frac{\text{deaths}_t^j}{\text{deaths}_t^f} \times \frac{\text{deaths}_t^f}{\text{continuing}_t^f},$$

and this can be simplified slightly by expressing the increase in jobs in “inherited” continuing firms (continuing net) as the product of a growth rate (g^j) and the job stock:

$$g_t^j = \frac{\text{continuing_net}_{t-1}^j}{\text{continuing}_{t-1}^j}.$$

Now this can be rewritten adding some extra terms which, although adding to the complexity of the expression, ultimately assists in its simplification:

$$\frac{\text{continuing}_t^j}{\text{continuing}_t^f} = \frac{\text{continuing}_{t-1}^j}{\text{continuing}_{t-1}^f} \times \frac{\text{continuing}_{t-1}^f}{\text{continuing}_t^f} \times (1 + g_t^j) + \frac{\text{births}_{t-1}^j}{\text{births}_{t-1}^f} \times \frac{\text{births}_{t-1}^f}{\text{continuing}_t^f} \times \frac{\text{continuing}_{t-1}^f}{\text{continuing}_t^f} + \frac{\text{continuing_net}_{t-1}^j}{\text{continuing}_{t-1}^f} \times \frac{\text{continuing}_{t-1}^f}{\text{continuing}_t^f} - \frac{\text{deaths}_t^j}{\text{deaths}_t^f} \times \frac{\text{deaths}_t^f}{\text{continuing}_t^f} \times \frac{\text{continuing}_{t-1}^f}{\text{continuing}_t^f}. \quad (6)$$

To make the accounting relationship more transparent, additional terms need to be defined: the birth rate (β):

$$\beta_{t-1} = \frac{\text{births}_{t-1}^f}{\text{continuing}_{t-1}^f}$$

and the death (hazard) rate (δ):

$$\delta_t = \frac{\text{deaths}_t^f}{\text{continuing}_{t-1}^f}.$$

The denominator is continuing firms from the previous year because that is the population at risk of dying.

Using a jf superscript to denote the jobs per firm ratio, Equation (6) can be rewritten as:

$$\text{continuing}_t^{jf} = (\text{continuing}_{t-1}^{jf} \times (1 + g_t^j) + \beta_{t-1} \times \text{births}_{t-1}^{jf} - \delta_t \times \text{deaths}_t^{jf}) \times \frac{\text{continuing}_{t-1}^f}{\text{continuing}_t^f}.$$

The terms inside the parentheses have a reasonably straightforward interpretation. There is the job-per-firm ratio for “inherited” continuing firms, which is multiplied by their growth rate (i.e. expansions less contractions expressed as a growth rate), and the job-per-firm ratio for start-ups multiplied by the birth rate, less the job-per-firm ratio for firm deaths multiplied by the death rate. The first term captures adjustments at what is called, conventionally, the “intensive” margin – changes involving the continuing firms. The second pair of terms measures the contribution of adjustments at the “extensive” margin – births and deaths – with births making a positive contribution, and deaths a negative contribution to the change in jobs per firm.

Finally, there is the term which multiplies the expression in parentheses. This acts as a “revaluation”, or dimensional adjustment: all the terms inside the parentheses are measured relative to the period (t-1) stock of firms. The growth term provides the simplest example. The impact of net jobs in continuing firms on the current period’s jobs per firm requires them to be measured in units relative to the current period number of continuing firms (as in Equation (5)), not the continuing firms of the previous period. This ratio term captures that adjustment.

The facts of firm and job dynamics, 1998-2014

First of all the factors driving the evolution of the stocks of firms need to be accounted for, so this study’s analysis of the data starts with the components which determine the change in stocks: births and deaths (though, remember, it is the lagged value of births which affects continuing firms).

Births

Figure 4.1 displays the data on firm births (in thousands) and average jobs per firm at birth, with the GFC period highlighted here (and in the later plots) by a shaded region covering the four years between 2008 and 2012.¹² The data has been plotted on a split scale with firm numbers on the left hand axis and jobs per firm (jperf) on the right hand axis. Both series are plotted against a log scale, with the same (log) range on each axis, and with the same tick marks (0.2 log units), so the slopes of the two series – the rates of change over time – are comparable, and visual comparisons of their relative contributions to change are easier to make.¹³ The log scale is a particular advantage here, since the stock of jobs is the product of the stock of firms and the number of jobs per firm: so the log of the stock of jobs is the log of the stock of firms plus the log of average jobs per firm. Consequently, the two series can be visually “added” to arrive at the (log) of jobs.

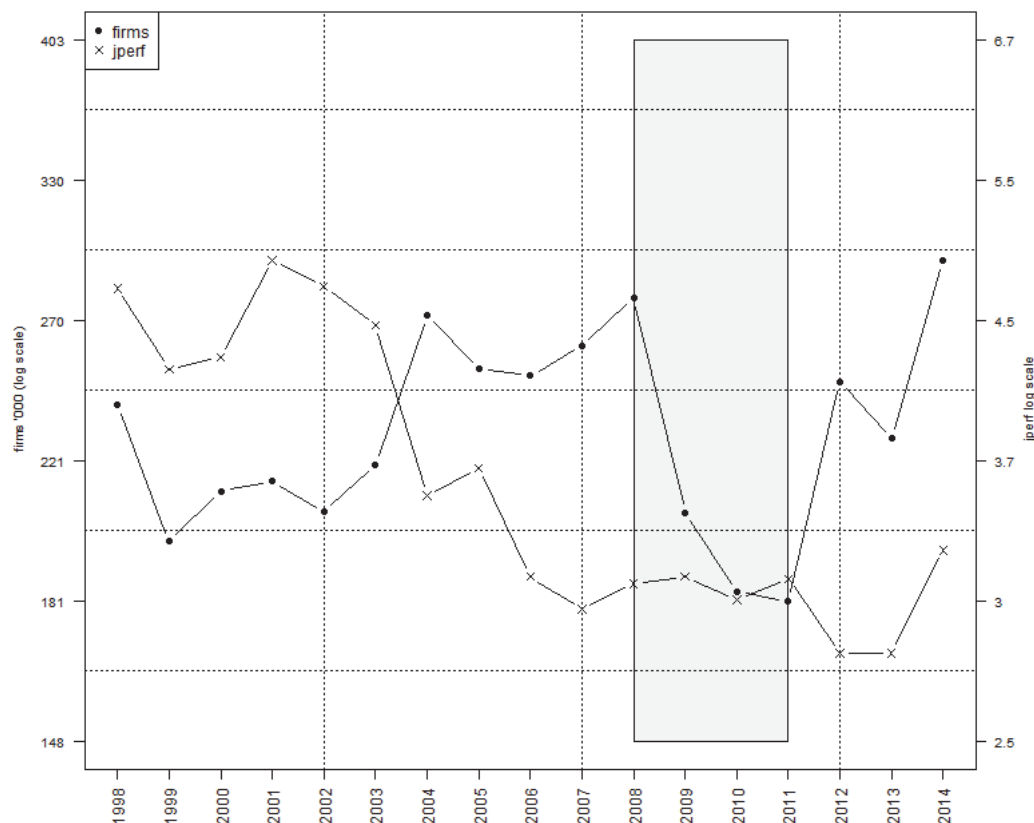
While there does seem to be a “middle” to the distribution of birth numbers over time – the whole period average is 230 000 – there are quite wide swings around that middle. First there is a dramatic 25% “surge” in firm births after 2003, the average 2004-08 is 50 000 larger than from 1998 to 2003. Second, after 2008, there is an equally dramatic “collapse” signalling the start of the GFC period, with the number of births dropping by 74 000, and the lower level persists for the next two years. Third, 2012, the first year of the recovery, recorded a 66 000 increase in births, an increase of roughly the same magnitude as the 2009 “collapse”. There was a slight setback in 2013, but in 2014 births exceeded the pre-GFC number.

By contrast, the pattern of change in jobs per firm is considerably less volatile. There is an early (1998 to 2003) period at a relatively stable low level, averaging about 4.5 jobs per firm, and a later relatively stable period (2007-13), averaging a significantly lower three jobs per firm.¹⁴ Overall, though, firms are born relatively small – about one-quarter of the all-firm average size – start-ups simply have not had time to grow. Most significantly for this study’s focus here, though, is that over the GFC period average birth size is almost entirely flat. There were many fewer births, but the average size of those firms that were born was the same (pre-GFC) figure.

From what could be seen of the pattern of change in the number of births and their average size, the evolution of jobs in start-ups could be inferred. But Figure 4.2, which records firm births and the numbers of jobs in start-ups, makes the conclusions easier to

see. Again, there is a split log scale with an equal log range and equally spaced (0.2 log units) tick marks and the range on the jobs axis has been chosen to emphasise the similarities between the two series over the GFC period.

Figure 4.1. **Births: firms (thousand) and jobs per firm (jperf)**

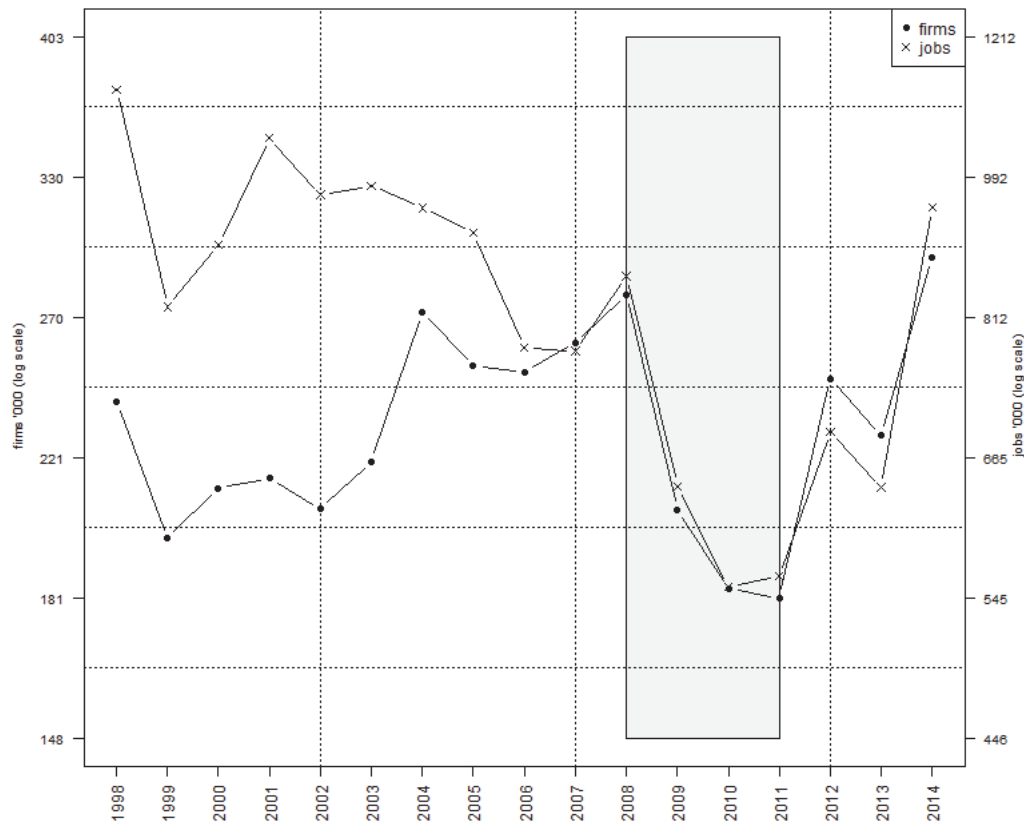


Note: The grey shading indicates the period following the global financial crisis.

Source: Authors' calculations.

Notice first, though, that there is little similarity between the path of births and the path of jobs between 2000 and 2006. Specifically, the “surge” in births is almost entirely offset by the drop in jobs per firm noted earlier, keeping the number of jobs relatively unchanged. However, from 2006 onwards the two series move in step, most dramatically during the GFC period and the subsequent recovery. Over the period 2008-14 the birth of firms is clearly driving the number of jobs in start-ups which might, of course, have been anticipated, given the relative constancy of average size noted earlier.

This conclusion, about the driving role of start-ups, is important because births and their associated jobs have two distinct channels of influence. First, in the year in which the birth takes place, the jobs feed into the stock/flow relation for the closing stock of firms and thus overall net job creation. Second, in the period following their birth, new-born firms become part of the stock of continuing firms and their jobs are added (as the stock/flow relation sets out) to the stock of continuing firm jobs. As shall be seen below the incorporation of births into the stock of continuing firms is a potent influence propagating the effects of the collapse in births at the beginning of the GFC period into the stock of jobs for years into the future.

Figure 4.2. **Births: firms and jobs (thousand)**

Note: The grey shading indicates the period following the global financial crisis.

Source: Authors' calculations.

Deaths

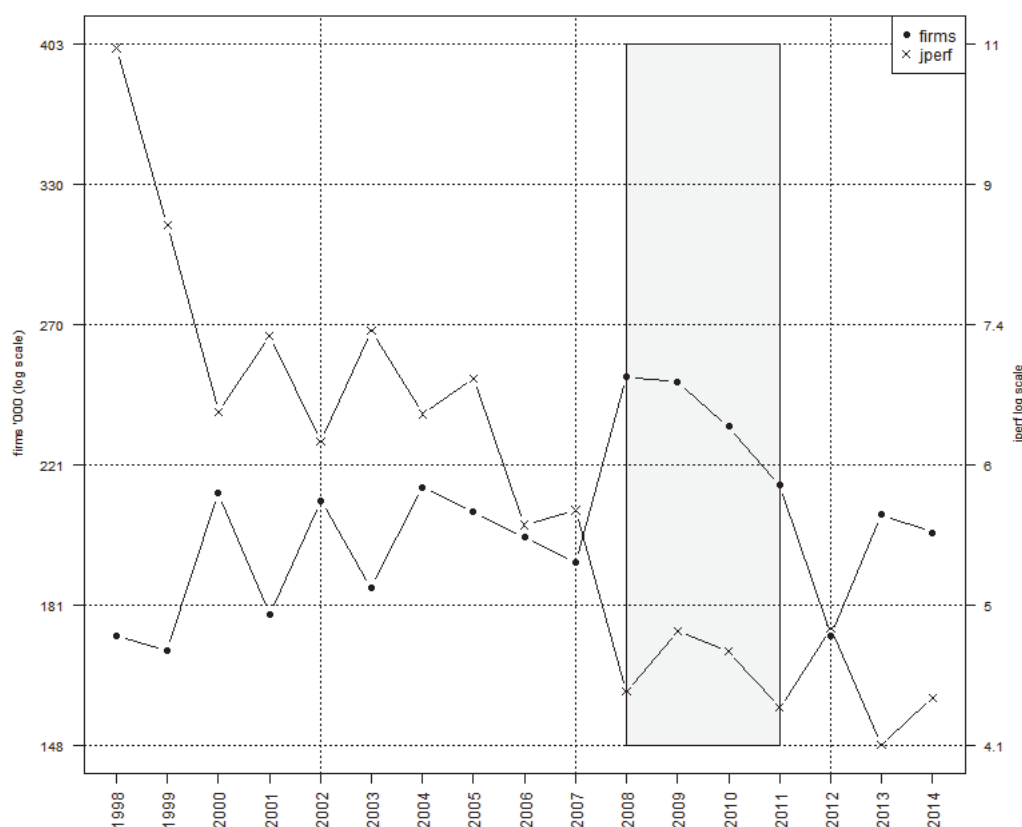
The plot of the number of deaths and the average size of firms at death are recorded on Figure 4.3. The plot has the (usual) split log scale, and the scale (not just the range) on the left hand (number of firms) axis has been chosen to match that of the corresponding births plot (Figure 4.1). However, although the range on the right hand (jobs per firm) axis also matches the comparable births range, the scale does not: dying firms are considerably larger than new-borns (they have had some time to grow).

The annual change in the number of deaths looks rather different to that of births. Specifically, and leaving aside the GFC period, there is rather more year-to-year variation, but within quite narrow bands – around 200 000 $\pm$ 10%. Although there is, as might have been anticipated, a “surge” in deaths around the GFC period, it appears to have started in 2008, the year before births dropped.¹⁵ By 2011 deaths were back within their pre-GFC range, however, during the three “surge” years deaths were about 250 000, so about 25% above the pre- and post-GFC average.

Like the number of deaths, the jobs per firm series for dying firms shows more year-to-year variation than does the corresponding series jobs per firm in births. However, leaving aside the extreme figure for 1998, and the year-to-year “sawtooth”,¹⁶ the pattern of change in jobs per firm displays a familiar pattern – an early period of stability, followed by a drop to a lower level, and a later period of stability. Here the early period average is close

to 7 (between 1998 and 2005), and in the later period (2008-14) the average is about 4.5. Again, as with births, average size seems to have been little affected by the GFC.

Figure 4.3. **Deaths: firms (thousand) and jobs per firm (jperf)**

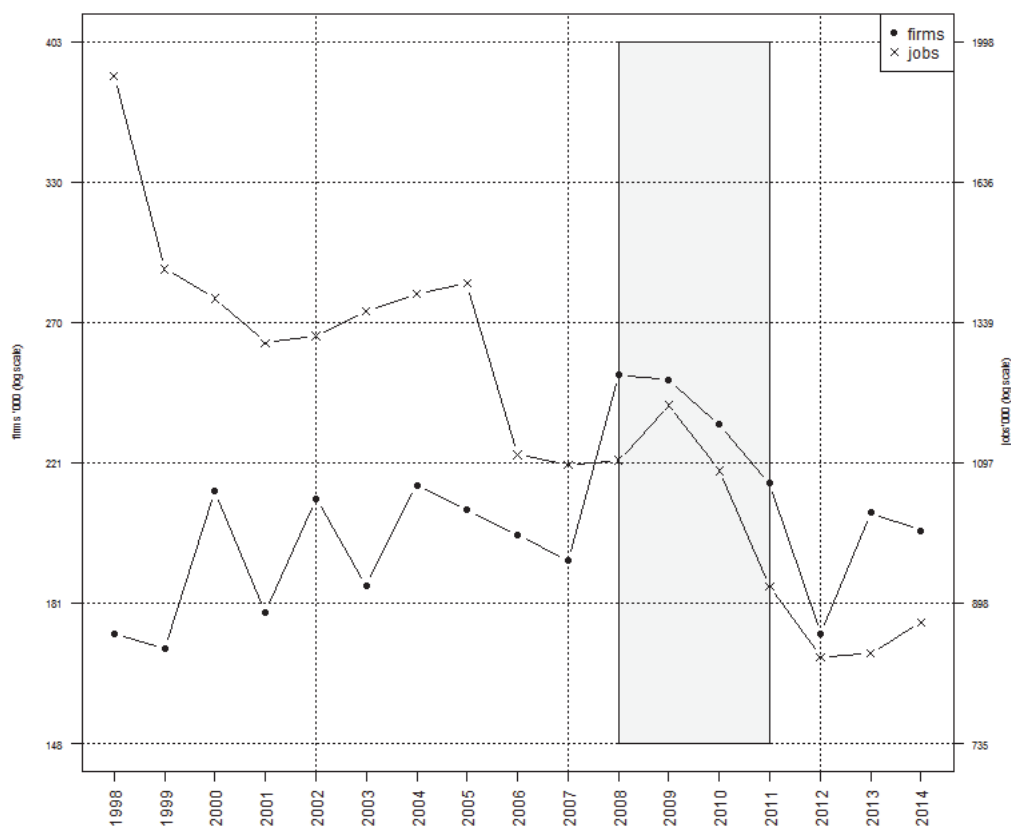


Note: The grey shading indicates the period following the global financial crisis.

Source: Authors' calculations.

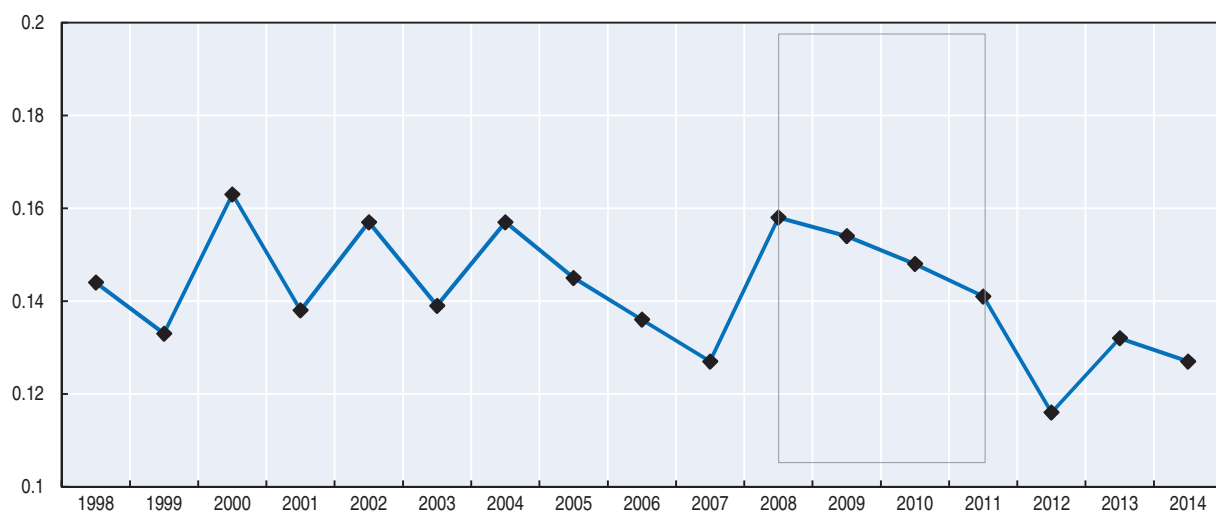
Because there is a noticeable negative correlation between deaths and the average size at death, the pattern of change in jobs lost through death (excluding 1998) is fairly flat up to 2005, as can be seen from Figure 4.4 (again constructed with split log scale and equal log distances between tick marks). From 1999 to 2005 it was around 1.4 million, until the drop in jobs per firm in 2006 when it fell to just over 1 million. Then, over the GFC period, job losses follow the rise, and then fall, in the number of firm deaths. Through the recovery the negative correlation between firms and jobs per firm seems to reassert itself. So with the number of firms in the pre-GFC range, but jobs per firm lower, job losses fell to a new, very much lower level, below 900 000.

An alternative measure for describing firm mortality is the hazard rate – the ratio of the number of firm deaths to the population at risk¹⁷ of dying, where the latter is the stock of continuing firms from the previous year plus last year's births – and the hazard rate has been plotted on Figure 4.5. While this rate also exhibits a sawtooth pattern, typically it fluctuates within quite a narrow band, between 0.13 and 0.16, right up to 2011, the end of the GFC period. There appears to be no evidence of exceptionally high mortality rates during the GFC period.

Figure 4.4. **Deaths: firms and jobs (thousand)**

Note: The grey shading indicates the period following the global financial crisis.

Source: Authors' calculations.

Figure 4.5. **Death ratio**

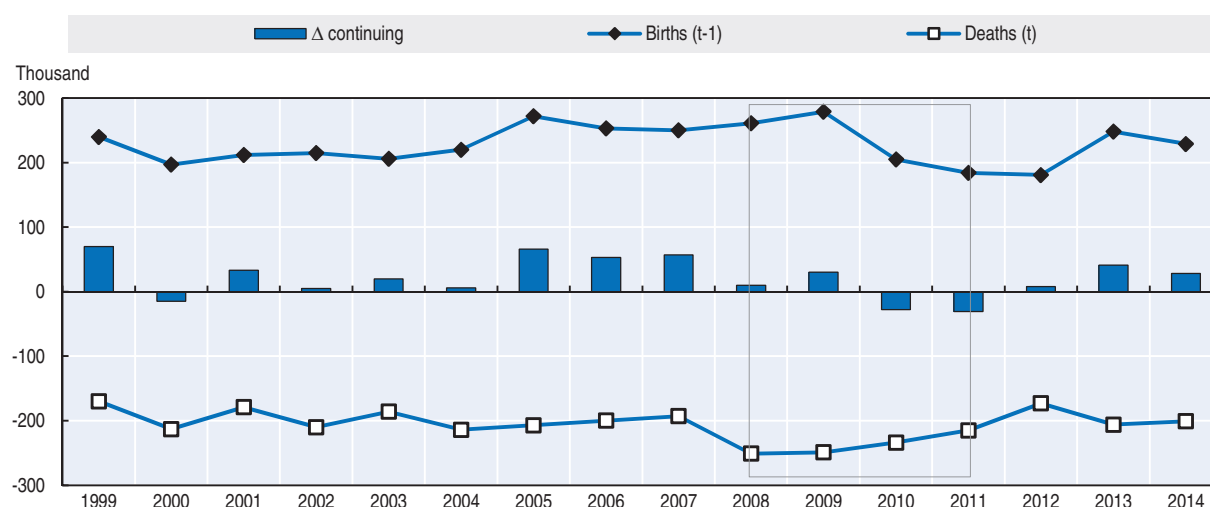
Note: The rectangle indicates the period following the global financial crisis.

Source: Authors' calculations.

Continuing firms

To fix ideas, this discussion of the stock of continuing firms starts with year-to-year changes. As Equation (2) has shown, the change in the number of continuing firms can be written as the sum of births in the previous period and deaths in the current period. Figure 4.6 displays the data: (previous period) births are at the top; deaths are plotted with a negative sign; and the bars in the middle are the sum of the two components – the change in the stock of continuing firms. As the discussion of births and deaths has yielded, both these series fluctuate between 150 000 and 250 000, while their difference is always in the range $\pm 50\,000$. The exceptional nature of the GFC period, at least of 2010 and 2011, is clear, with deaths exceeding (previous year) births and continuing firm numbers contracting by about 30 000 in each year (even though the hazard rate was not exceptionally high over this period).

Figure 4.6. **Contributions to change in continuing firm numbers**

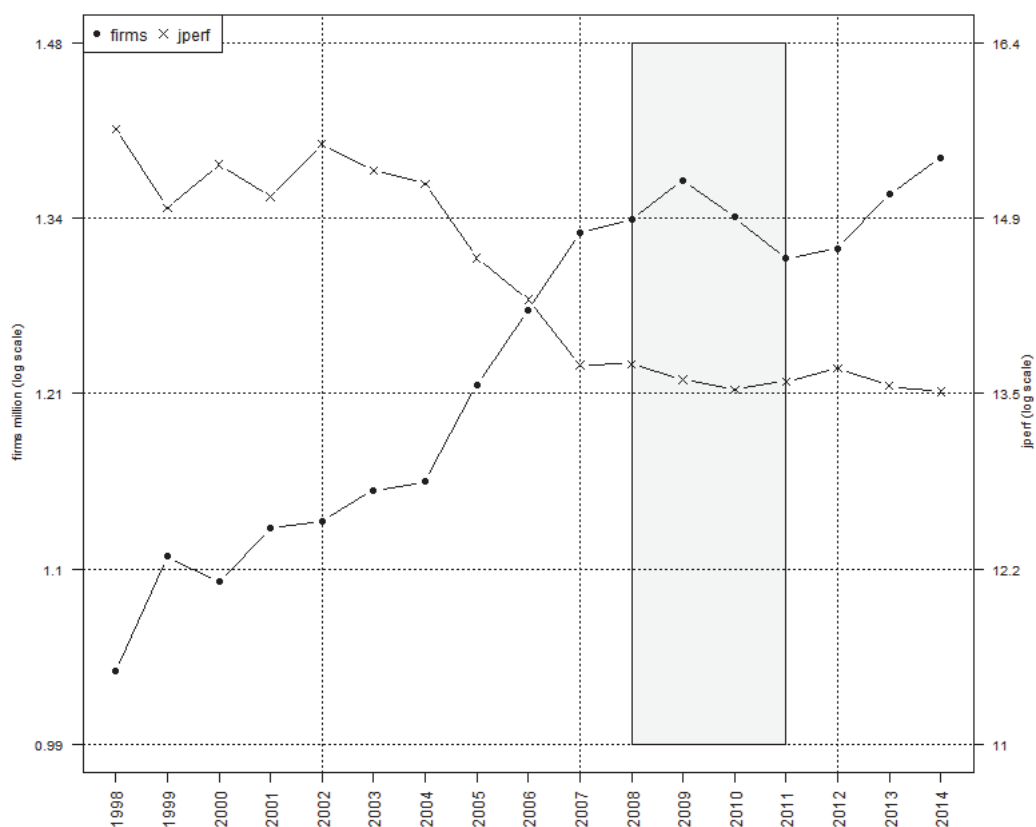


Note: The rectangle indicates the period following the global financial crisis.

Source: Authors' calculations.

Figure 4.7 displays the data on the stock of continuing firms together with the average number of jobs per firm. Again, the data has been plotted on split log scales with firm numbers on the left hand axis and jobs per firm on the right hand axis with the same (log) range on each axis and with the same tick marks (0.1 log units).¹⁸ From a starting point at around 1 million in 1998 the stock of firms rises steadily up to 2004, but at a relatively modest rate, after which it rises rather more steeply up to 1.35 million in 2009. Then it drops, a year after the onset of the GFC period. Although the log scale affects perception a little, the pattern of change depicted by the bars in Figure 4.6 can be seen here over the GFC period. Growth resumes after 2012, and by 2014 the stock of firms exceeded the 2009 level.

The other curve on the plot, average jobs per firm, shows (as it did for births), rather less year-to-year variation over most of the period than the numbers of firms (and remember the slopes of two series are in comparable units). Indeed, jobs per firm exhibits two periods of relative constancy: up to 2004 it averaged 15.3 jobs per firm, while in the second period of relative stability, between 2007 and 2014, it averaged 13.6 jobs per firm (in the intervening period of adjustment it declined quite smoothly). As with births, jobs per firm declined very little during the GFC period (a more precise account is given below).

Figure 4.7. **Continuing firms (million) and jobs per firm (jperf)**

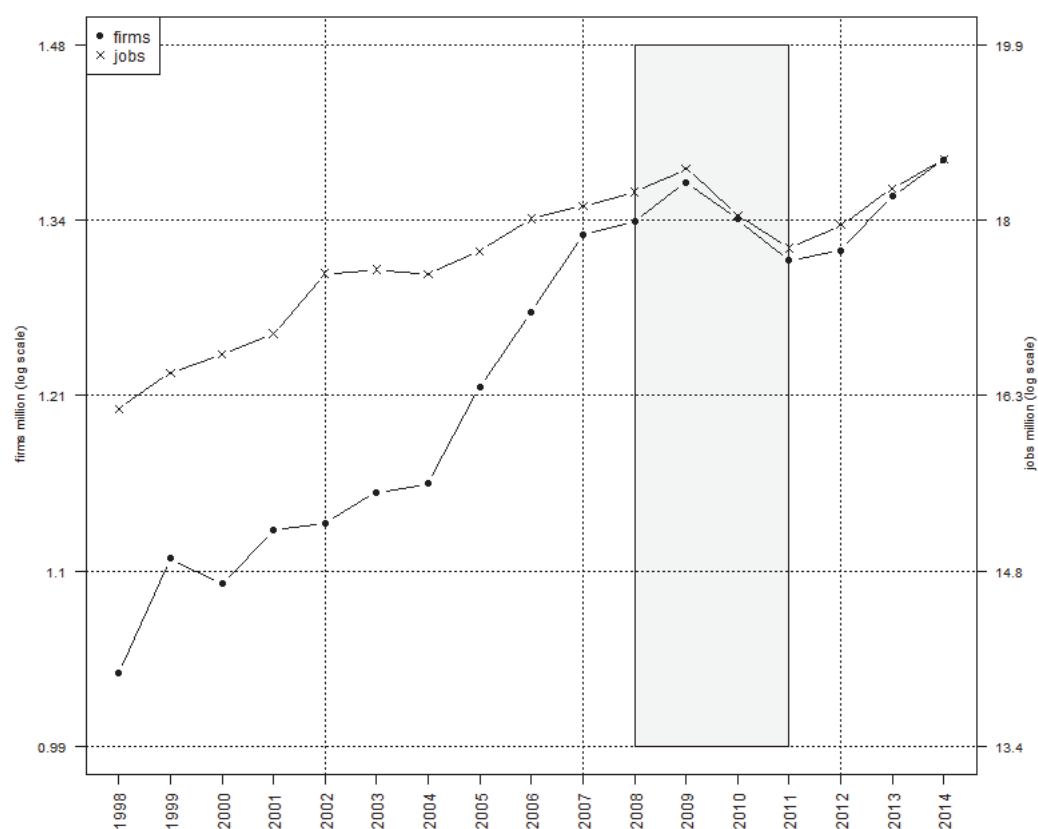
Note: The grey shading indicates the period following the global financial crisis.

Source: Authors' calculations.

Because the stock of firms has a rather striking time path, and jobs per firm varies relatively little, it is possible to “see” the trajectory of job numbers in the trajectory of firm numbers (remember the log of jobs is equal to the log of firms plus the log of jobs per firm). Figure 4.8 records data on jobs together with the number of firms and, to make the connection between firms and jobs easier to see, a split log scale has been used again (firms on the left, jobs on the right) with the same log range (but not scale) on each axis and tick marks 0.1 log units apart. The firms curve is simply reproduced from Figure 4.7, and this repetition serves to reinforce the clear difference in trajectory between firms and jobs. This follows, of course, from the downward slide in average jobs per firm between 2004 and 2007. The jobs curve has been placed on the plot so that it coincides as closely as possible with the firms curve during the GFC period. Clearly through the GFC “dip” and the subsequent recovery, job numbers follow the number of firms extraordinarily closely.

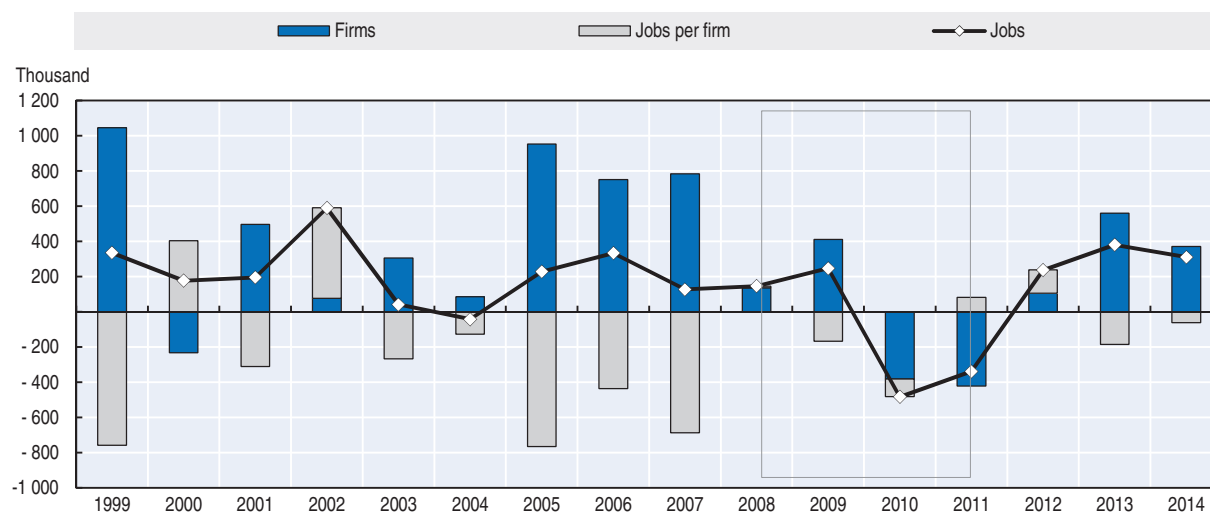
In fact it is possible to be quite precise about the relative importance of the contributions of changes in the stock of firms and in jobs per firm to (net) job creation. The bars on Figure 4.9 are the annual (weighted) change in the stock of continuing firms (dark) and the annual (weighted) change in jobs per firm (light).¹⁹ The sum of these two series is the change in the stock of jobs²⁰ which is recorded by the line which fluctuates around the middle of the plot.

The broad pattern of change in jobs per firm is known – fairly constant but with a major decline 2004-07 – while the stock of firms typically grew, particularly in 2004-07

Figure 4.8. **Continuing firms and jobs (million)**

Note: The grey shading indicates the period following the global financial crisis.

Source: Authors' calculations.

Figure 4.9. **Contributions to change in continuing firm jobs**

Note: The rectangle indicates the period following the global financial crisis.

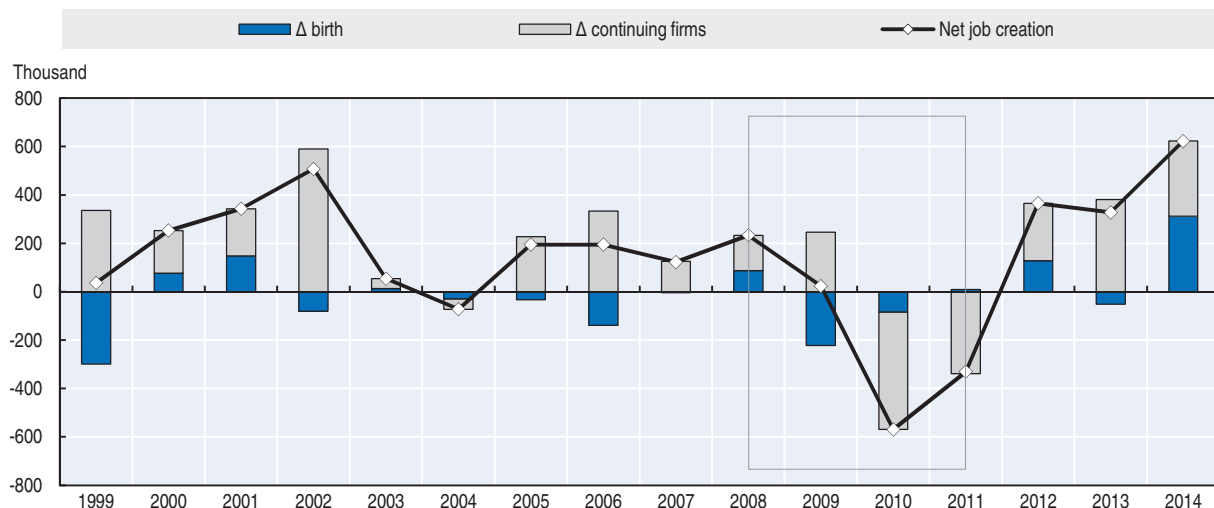
Source: Authors' calculations.

(when jobs per firm were in decline). It is also equally clear that the GFC period was quite exceptional, with an extraordinary decline in jobs driven almost entirely by an exceptional drop in firm numbers. So this plot confirms what had been inferred from Figure 4.8, that the “bite” out of jobs in 2010 and 2011 which stands out so clearly is driven by the corresponding “bite” out of the number of firms. Equally, it is the turnaround in firm numbers after 2011 (from negative to marginally positive) which drives the recovery in jobs. It becomes apparent that the contraction in the stock of firms contributed a job loss of around half a million a year in the GFC period and in the recovery phase the turnaround in firm numbers is proximately responsible for the 1 million new jobs.

Drawing the threads together

Figure 4.10 brings the analysis to a close with a display of the contributions to change in the overall stock of jobs (net jcr), which Equation (3) had shown to be the sum of the change in jobs in continuing firms plus the change in jobs in start-ups. Of course, many of the features of this plot are well-known from the earlier discussion of births and continuing firms. So, for example, the 2002 peak in net job creation, accounted for by a change in continuing firms, can be tracked back to a large change in average size in that year, as plotted on Figure 4.9 (going one step further back it is equally visible on Figure 4.7, where it appears as an uptick in the level of jobs per firm).

Figure 4.10. **Contributions of births and continuing firms to net job creation**



Note: The rectangle indicates the period following the global financial crisis.

Source: Authors' calculations.

Focusing on the GFC period, it can first be seen that net job creation in 2009 was shielded from the impact of the fall in births by the contribution of increased jobs in continuing firms. This increase, as Figure 4.6 (and indeed Figure 4.1) clearly show, was generated by a peak in births recorded in 2008. So job growth was slow in 2009 (but not negative) because of a “bulge” in newly minted continuing firms born in 2008. In 2010 the 2009 collapse in births fed into the stock of continuing firms and, with the average size unchanged, it translated into very largely negative net job creation. Again, in 2011, there is the delayed impact of a fall in births in the previous year (2011 births themselves were essentially unchanged from 2010). Although births did increase substantially in 2012, and this had some impact, the

improvement of continuing firms was more important and the effect here, as Figure 4.6 shows, is due to the 2012 slump in deaths. Once the recovery was under way, though, the increased numbers of births began to play an important role. Indeed in 2014, the increase in births, and the feedthrough of improved births in 2013 into continuing firms, were of roughly equal importance as contributors to net job creation.

Butcher and Bursnall (2013) seems to be the only other detailed recent study of job creation and destruction in the United Kingdom over the GFC period (they have little to say about the recovery, though, since their last data point is taken from the 2012 BSD). Comparison between this chapter's analysis and their work is complicated for a number of reasons. First of all there is a simple matter of dating, as noted earlier, they adopt the convention of referring to data from the BSD as using the BSD date less one year (so, for example, BSD 2009 data is labelled 2008). More substantially, their analysis uses workplace-level data rather than firm-level data (where a workplace is a production location, and firms may consist of a number of workplaces). Consequently, their approach – an application of the conventional “gross flows” framework – might be regarded as somewhat removed from this analysis. Nonetheless (and perhaps because most firms are in fact single workplace firms) this analysis does reach similar conclusions on one matter:

“The loss of employment in a downturn is sometimes seen to be due to closure of workplaces or lay-offs. In the current case, in two of the three years of low or no net job growth (2008, 2009 and 2010 [2009, 2010 and 2011 in this study's terms]) the main effect is a reduction in job creation through reduction in entry of workplaces.” Butcher and Bursnall (2013, p. F9) [dates added by this chapter's authors].

Even though this analysis approaches the issue rather differently – Butcher and Bursnall work directly with the fall in jobs generated by entry, whereas this study focuses on the fall in firm births – both approaches agree on the key role of births at the onset of the recession.

Some counterfactual calculations for the GFC period

A simple model

This section sets out the results of a very simple “what if” exercise. It works through the implications for jobs of a “counterfactual” where firm births did not collapse in 2009, but instead remained at their 2008 level. The effect of setting firm births in 2009, the first year of the GFC period, at their previous year's value, and thereafter at their actual historic values, is to simply postpone the onset of the GFC by one year and shorten the length of the GFC period by one year. Computing the difference between this analysis' counterfactual and the historical record yields a clearer view of the importance of start-ups in the GFC period.

To undertake this “what if” exercise this study's accounting framework is turned into a simple “model” by making some assumptions about which quantities might be treated as “given”, these take on their actual values or are subject to counterfactual manipulation, while the other variables are then endogenous and determined by the system of equations. Since, as shown above, the job-per-firm ratios for births, deaths and continuing firms ratios varied relatively little between 2008 and 2013, it seems plausible (as a first approximation) to assume that they appear unlikely to have made any “active” contribution to the contraction and the recovery which followed. Accordingly, to keep matters simple, average jobs per firm ratios are also taken as given, as well as the proportion of the stock of firms which dies during a year (δ). The number of births in 2009 is treated which, as seen, collapsed with the

onset of the GFC, as exogenous, setting it at its 2008 value in this study's counterfactual calculation. Clearly this is a very simple model. As can be seen it is only a handful of assumptions away from being a collection of accounting identities. Nevertheless, it does shed some interesting light on firm and job dynamics during the GFC period.

There are seven endogenous variables. Three are firm aggregates (superscript f): deaths, continuing firms and closing firms and these are determined by the relationships below,²¹ where a bar over a variable name indicates that it is either exogenous or given (and set at its observed value):

$$deaths_t^f = \bar{\delta}_t \times (\overline{continuing}_{t-1}^f + \overline{births}_{t-1}^f) \quad (7)$$

$$\overline{continuing}_t^f = \overline{continuing}_{t-1}^f - deaths_t^f + \overline{births}_{t-1}^f \quad (8)$$

$$\overline{closing}_t^f = \overline{continuing}_t^f + \overline{births}_t^f. \quad (9)$$

There are four job aggregates (superscript j): births, deaths, continuing and closing:

$$\overline{births}_t^j = \overline{births}_t^f \times \overline{births}_t^{jf} \quad (10)$$

$$\overline{deaths}_t^j = \overline{deaths}_t^f \times \overline{deaths}_t^{jf} \quad (11)$$

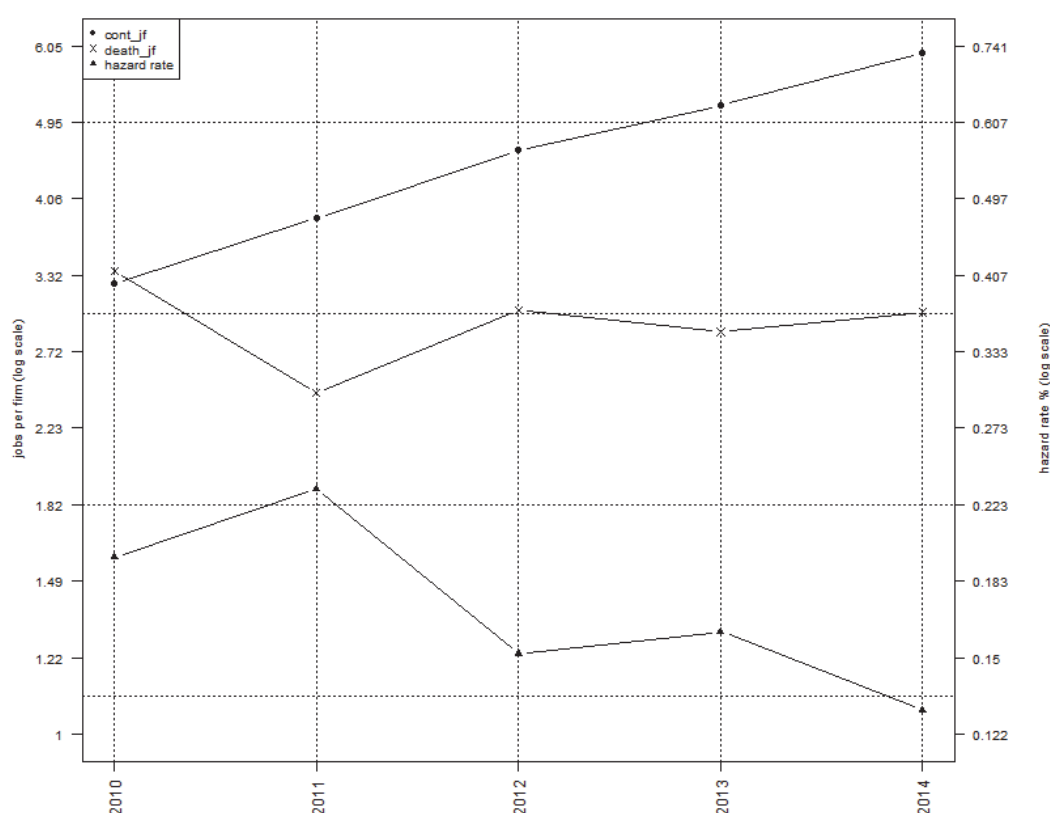
$$\overline{continuing}_t^j = \overline{continuing}_t^f \times \overline{continuing}_t^{jf} \quad (12)$$

$$\overline{closing}_t^j = \overline{continuing}_t^{jf} + \overline{births}_t^j. \quad (13)$$

Setting 2009 births to its 2008 value is equivalent to adding 74 000 to births in 2009, the number by which 2009 fell short of 2008. This analysis proposes to treat these firms (from a jobs-per-firm viewpoint) as if they were like the 205 000 firms actually born in 2009. Figure 4.1 showed that the average size of firms born in 2009 was about 3, so that is the figure that is fed into Equation (9) to generate the jobs associated with the extra births.

Moreover, Figure 4.3 showed that the average size of continuing firms in 2010 is around 13.5. However, firms born in 2009 do not “jump” from an average birth size of three to the average all-firm size around 13.5 in just one year. The actual path of average jobs per firm for firms born in 2009 is plotted on Figure 4.11 for the period 2010 to 2014.²² It can be seen that in 2010 the average size has grown a little larger than it was at birth. From 2010 it moves up slowly in succeeding years. Since the data has (again) been plotted against a log scale, the smooth curve can be interpreted as steady growth, and by 2014 average size has doubled.

This analysis applies the same logic in assigning “given” values to the average size of firms at death, and this series is also plotted on Figure 4.11. Although average size at death starts at about the same size as the firms that survive, the size at death series does not grow. This confirms a well-known characteristic of firm performance: firm deaths, particularly among relatively young firms, are concentrated among smaller firms.²³ The remaining curve on Figure 4.11 is also connected with firm death – it is a plot of the final “given”: the hazard (of death) rate. It is difficult to get a clear picture of the shape of this curve from just five observations, however there are two features it shares with the same curve for other cohorts. First, it rises from age 1 to age 2, and second, it falls thereafter, although the downward path can sometimes be a little “bumpy”. Needless to say, the presence of these age effects – here in average jobs per firm and the hazard rate – illustrate the need for cohort data in studies of firm performance, but that is an argument beyond this chapter's scope.

Figure 4.11. **Exogenous variables for counterfactual**

Source: Authors' calculations.

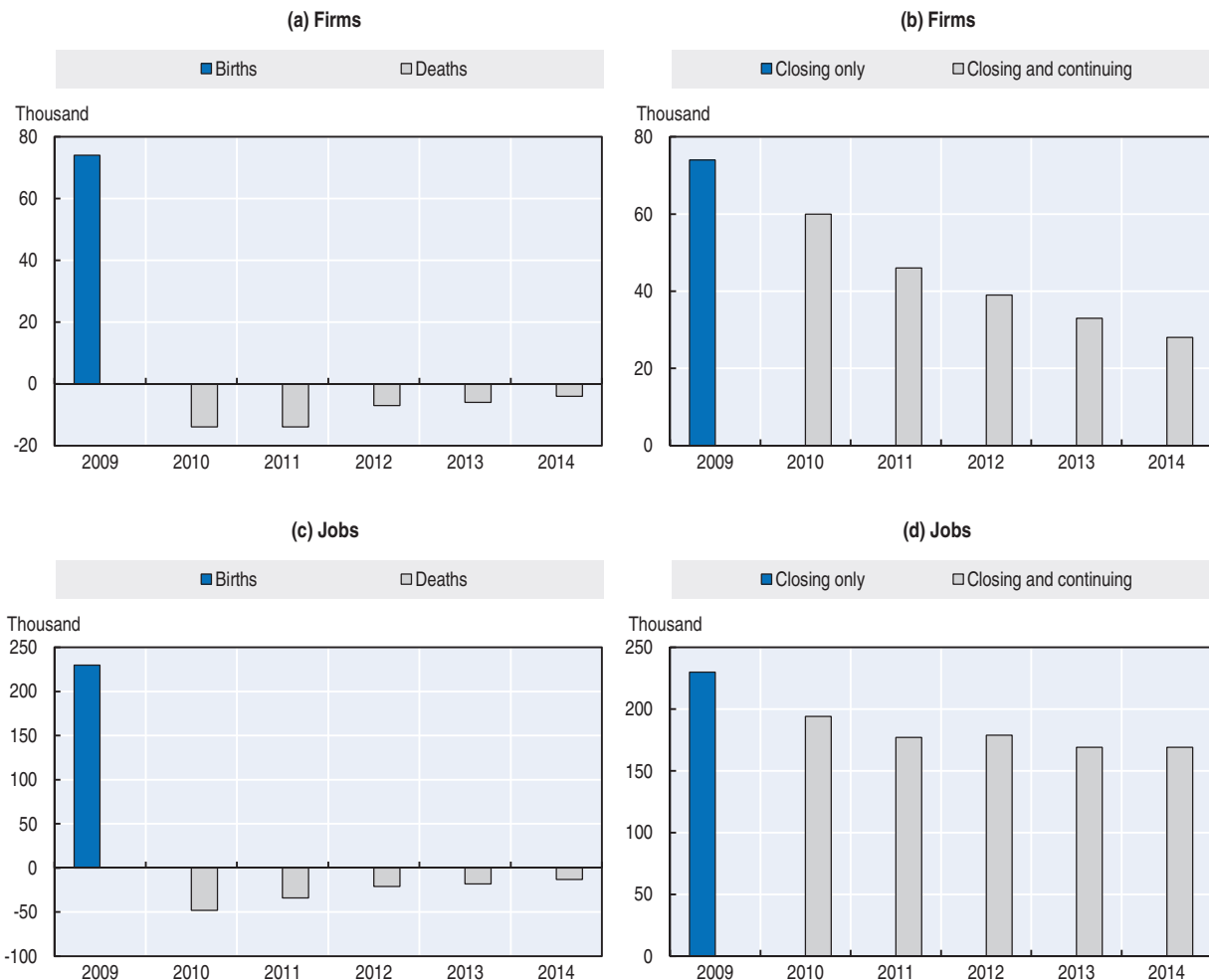
The results of the counterfactual

The results of this study's counterfactual calculations are summarised in Figure 4.12. The two panels in the top row refer to firms, the two panels in the bottom row to jobs. All the numbers are plotted as differences from their historical values: calculated less observed. The first bar in Panel (a) records births, and simply serves as a reminder of the size of the exogenous change that have been assumed: in 2008 births were 279 000, in 2009 they fell by about 25% to 205 000, a reduction of 74 000. So the 74 000 "extra" counterfactual births for 2009 appear on the plot. The "excess" births in 2009 produce (by definition) a matching increase in closing firm numbers in 2009, which are recorded on Panel (b). But of course there is no effect (again by definition) on continuing firm numbers in 2009, which depend on births in 2008. By assumption births in 2010 return to their observed value and so the birth plot records excess births of zero for all following years. Now the "excess" births of 2009 feed through to increase continuing firm numbers in 2010 (as those births are "re-labelled") but the increase falls slightly short of 74 000 because, as shown, and can be seen from Panel (a), some deaths have occurred and these are recorded as negative numbers. In fact, 14 000 firms have died, so the "excess" continuing firm figure is 60 000 (= 74 000-14 000). And, of course, with "excess" births now equal to zero, the "excess" closing firms figure is also 60 000.

Moving backward and forward between Panel (a) and Panel (b), the process of change in subsequent years can be traced. With no new "excess" births, it can be seen that the numbers of continuing (and closing) firms continue to decline as deaths reduce the "excess" from 2009, year by year. However, because deaths are a proportion (albeit declining after 2011) of

the previous year's closing firms, "excess" deaths decline too. The process of adjustment is quite slow, and by 2014 there are still 28 000 "excess" firms: about one-third of the "excess" births are still alive. Evidently a fall in births like that observed in 2009 has not just a large immediate impact on the stock of firms, but it has an impact which persists for many years.

Figure 4.12. **Counterfactual results, jobs and firms**



Source: Authors' calculations.

This analysis takes a very simple approach to translating firm numbers into job numbers. Using the observed average size at birth of 3.11, the "excess" births produce 230 000 "excess" jobs in that year. For obvious reasons then, there is a very close relationship between the plots of firm numbers in the first row of Figure 4.12 and the corresponding plots of job numbers in the second row. Although continuing firms are marginally larger in 2010 than they were at birth, the number of continuing firms is slightly smaller because 14 000 firms have died. So 230 000 jobs at birth become 194 000 jobs at age 1 in 2010. This study showed that the stock of continuing firms will continue to shrink but, the effect of death on the number of jobs depends on the balance between the growth in the average size of survivors and the (essentially constant) size of the firms which die. As a consequence, the path of "excess" jobs in continuing (and closing) firms can be a little bumpy. This analysis showed that in 2014 there were still 28 000 "excess" firms and between them these firms account for 169 000 jobs.

It is important to emphasise that this study's counterfactual calculations are not intended to imply that there was an alternative path available to the United Kingdom which would have mitigated the effect of the collapse of firm births. This study has presented no evidence to suggest that firm births are manipulable by policy makers. While it may be reasonable to assume that firm births are endogenous at the macroeconomic level, it seems equally reasonable to suppose that they are determined by all the factors – international and national, policy choices and random shocks – which determine macroeconomic performance more generally. However, unless there is some particular reason to believe that some unrecognised feedback loop is operating (at the aggregate level) during the GFC period which connected the stock of continuing firms in year t to births in year $t + 1$, then this study's calculations can provide a rough guide to the implications of the extraordinary fall in births which occurred in 2009 (and was sustained until 2011).

What have we learned?

This chapter has shown how a shift in perspective – focusing on firm stocks rather than job flows – provides a more coherent, and slightly different, account of firm and job dynamics in the United Kingdom over the period since 1998. This change of perspective does have a cost, annual gross flows – expansions and contractions of continuing firms – disappear from view, to be replaced by a summary statistic: jobs per firm. Of course the value of this approach depends on its usefulness, which depends in turn on the questions to be answered: in this case a narrative account of recession and recovery. So this discussion of the United Kingdom data was organised around the simple idea that the stock of jobs can be written as the stock of firms multiplied by average jobs per firm. This analysis applied this simple idea to births, deaths and to the stock of continuing firms and found, in each case, that average jobs per firm varied relatively slowly (and in much the same way in all three cases). By implication then, at least over the last decade and a half in the United Kingdom, variation in the number of firms (being born, dying or continuing) appeared to play a more active role in driving variation in job creation than did variations in the average size of continuing firms.

A narrow focus on the GFC period yields that its onset was signalled by the collapse in firm births in 2009 (the number of firm deaths had moved up sharply the year before, but had been offset by record births). Births stayed at this depressed level (indeed, they fell a little further) in 2010 but the principal depressing effect on firm numbers had by then become the decline in the number of continuing firm. The previous year's drop in births had fed through, and deaths remained roughly unchanged. Continuing firm numbers fell again in 2011: the previous year's births were low and deaths unchanged. In 2012 the turnaround began. First of all deaths fell substantially and consequently continuing firm numbers stabilised; second, birth numbers recovered sharply, almost back to pre-GFC levels. In 2013 the recovery of continuing firm numbers got under way as 2012 births fed through. By 2014 births, deaths and the stock of continuing firms had recovered to pre-GFC values. The time path of jobs over the recession and recovery followed the time path of firms quite closely because in neither the recession nor the recovery phases were there very large adjustments in the average number of jobs per firm. To be sure, the rate of growth of jobs per firm in continuing firms was relatively depressed during the downswing (it even turned negative in 2010) and recovered during the upswing, but compared to fluctuations in firm numbers these swings were of relatively little importance.

This chapter stipulates that policy makers can learn something from the analysis presented here, but not because it has immediate implications for the choice of policy instruments. Rather it provides a framework of ideas within which policies can be designed, understood and, subsequently, evaluated. Even though this study does not argue that the overall number of start-ups is manipulable (or should be manipulated), it does contend that a firm grasp of the message that “today’s start-ups are tomorrow’s continuing firms” may suggest that there may be a case for considering interventions which improve firms’ chances of survival and their prospects for growth.²⁴

Notes

1. There is an earlier tradition using a similar framework, referred to as the “components of change analysis”, a sub-field of industrial geography. The work of Birch (1979) (and the work he inspired) provides a bridge between the older and newer literatures.
2. There are two inter-related strands: one concerned mainly with labour market fluctuations (see Davis et al. [2006] for a summary); the other with the effect of regulation on labour market flexibility and the links with productivity (see Haltiwanger, Stefano and Schweiger [2014] for a recent, widely cited, example).
3. A related paper investigates the argument using an extended model applied to a longer run of data, see Sedláček and Sterk (2016).
4. The terms “start-up” and “firm births” are used interchangeably.
5. For a full, official, account of the Business Structure Database and its compilation, see Evans and Welpton (2009).
6. Since an employee can work for more than one firm, summing over firms produces an estimate of jobs rather than employment. This distinction is ignored here and the terms “employment” and “jobs” are used interchangeably.
7. The database which underpins this study – the Longitudinal Business Structure Database – can be accessed by approved researchers through the ONS Virtual Microdata Laboratory or the United Kingdom Data Service Secure Lab.
8. The United Kingdom version of the EU NACE rev.1.
9. Others have made different choices: Butcher and Bursnall for example, use the year prior to the snapshot, so they refer to the March 2014 snapshot as 2013 data.
10. It is a by-product of using a data collected for administrative purposes as a resource for research.
11. Since some of these start-ups might die in their birth year, strictly speaking, it is net start-ups from the previous period.
12. It is worth remembering, though, that there is an important caveat attached to these dates, see the second section above.
13. There is an arithmetic relationship between the change in the logarithm of a pair of numbers and the rate of growth. If g is the rate of growth of X between t and $t-1$,

$$\frac{X_t}{X_{t-1}} \equiv (1+g)$$

$$\Delta \ln(X_t) \equiv \ln(1+g),$$

then using the first term in a Taylor’s series expansion for $\ln(1+g)$,

$$\Delta \ln(X_t) \approx g.$$

14. The change in jobs per firm is associated with a shift at the “small” end of the firm size distribution: between 2003 and 2004, the share of firms born with less than five employees increased by two percentage points, and that increase, in turn, largely reflected an increase in single job firms.
15. Again, it is worth emphasising that this study’s data has its origins in a live register and so the precise dates assigned to births and deaths may depend, to some extent, on the organisation and timing of administrative procedures recording births and deaths.

16. The 1998 figure may be an artefact. The first year of data is 1997 and 1998 is the first year for which deaths can be identified, so it is possible that amongst the 1.2 million firms recorded in 1997 there were in fact a proportion – possibly as many as 200 000 – which were, in fact, already dead. Equally, the “sawtooth” may also be an artefact. Since this study’s data derives from an administrative source and (e.g. for revenue-related reasons) there may be more concern with capturing newborns than with “killing off” firms which are no longer alive. Indeed, current practice allows firms to remain on the business register for a number of years after which they have become “inactive”, an administrative practice for which this analysis has tried to adjust.
17. The term “population at risk” is used as an alternative, but equivalent term, to the term “risk set”: “The set of individuals for which the event of interest has not happened before a given time t , and who have not been censored before time t , is termed the risk set at time t .” (Aalen, Ornulf and Gjessing, 2008, p. 4).
18. The log range is half that for births because continuing firms and their average size show relatively less variation.
19. This “contributions” plot in log points could have been constructed directly from the slopes of Figures 4.7 and 4.8, but it seemed preferable to report the changes in natural numbers.
20. There is in fact a third “interaction” term – the product of the change in the stock of firms and the change in jobs per firm. This is a second order term and typically small, and although it is not plotted separately, it is included in the change in jobs. The computation underpinning the plot involves the expression for the first difference of a product:

$$jobs_t = firms_t \times jperf_t,$$
 taking first differences:

$$\Delta jobs_t = \Delta firms_t \times jperf_t + firms_t \times \Delta jperf_t - \Delta firms_t \times \Delta jperf_t.$$
 The “double Δ ” term does not appear on the plot.
21. There also two “auxiliary” equations which feed the current values of births and continuing firms from one period to their lagged values in the following period.
22. Since only births differ from “history” in 2009, this study’s other “given” variables only affect the outcome from 2010 onwards.
23. For a discussion of size effects on survival in a cohort of UK firms, see Anyadike-Danes and Hart (2015).
24. For an illustration of how evidence on the age and size dependence of firm performance might inform policy design see Anyadike-Danes (2015).

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Chapter 5

Cyclical labour market adjustment in New Zealand: The response of firms to the global financial crisis and its implications for workers

by

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This chapter examines the dynamics of employment adjustment in New Zealand, focusing on the response of firms to the 2008-09 global financial crisis (GFC). New Zealand's Longitudinal Business Database is used to examine firms' employment responses to output shocks before and after the crisis, and to investigate variations in job and worker flows. The analysis of business microdata uncovers two key features of New Zealand labour market adjustment to the GFC. First, there was considerable heterogeneity across firms, both before and after the crisis, in the size of output shocks that firms faced, the amount of employment adjustment in response to any given output shock, and in the size of worker flows given the firm's employment adjustment. Second, the crisis not only moved the distribution of output shocks faced by firms, but also altered the relationship between output shocks and changes in job and worker flows and employment.

Access to the data used in this study was provided by Statistics New Zealand in accordance with security and confidentiality provisions of the Statistics Act 1975 and the Tax Administration Act 1994. The results in this chapter have been confidentialised to protect individual businesses from identification. See an earlier version of this work, Fabling and Maré (2012), for the full disclaimer.

Introduction

This chapter examines the dynamics of employment adjustment in New Zealand, focusing on the response of firms to the 2008-09 global financial crisis. It uses data from Statistics New Zealand's Longitudinal Business Database (LBD) to examine firms' employment responses to output shocks before and after the crisis, and to investigate variations in job and worker flows. This chapter's analysis of firm micro-data highlights two key features of New Zealand labour market adjustment to the 2008-09 crisis. First, there was considerable heterogeneity across firms both before and after the crisis, in the size of output shocks that firms faced, the amount of employment adjustment in response to any given output shock, and in the size of worker flows given the firm's employment adjustment. Second, the crisis not only moved the distribution of output shocks faced by firms, but also altered the relationship between output shocks and changes in job and worker flows and employment.

This study discusses the resilience of the New Zealand labour market to economic shocks, and the possible role of labour market policy settings. A resilient labour market is one that can recover from adverse shocks with minimum disruption in the form of long-term unemployment. The labour market features that promote resilience will depend on the nature of labour market shocks. For a labour market that experiences only cyclical shocks, resilience is achieved by some form of smoothing across the cycle. This may take many forms, such as long-term contracts (with countercyclical productivity/labour hoarding; pro-cyclical wages), unemployment insurance and benefits, or active labour market policies. The degree of cyclical flexibility may be reflected in cyclicalities of employment, hours, wages, profits, and productivity. The mix of institutions and policies to achieve this smoothing will also affect the sharing of the costs of cyclical downturns. Optimally, smoothing should be greater for more risk-averse groups.

A labour market that is resilient to cyclical shocks may be ill-suited to shocks that require a reallocation of employment across industries, occupations, or regions. In order to respond effectively to such shocks, labour market institutions and policies that facilitate retraining, job turnover and reallocation, and geographic and industry mobility are needed.

The next section of the chapter discusses the nature of labour market resilience and what can be learned from the analysis of labour market flows. This is followed by a summary of recent cyclical variation in New Zealand, paying particular attention to developments since the onset of the global financial crisis (GFC). After describing the data in the fourth section, the microeconomic sources of aggregate employment and earnings fluctuations is analysed (fifth section of this chapter) and patterns of adjustment conditional on output shocks faced by firms, or on net employment change within firms. The chapter concludes with a summary of the main findings and a discussion of their implications.

Labour market resilience

Recessions impose costs. Reductions in labour demand lead to reductions in wages or employment, or to lowered productivity and profitability. Fluctuations in earnings make risk-averse workers worse off. Firms, especially small and young firms, may also be risk-averse due to their limited ability to absorb sustained losses.

Labour market institutions promote resilience by spreading the costs of labour demand fluctuations and by facilitating a rapid recovery of employment and earnings when labour demand expands. Faced with purely cyclical variation in labour demand, workers and firms have an incentive to maintain their employment relationship during downturns, to avoid hiring, firing and retraining costs, and to smooth incomes. Risk-averse workers would accept lower average wages over the cycle in exchange for a smoother earnings path, making stable employment attractive to employers as well. The absence of a complete insurance market to cover income risks leaves a demand for income smoothing through employment contracts. Such an arrangement of “job-based insurance” may, however, break down in unexpectedly severe downturns when it becomes too costly (relative to turnover costs) to continue the employment relationship. It also breaks down if labour demand fluctuations are characterised by a process of creative destruction, and require a reallocation of capital and labour between firms or industries. In this case, a resilient labour market should facilitate rapid and low-cost transitions that do not impose unnecessary costs, delays or income fluctuations. In practice, there is an inevitable tension between providing stability and flexibility.

In recent years, the European Commission has advanced the Danish notion of flexicurity to characterise the balance that needs to be struck between flexibility of adjustment and security of income and employment (European Commission, 2010). Their approach emphasises the need for flexibility in the labour market, together with income support policies to smooth incomes, and active labour market and training policies to aid reallocation. In a dynamic and changing economy, *de facto* (social) insurance is provided through the tax system rather than through employment contracts. The Danish, and more generally European, labour institutions reflect a combination of relatively generous provisions supported by relatively high tax rates.

In New Zealand, labour market policies are directed more towards fostering flexibility and maintaining work incentives than in many other countries. In 2008, New Zealand had one of the lightest systems of employment protection in the OECD (Venn, 2009), despite modest increases in protections as part of the 2000 Employment Relations Act (ERA). In 2009, protections were reduced by allowing a 90-day trial period for employees in firms with 19 or fewer employees, during which time employers could dismiss an employee without the employee being able to take a personal grievance for reasons of unjustified dismissal. From April 2011, all employers were eligible to use such trial periods. Despite the internationally low level of employment protection, most employees are covered by protections against unjustified dismissal that make dismissing workers a costly and potentially lengthy process, putting downward pressure on job destruction rates.

The majority of employees have their terms and conditions governed by individual contracts with employers. The prevalence of collective bargaining in New Zealand declined markedly in the 1990s, following significant legislative reforms (the Employment Contract Act, 1991). Private sector collective bargaining coverage dropped from 48% of employment in 1990 to 21% in 2000 (Foster et al., 2011). Despite legislative change in 2000 (ERA) that explicitly promoted collective bargaining and facilitated union membership growth

(Rasmussen, 2009), private sector collective bargaining coverage has remained at about 10% since 2004. Economy-wide union membership declined from 43% in 1991 to 21% in 2000 and has remained at that level since.

New Zealand has less extensive active labour market policies than European countries and has income support policies that emphasise in-work benefits, with only moderate replacement rates for unemployment benefits, providing limited scope for income smoothing. New Zealand also has relatively light regulatory controls, making it the easiest country in the world to start a new business and one of the easiest in which to do business (World Bank and IFC, 2012). Therefore firm entry and exit might be expected to play a relatively strong role in New Zealand's employment dynamics.

What can be learned from job and worker flows?

There is a well-established literature examining differences in job and worker flows across the business cycle, following the seminal American work of Davis and Haltiwanger (1992). A key insight from this literature is that job and worker flow rates are large compared with net employment changes, reflecting an ongoing dynamic process of reallocation of jobs and workers. In the United States, Canada and the United Kingdom, job reallocation, and job destruction in particular, are higher in downturns. Recessions can be seen as periods of heightened “creative destruction” in which new innovative firms replace less productive existing firms (Schumpeter, 1947). In European countries, job reallocation rates are less cyclical, and somewhat lower, than in the United States.

In trying to account for cross-country differences in unemployment and job flows, a key focus has been on the role of different labour institutions and policies.¹ Employment protection serves to raise firing costs, lowering job destruction rates and, in equilibrium, job creation rates, as employers are more cautious about hiring. By lowering the speed of job reallocation, employment protection can also slow the speed of adjustment to a new equilibrium, even though the impact on equilibrium employment and unemployment is ambiguous. (Nickell, 1978; Bertola, 1990; Bentolila and Bertola, 1990). Differences in firing costs can thus contribute to different patterns of cyclical adjustment, including the sort of cross-country differences in the cyclicity of job destruction noted above (Garibaldi, 1998).

The impact of unemployment benefit generosity is less clear cut. Lower replacement rates increase job search intensity and lower reservation wages, leading to higher equilibrium employment and lower equilibrium unemployment. With a lower reservation wage, some workers will accept lower quality matches. As a result, the rate of job-to-job flows may increase as workers try to improve the match. The low reservation wage may also discourage the creation of higher productivity but more risky jobs, with an adverse impact on employment levels.²

Drawing on these insights, New Zealand's system of relatively light employment protections, low unemployment benefit levels, and ease of firm entry suggest that New Zealand will have relatively high firm, job, and worker flow rates that are responsive to cyclical demand fluctuations.

A high rate of firm births and deaths is expected as a consequence of the ease of firm entry, which lowers the productivity hurdle that new firms must overcome. There will therefore be a larger pool of young, low-productivity firms that are vulnerable to going out of business when faced with an unanticipated reduction in demand. With a low hurdle, firm birth rates will be stronger when demand growth resumes.

Job flows will be high due to the relatively light employment protection. The high flows facilitate the reallocation of jobs, improving the speed with which the labour market is able to reach a new equilibrium and recover from a downturn.

High worker flows are expected as a consequence of low benefit levels and the consequently greater prevalence of on-the-job search. However, a pronounced decline in worker flows during recessions might be expected. During a downturn, workers will prefer to remain employed rather than become unemployed, leading to a drop in quit rates and possibly greater reliance on hour adjustment and wage flexibility. Hiring rates will also drop as positions remain filled by existing workers. Young workers entering the labour market for the first time and workers in high turnover industries may be at a particular disadvantage due to the cyclical decline in worker flows. Workers whose jobs do end involuntarily during a recession are at risk of a decline in earnings, as a consequence of their low reservation wages.

Recent cyclical variation in New Zealand

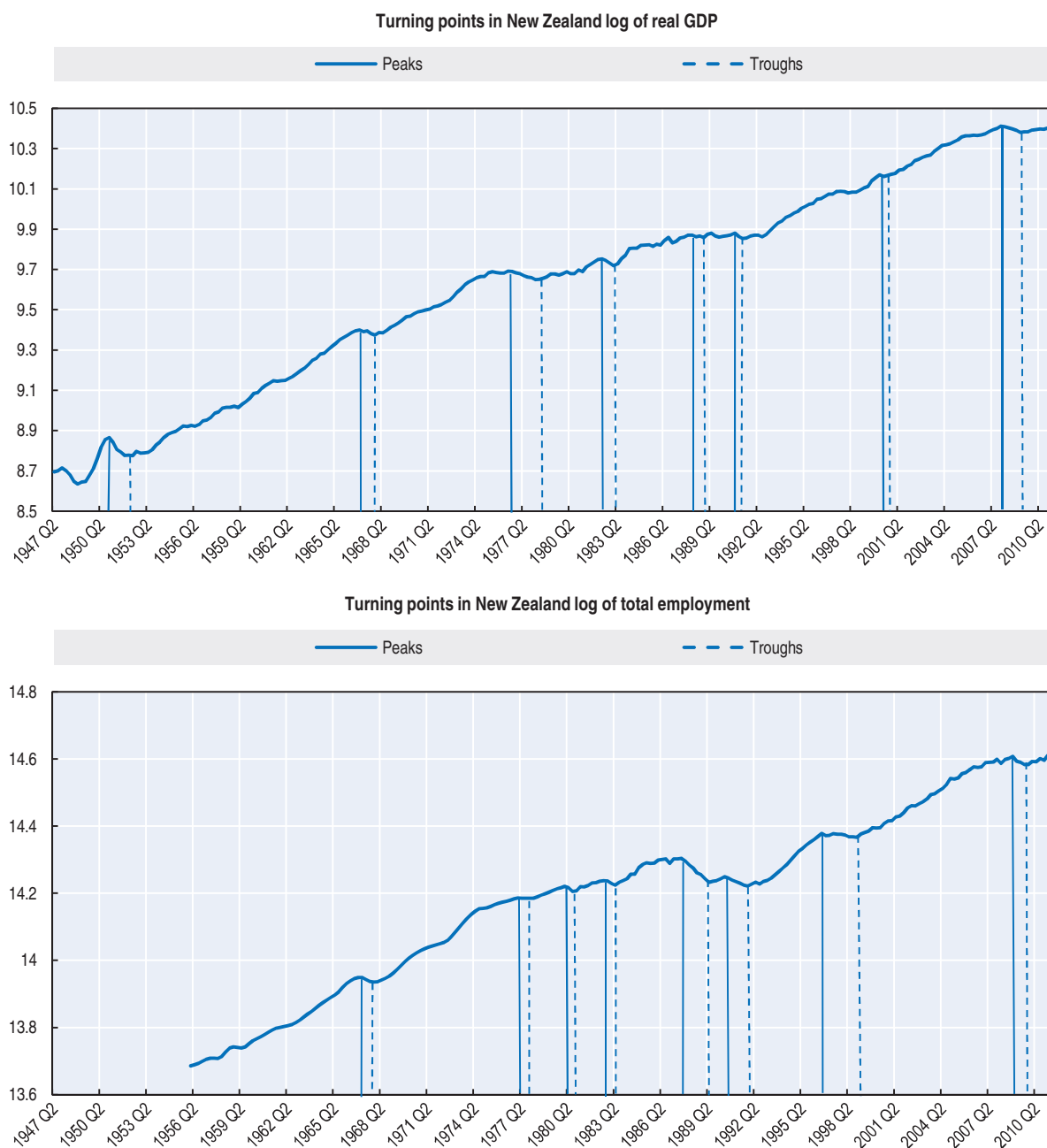
Prior to the GFC, New Zealand had experienced a prolonged period of growth. Leading up to the business cycle peak of 2007 Q4, output had been increasing for almost ten years, since 1998 Q1. This was the longest upswing in New Zealand since 1966, although the rate of growth had been slowing since 2005, reflecting a decline in activity in the tradable sector. Growth was starting to pick up again in 2007, until the economy went into recession in the first quarter of 2008, reflecting not only the onset of the GFC, but also the effects of an overdue cooling of the housing market. The contraction was sharp and its effects were widespread. Output had dropped by 3.1% by the first quarter of 2009 and there were steep declines in business and consumer confidence, retail sales, and investment. Growth stalled in the non-tradable sector, while tradable activity declined.

In comparison with other OECD countries, the recession in New Zealand was relatively mild – no doubt buoyed by the fact that in Australia, New Zealand's largest trading partner, gross domestic product (GDP) declined in only one quarter (2008 Q4). In New Zealand, aggregate growth resumed weakly in the second quarter of 2009, and real GDP was still marginally below its 2007 Q4 level in the first quarter of 2011.

The recession had a clear impact on the New Zealand labour market, albeit with a lag. Prior to the recession, employment had been increasing since the fourth quarter of 1998. Like output growth, growth in employment had been slowing since late 2005, although it continued to rise for several quarters after output contracted, before contracting for four quarters. Employment growth resumed for three quarters after output began growing again. The employment fluctuations were less pronounced than output changes, leading to pro-cyclical labour productivity changes. In contrast, wage growth held up until late in 2008, eventually slowing in 2009, in concert with employment growth.

Compared with previous recessions in New Zealand, the 2008 recession was initially less severe but was more prolonged. The impact on the labour market was roughly commensurate with the output changes, a pattern seen in recent recessions but in contrast to the major changes that occurred in New Zealand in the 1980s and 1990s.

Figure 5.1 shows cyclical variation in output and employment in New Zealand over the past 60 years, highlighting the timing of peaks and troughs for each series.³ Employment declines have lasted longer than output declines in the previous three recessions, and have been more severe – especially for the contractions starting in 1987-88, when employment

Figure 5.1. **New Zealand output and employment cycles**

Note: Turning points were identified using the Bry-Boschan quarterly algorithm outlined in Harding and Pagan (2002), with (window = two quarters; minimum phase = three quarters; minimum cycle = five quarters). This was applied to seasonally adjusted real production GDP, and seasonally adjusted total employment derived by splicing the historical series in Chapple (1994) with the latest revision of the Household Labour Force Survey.

Source: Authors' calculations.

dropped by over 7% in seven quarters. Table 5.1 summarises the peak-to-trough declines in output and employment for recent cycles, together with the duration of each downturn, and the length of time before the previous peak levels were regained. The 2008 recession appears more significant on this basis. The output drop, in particular, is the longest-duration contraction since the 1976 Q2 recession,⁴ and also the most sustained, taking at

least 13 quarters (to date) to regain the 2007 Q4 level of output. The contraction in output (-3.1%) is the deepest since 1982 Q2 (-3.1%).

Table 5.1. **Maximum cumulative decline in output and employment**

Peak	Output decline (peak-to-trough) % change	Peak-to-trough duration (quarters)	Time to regain peak level (quarters)	Peak	Employment decline (peak-to-trough) % change	Peak-to-trough duration (quarters)	Time to regain peak level (quarters)
1950 Q4	-8.9%	6	14				
1966 Q4	-2.5%	4	8				
1976 Q2	-4.2%	7	18	1967 Q1	-1.4%	3	7
				1977 Q1	-0.1%	3	4
				1980 Q1	-1.5%	2	6
1982 Q2	-3.2%	3	5	1982 Q3	-1.3%	3	5
				1987 Q3	-7.2%	7	29
1988 Q1	-1.3%	3	4	1990 Q2	-2.8%	6	13
1990 Q4	-2.6%	2	9	1996 Q3	-1.2%	9	11
1997 Q3	-0.9%	2	5				
2007 Q4	-3.1%	5	at least 13	2008 Q4	-2.5%	4	9

Source: Authors' calculations.

Labour market adjustment during the GFC

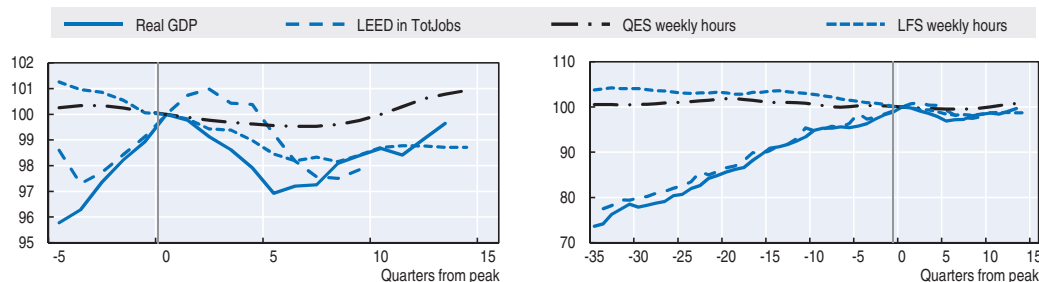
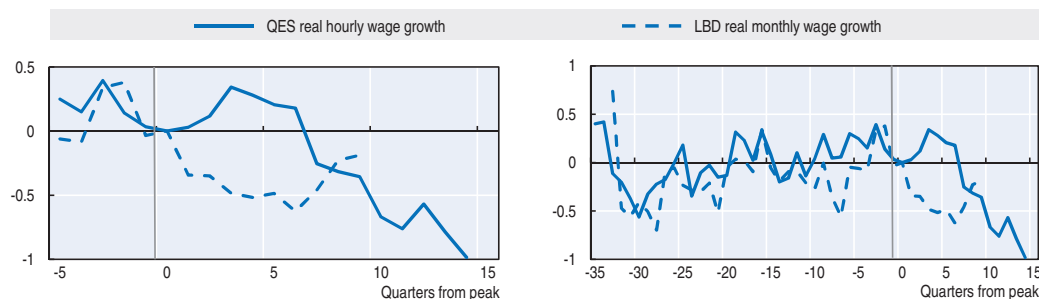
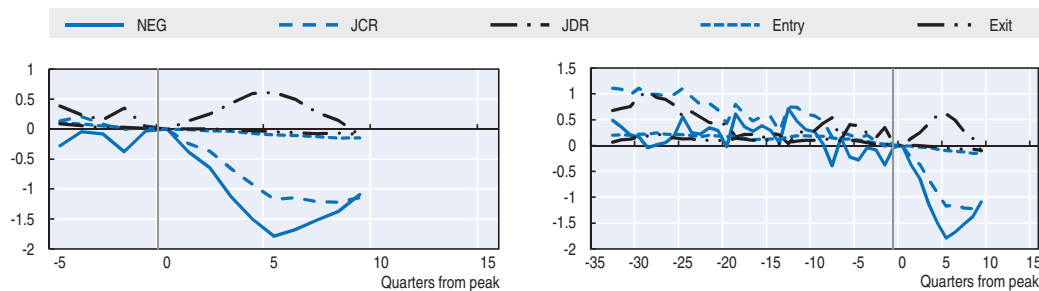
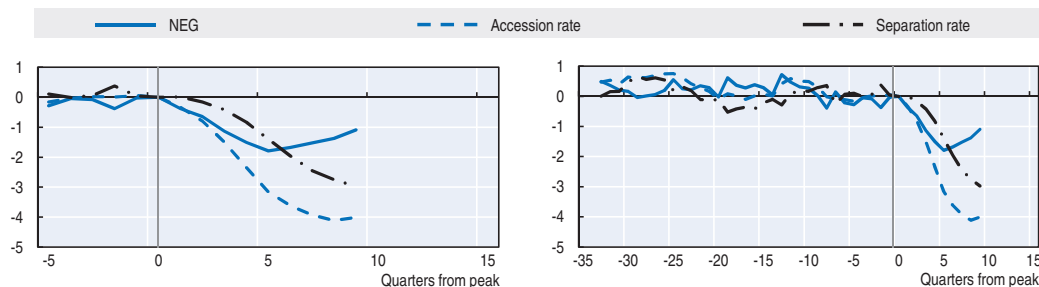
While employment growth provides a useful summary indicator of the labour market responses to the cyclical downturn, the impacts are also evident in other labour market indicators. The labour force continued to grow and the participation rate remained high while employment growth slowed, leading to an increase in unemployment. Unemployment rose sharply, increasing from below 4% in early 2008 to stabilise at around 7% from late 2009. Employment intentions dropped almost immediately when output declined and remained negative until mid-2009, shortly before employment growth resumed. Average weekly hours of work had been dropping steadily since 2005, and continued to do so until 2010, when employment growth resumed, despite stronger growth in full-time than part-time employment. At the start of the recession, growth in full-time employment stalled and part-time employment grew more rapidly. By late 2009, part-time employment growth slowed and full-time employment growth picked up. Wage growth remained positive throughout the early stages of the recession, but slowed markedly in 2009, and has remained low.

The unemployment rate has remained higher than pre-peak levels, particularly for young people. Since 2007 Q4, the overall unemployment rate rose from 3.5% to 6.5% for all workers, and from 13.1% to 27.6% for 15 to 19-year-olds.⁵ Youth participation has also shifted – down from 65% to 45%, in contrast to relatively stable participation rates overall. Long-term unemployment has grown faster than unemployment overall – rising from 4.5% to 9.2% of overall unemployment.

The first row of Figure 5.2 shows GDP, linked employer-employee data (LEED) employment, and hours change around the 2007 Q4 GDP peak (left column) and for the entire period when LEED data are available (right column). Two hours measures are shown – one derived from the Quarterly Employment Survey (QES), which reflects average paid hours per

Figure 5.2. **Labour adjustment around the 2008 recession**5 quarters before to 15 quarters after peak
2005 Q4-2011 Q1

All periods with LEED data 1999 Q2-2011 Q1

(a) GDP and employment**(b) Wage growth rate****(c) Employment growth, job creation and job destruction rates****(d) Employment growth, accession and separation rates**

Notes: All series are seasonally adjusted by the authors using the United States Census Bureau's Win-X12 program. Series in the right hand column are subsequently smoothed using a centred five-period moving average, to aid presentation.

Source: Authors' calculations.

employee, and one from the Household Labour Force Survey (HLFS), showing hours worked per person. Both show declines following 2007 Q4, although the HLFS measure of average hours had been declining for some time prior to the GDP peak. Both series show a recovery in hours from around five quarters after 2007 Q4. The second row of Figure 5.2 shows growth in QES real hourly earnings per full-time equivalent employee, and growth in real monthly earnings, from the micro-data sample described in the fourth section below. Monthly earnings decline before hourly earnings, reflecting the drop in average hours. Real monthly earnings growth subsequently resumes as hours pick up, but real hourly earnings continue to decline.

Aggregate employment fluctuations are the net result of large gross flows of jobs and of firms. The fifth section of this chapter examines changes in job and worker flows across firms. The current section summarises the changes in aggregate job flows (job creation and job destruction rates) and worker flows (accession and separation rates) that occurred during the 2008 recession. The quarterly job creation rate (JCR) and job destruction rate (JDR) are calculated following the approach of Davis, Haltiwanger and Schuh (1996) as the net change in employment, expressed as a proportion of average employment.⁶ The JCR reflects employment changes in entering and expanding firms and the JDR reflects employment changes in exiting and contracting firms. Like the job creation and destruction rates, the worker flow rates are measured quarterly. They reflect the number of employees who had not been at the firm three months earlier (accession rate [AR]), or the number of previous employees who were no longer at the firm (separation rate [SR]).

The bottom half of Figure 5.2. provides information on the changes in job and worker flows that generate the aggregate employment changes. The dark line in the third row graphs shows the path of net employment growth (NEG), which is the quarterly change in aggregate employment expressed as a proportion of average employment during the quarter. The decline in NEG resulted from a rise in the JDR and a decline in the JCR. The third row graphs show the pronounced rise in the JDR in the six quarters after the GDP peak, together with the slight decline in the JCR. The JCR had, however, been gradually declining for the previous 30 quarters. The JDR had been following a similar slow decline until 2005 – about ten quarters before the 2007 Q4 peak. It then stabilised before its rise during the recession.

The patterns of worker turnover are markedly different from those of job turnover. The fourth row of Figure 5.2 shows changes in the worker accession and separation rates, together with the quarterly NEG rate. Prior to the 2007 Q4 peak, both the accession and separation rates were relatively stable. Immediately following the peak, the rates of both accessions and separations declined markedly, signalling a pronounced reduction in labour market liquidity. By 2010 Q2, six quarters after the peak, the worker accession rate had declined by four percentage points (from 17.9% to 13.7%). Despite the rise in job destruction, the worker separation rate dropped by 2.8 percentage points (from 17.0% to 14.2%) over eight quarters.

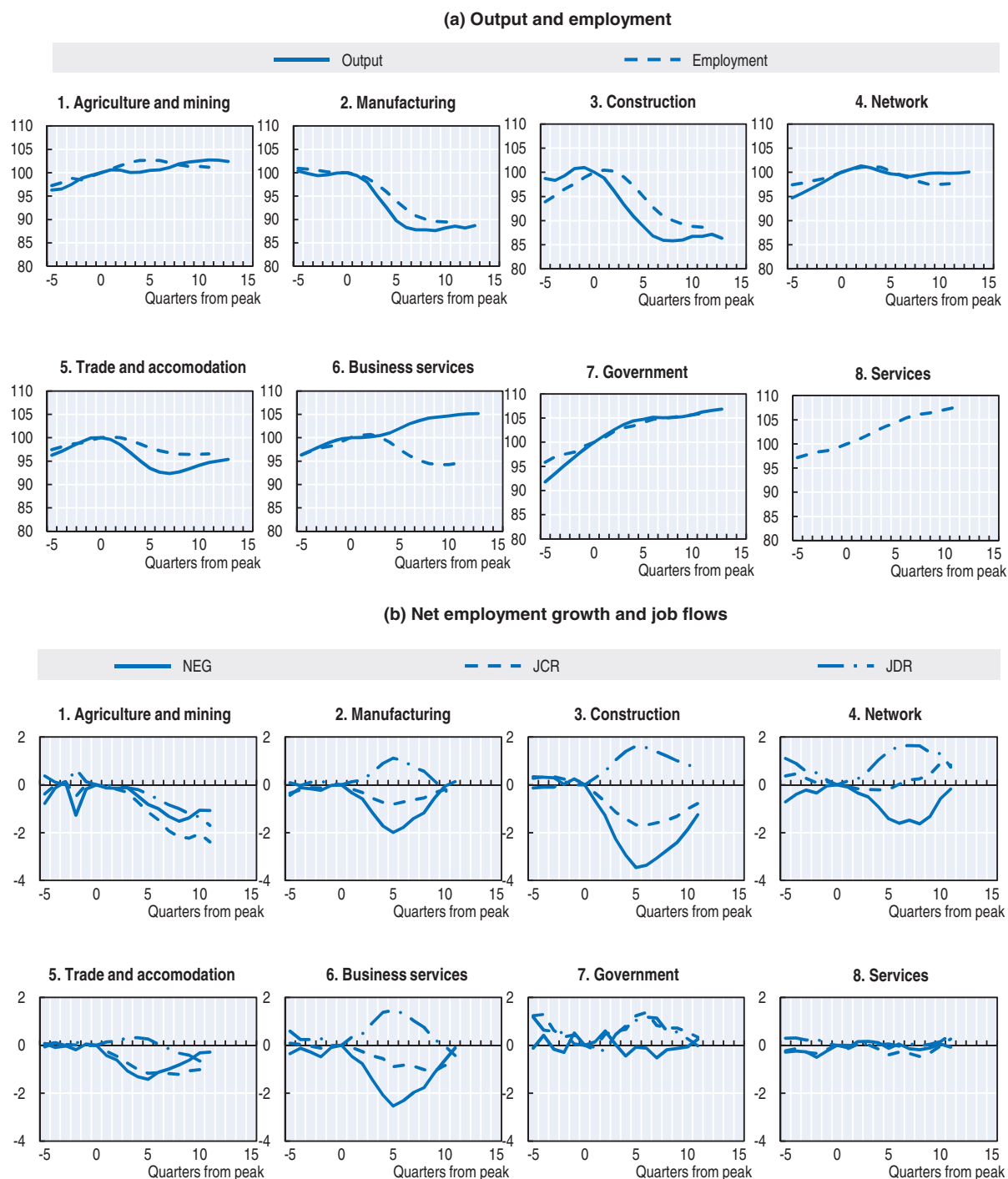
Variation across industry and region

The impact of the recession varied across industries, though it appears to have affected geographical regions similarly. Figure 5.3 provides a summary of output and employment growth, and job and worker flows by industry. Industries have been grouped as shown in Table 5.2.⁷

Output declines were particularly strong in the manufacturing, construction, and combined wholesale/retail/accommodation industries. These industries collectively accounted for around 45% of employment and experienced a 14% reduction in output and

a 9% reduction in employment. In agriculture and mining, network industries (electricity, gas and water, transport and storage, and communications), and government, output

Figure 5.3. **Job and worker flows by industry**



Notes: JCR = job creation rate; JDR = job destruction rate; NEG = net employment growth; TJ = total jobs; AR = accession rate; SR = separation rate. All series are seasonally adjusted by the authors using the United States Census Bureau's Win-X12 program and subsequently smoothed using a centred, 5-quarter moving average. In Panel (a), all series are indexed to a value of 100 in 2007 Q4. In Panel (b), series are expressed as percentage point deviations from 2007 Q4 values.

Source: LEED quarterly tables from Statistics New Zealand.

growth slowed but did not decline appreciably. In the business services industries, output growth resumed relatively strongly after only four quarters of weak growth. The same was not true of employment growth, which declined by around 8% in business services. Agriculture and mining also experienced declining employment in the face of stable or rising output. Employment in community and personal services industries continued to grow throughout the recession, though output data are not available for these industries. For other industries, employment growth followed a similar path to output growth, albeit with a lag. For wholesale trade, retail trade, and accommodation, cafés and restaurants, the decline in employment was small relative to the output decline.

Table 5.2. **Grouping of ANZSIC96 industries**

ANZSIC 1996 industry group		Grouped industry
A	Agriculture, forestry and fishing	1. Agriculture and mining
B	Mining	1. Agriculture and mining
C	Manufacturing	2. Manufacturing etc.
D	Electricity, gas and water supply	4. Network
E	Construction	3. Construction
F	Wholesale trade	5. Trade and accommodation
G	Retail trade	5. Trade and accommodation
H	Accommodation, cafés and restaurants	5. Trade and accommodation
I	Transport and storage	4. Network
J	Communication services	4. Network
K	Finance and insurance	6. Business services
L	Property and business services	6. Business services
M	Government administration and defence	7. Government
N	Education	7. Government
O	Health and community services	8. Services
P	Cultural and recreational services	8. Services
Q	Personal and other services	8. Services

The second panel of Figure 5.3 shows NEG rates together with job flow rates. Industries with the greatest employment declines – manufacturing, construction, and trade and accommodation, experienced the expected pattern of rising job destruction and declining job creation, which reversed as the contraction eased. In business services, the fluctuation in job destruction was particularly strong, accounting for most of the change in quarterly NEG. Three industry groups show atypical patterns. Job creation and JDRs both declined during the recession for agriculture and mining, and in network industries job creation and job destruction both increased. Job creation and destruction rise and then fall together in government, perhaps reflecting ongoing public sector reorganisation. There was minimal variation in job flows in the community and personal services industries.

Most regions show the expected pattern of pro-cyclical job creation and countercyclical job destruction. The exception is the Wellington region, where job creation continued to grow during the early stages of the recession, perhaps due to the concentration of public sector jobs in the region. Auckland experienced the strongest decline in employment but is the only region to have more than recovered its 2007 Q4 level of employment. The recovery reflects the fact that Auckland had the strongest recovery in job creation coming out of the recession. Job reallocation within each of the regions was achieved with greatly reduced worker reallocation rates. Accession rates in particular fell by 2% to 3% within five to ten quarters of the output peak, and did not rise again until after employment growth resumed.

Policy changes during the recession

Following the onset of the recession, New Zealand fiscal and monetary policies were both stimulatory, although they were not brought together as a formal stimulatory package. The 2007-08 government budget surplus of 3.6% of GDP was lowered to 0.1% of GDP in 2008-09, with a projected deficit of 2.8% of GDP by 2010-11. This change in fiscal position represented a fiscal impulse of 6.4% of GDP over four years, largely as a result of reductions in personal (4.1%) and business (0.4%) tax, and a programme of infrastructure spending (0.9%) (New Zealand Treasury, 2008; Giesecke and Schilling, 2010). Monetary policy remained expansionary throughout the recession, with the official cash rate – the main monetary policy instrument – staying at record low levels of 2.5% for most of the 2008-11 period.

In October 2008, the government introduced the “retail deposit guarantee scheme”, to guarantee deposits in New Zealand financial institutions and maintain confidence in the financial system. The scheme was extended in 2010. Although the New Zealand and (closely related) Australian financial sectors fared relatively well in the GFC, there were nevertheless payouts under the guarantee scheme.

There have been ongoing incremental changes to labour market and benefit policies since 2007, including the expansion of active labour market policies directed at youth, the introduction of 90-day trial periods and the abolition of the youth minimum wage rate. There have not, however, been any major policy changes to date.

Data

This analysis uses quarterly data from Statistics New Zealand’s LBD, which contains longitudinally-linked information on all employing enterprises in New Zealand from 1999 Q2 until 2010 Q1, thus covering all employees in New Zealand. The database brings together a broad range of administrative data collected for tax purposes and data from a range of business surveys.

For the current study, attention is restricted to private sector enterprises operating for profit. Such enterprises account for 94.7% of employing enterprises, and 75.8% of employees. The excluded enterprises are mostly public sector agencies that have disproportionately large employment. This study further restricts attention to enterprises that always employ three or more employees, to avoid problems encountered in longitudinally linking very small firms.⁸ It also excludes a very small number of observations where key variables are missing and drop quarterly observations for which mean employment is zero. With these restrictions, the data covers 96.6% of employees in private-for-profit enterprises (55.1% of employing private-for-profit enterprises). On average, the quarterly data has around 98 000 enterprises employing around 1.2 million employees.

The main variables of interest are quarterly employment and earnings, obtained from monthly pay as you earn (PAYE) income tax returns filed by employers from Statistics New Zealand’s LEED. The unit of observation in the LEED is a job (an employer-employee combination, observed monthly). This analysis uses LEED-based measures that are aggregated to enterprise-level quarterly observations. Employment is measured as the number of employees being paid by an enterprise on the 15th day of the middle month of a quarter. The monthly earnings rate is calculated as the average gross monthly earnings of employees employed on the 15th day of a month, deflated by the industry-specific “all wage and salary” Labour Cost Index (LCI). An employment-weighted average of the monthly earnings rate is used, averaged across the three months in each quarter.

LEED data are also the source of information for worker and job flows. Accessions are identified as current employees who were not employed at the firm on the 15th day of the middle month of the previous quarter. Separations are those who were employed at the firm on the 15th day of the middle month of the previous quarter but are not employed in the middle of the current quarter. It is not possible to separately identify voluntary and involuntary separations. Accession and separation rates are calculated as a ratio to average quarterly employment $((E_t + E_{t-1})/2)$. NEG is also measured as a ratio to average employment, to give a measure that is bounded by -2 (for firm exit) and +2 (for firm entry).⁹ This can be decomposed into the positive contribution from expanding firms (JCR) and the negative contribution from contracting firms (JDR). Wage growth is measured using an analogous formula: $\Delta w = (w_t - w_{t-1}) / [(w_t + w_{t-1})/2]$.

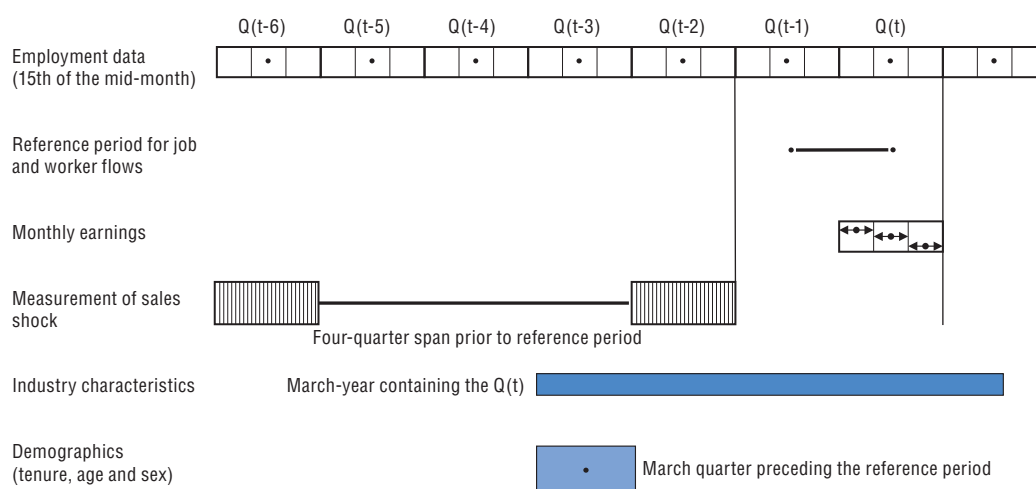
LEED also provides data on the demographic composition of each enterprise's workforce. This analysis uses information on workers' age and sex, and on workers' tenure at the enterprise. These are measured as the proportion of male and female employees in each of four broad age bands (under 15, 15-24, 25-55, and over 55) and the proportion of all employees with completed tenure of zero, one, two, three and four years. The final tenure category relates to workers who have completed five or more years of tenure. Because this measure is left-censored, this study restricts all regression analyses to the period from 2004 Q3 to 2010 Q1 for consistency. It uses annual data on the number of working proprietors and contractors engaged at each enterprise and express these as a proportion of total employment (sum of employees, contractors, and working proprietors).

Sales data are used to construct a measure of the output shock facing each firm. Sales data are obtained from monthly goods and services tax (GST) sales, aggregated to quarterly frequency. To accommodate the pronounced seasonality in sales data, and to reduce the influence of quarter-to-quarter volatility, an annual change in quarterly sales is used, measured analogously to the wage and employment changes. In order to ensure that the output shock precedes the measured employment and wage dynamics, the annual sales change lagged by two quarters is used. The two-quarter lag ensures that the year over which the output shock is measured entirely precedes the two quarters used for calculating employment and wage changes, as illustrated in Figure 5.4. Firms entering employment during the reference period almost never have lagged sales, so are omitted from the analysis of output shocks.

Changes in aggregate GDP and employment suggest that employment changes lag GDP by one to three quarters. If employment responds quickly, this study's approach may understate the negative response to output shocks, since a proportion of exiting firms will leave the population before the employment reference period. Conversely, if labour market lags are particularly long, this study will fail to detect employment responses to output shocks. It includes in the analysis indicators of firm performance that are potentially related to firms' labour dynamics and adjustment. An employment-based predominant two-digit ANZSIC96 industry is calculated for each enterprise, and heterogeneity across industries is examined by including intercepts for different combinations of firm size and industry, or by including averages of key characteristics by firm size and industry.¹⁰ These characteristics include the proportion of employment in exporting firms, in firms with foreign direct investment, and in firms with some employees on collective employment agreements.¹¹ This analysis also uses employment-weighted average responses to subjective questions on whether the enterprise's profitability is high relative to that of competitors, and whether profitability has increased or remained stable in the previous year. Finally, it uses information on whether firms sought finance and, if so, whether

finance was available on acceptable or unacceptable terms. All of these indicators are drawn from Statistics New Zealand's annual Business Operations Survey (BOS), which is available from 2004-05 (i.e. for the entire tenure-restricted period of 2004 Q3 to 2010 Q1). The BOS has slightly narrower industry coverage¹² than the private-for-profit scope used for this chapter's other analyses. It also excludes enterprises with fewer than six employees, and those that have been in operation for less than a year. From a target population of around 34 000, information is collected from a sample, stratified by firm size and industry, yielding useable responses for between 5 500 and 6 000 enterprises (> 80% response rate). Using firm-level responses to BOS variables results in a small sample that does not support robust analysis of labour adjustment. Therefore average responses (with non-response coded as zero) are calculated by the (firm size by industry) sample strata and apply the contemporaneous annual averages to quarterly enterprise observations.

Figure 5.4. **Variable definition: data timing**



Source: Authors' calculations.

Microeconomic sources of aggregate adjustment

The aggregate decline in employment following the 2007 Q4 peak in GDP is the net outcome of heterogeneous patterns of adjustment at the firm level. Three dimensions of this heterogeneity are examined here. First, firms experienced different output shocks; second, conditional on the size of the output shock, firms had different net changes in employment; third, conditional on the size of the firm's employment change, there is heterogeneity in the pattern of worker flows (accessions and separations). Analysis of firm-level adjustment provides a richer understanding of the microfoundations of aggregate cyclical dynamics, as summarised by Davis and Haltiwanger (1999) and Davis, Faberman and Haltiwanger (2006).

Table 5.3 compares employment growth, and job and worker flows after the 2007 Q4 peak with those in the 34-quarter period up to and including the peak using LBD data. This shows similar patterns to those observed using published aggregate statistics (Figure 5.2). Net quarterly employment growth slowed from 0.85% to -0.64%. This reflects almost constant job destruction (of -6.7%) combined with a decline in job creation (from 7.6% to 6.0%). As in the published data, both accession and separation rates were lower following the GDP peak.

Table 5.3. **Changes in job and worker flows**

	Pre-peak	Post-peak
	1999 Q3-2007 Q4 (%)	2008 Q1-2010 Q1 (%)
Net employment growth	0.85	-0.64
Job creation rate	7.58	6.02
Job destruction rate	-6.73	-6.66
Accession rate	17.68	14.76
Separation rate	16.83	15.40

Note: Reported values are employment-weighted averages of quarterly rates.

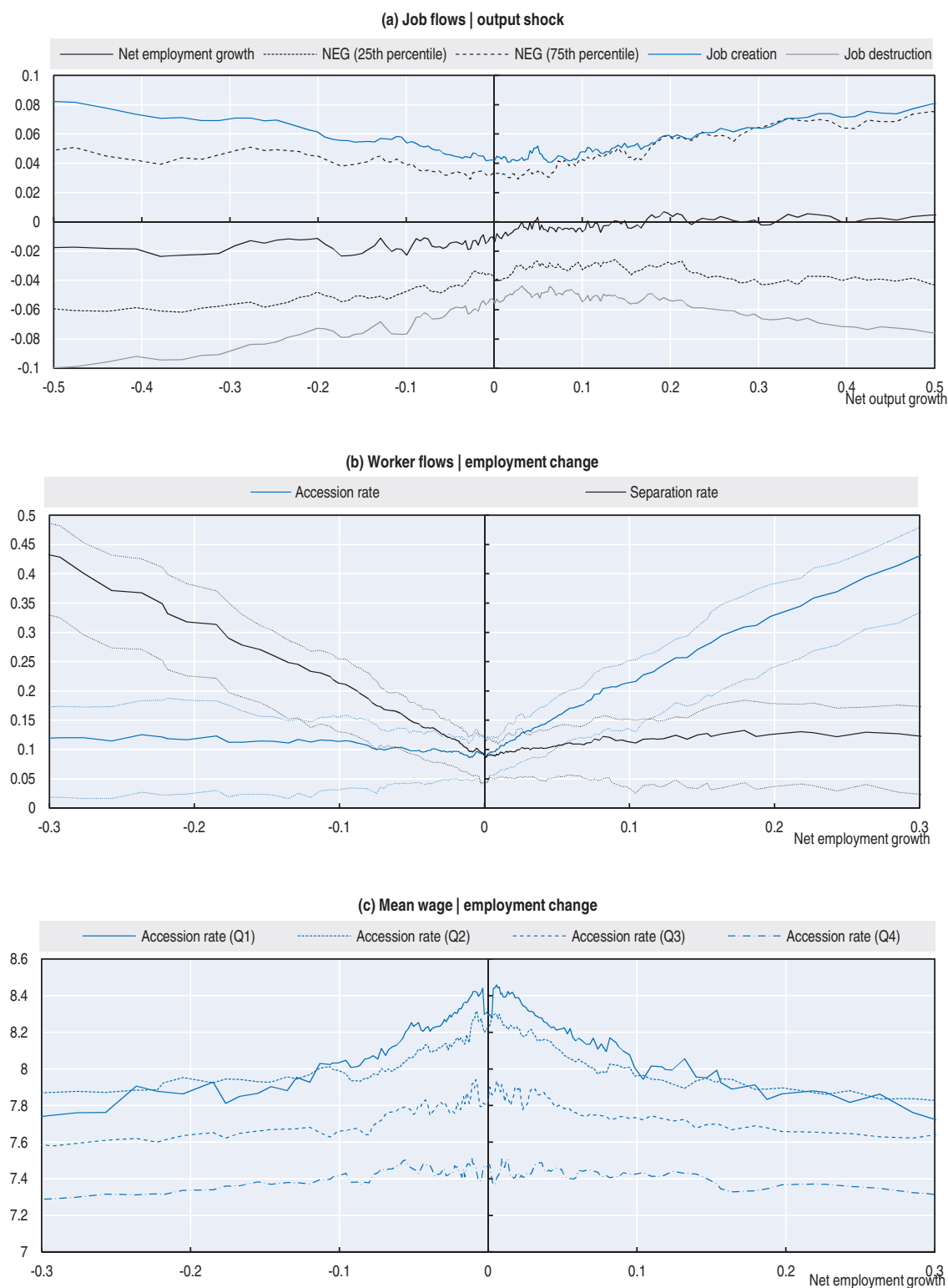
Source: Authors' calculations.

Heterogeneity of adjustment

The first panel of Figure 5.5 shows average NEG and job flow rates conditional on the size of the output shock experienced by firms. The output shock measure is divided into 181 discrete bins, each containing approximately the same proportion of employment. The figure restricts attention to output shocks between -0.5 and 0.5, since this range captures 82.6% of average employment. The employment response of firms to a change in output will be more pronounced when output growth is strongly related to an expected sustained increase in labour demand. Output growth may be a weak signal of changing labour demand if there is uncertainty about future growth prospects, as is the case around cyclical turning points, or if output growth is highly volatile. In such cases, there is likely to be a weak relationship between observed output changes and subsequent employment change.

The first panel of Figure 5.5 shows a clear positive relationship between (lagged) output growth and NEG for output shocks between -0.05 and +0.05 (elasticity of 0.2). For larger output increases or decreases, the elasticity is close to zero (0.03 or less), with the somewhat implausible implication that, on average, employment does not respond to output change. The lack of a relationship between large output shocks and current employment growth may be a consequence of volatile output fluctuations. For some firms, a negative output shock is a sign of reduced demand and consequently lowered labour demand. For others, a contraction in output reflects an unusually poor year, which is followed by subsequent growth in employment. On balance, a negative output shock is associated with relatively slow subsequent employment growth (-0.013 on average), whereas average employment growth following any positive output shock is fairly constant at around zero.

The dashed lines show the empirical 25th and 75th percentiles of NEG for each output shock bin. The average response of employment to output shocks, as captured by NEG, conceals systematic patterns of response at different points of the employment change distribution. For firms experiencing a positive output shock, the upper quartile of employment growth rises linearly with the size of the output shock. In contrast, the lower quartile employment change for firms experiencing a positive shock is around -0.03, regardless of the size of the shock. The positive output shock is transmitted to employment growth for firms with high levels of employment growth, but not for many firms whose employment continued to decline. A similar pattern is observed for firms experiencing a negative output shock. On average, the output shock feeds through to a decline in employment, but firms at the upper quartile of employment growth maintained employment growth of 0.03 to 0.04 regardless of the size of output shock. These patterns are consistent with behaviour predicted by Ss models of adjustment – expanding firms respond to positive shocks and contracting firms respond to negative shocks.

Figure 5.5. **Heterogeneous adjustment**

Notes: Output shocks are measured as lagged annual growth in sales, as described in the text. Figures are plotted using 181 discrete ranges ("bins") of NEG or output shocks, each containing approximately the same employment. Plotted lines are centred 5-bin moving averages. Dashed lines in Panel (b) are empirical 25th and 75th percentiles.

Source: Authors' calculations.

The other pattern evident in Figure 5.5 is that job creation and JDRs are both higher among firms experiencing large output shocks, regardless of whether the output shock is positive or negative. Again, this is suggestive of heterogeneous responses to output shocks, even within narrowly defined ranges of output shock. The slightly lower employment growth among firms facing negative output shocks is the net effect of some firms with sizeable increases in employment and some with sizeable decreases.

There is also considerable heterogeneity in accession and separation rates among firms with the same NEG. The second panel of Figure 5.5 shows average worker flow rates conditional on NEG. NEG is also divided into 181 discrete bins, each containing approximately the same share of total employment. The figure is restricted to net employment changes in the range of -0.3 to 0.3 (capturing almost 90% of average employment). The two curves have the familiar “hockey-stick” shape, with a low and relatively stable accession rate for contracting firms, and a near-linear increase in the accession rates as net employment increases for expanding firms. Similarly, the separation rate increases with the size of employment contractions but is low and stable for expanding firms. The dashed lines show the empirical 25th and 75th percentiles of worker flow rates. There is a sizeable 0.07 to 0.15 interquartile range evident for each level of employment growth, reflecting considerable variation in turnover rates.

The third panel of Figure 5.5 investigates whether the heterogeneity of worker flows is related to differences in wage levels across firms. Within each NEG bin, firms are ranked according to their worker turnover and calculate mean wages for each quartile of the worker turnover distribution.¹³ There is a clear inverse relationship between wage levels and worker turnover. The firms with the highest turnover rates (fourth quartile of the accession rate) have significantly lower mean wages than other quartiles. The two lowest turnover quartiles have a similar level of relatively high wages. The wage profiles also show markedly higher wages among firms experiencing small absolute changes in employment. This reflects firm-size wage premiums, since large firms are over-represented among firms with small absolute changes in employment.¹⁴ The patterns highlight the importance of controlling for differences in firm size, and other attributes such as industry, in subsequent regression analysis.

Changes during the global financial crisis

Table 5.4 provides a decomposition of the average changes in job flows summarised in Table 5.3 together with a decomposition of changes in average monthly wage growth. Specifically, Table 5.4 shows how much of the observed change was due to changes within contracting as opposed to expanding firms, or to changes within firms experiencing positive as opposed to negative output shocks.

The upper panel shows the contributions to overall employment change from subgroups of firms defined according to the size of their firm-level employment change. Contracting firms are divided into “large contractions” ($\text{NEG} \in (-2; -0.3)$), and other contractions ($\text{NEG} \in [-0.3; 0)$). Similarly, expanding firms are categorised as large expansions and other expansions. Firm entry and exit are identified separately, although they are included in job creation and destruction respectively in most other results.

Comparing contributions before and during the crisis, the main changes come from a substantial reduction in the contribution from expanding firms – both large and other expansions – and a slightly larger negative contribution from small contractions. When

classified by the size of output shocks, the employment reduction came mainly from negative contributions from firms with small positive or negative output shocks.

Table 5.4. **Decomposition of growth in employment and wages**

	Employment		Average wage	
	Pre-peak (%)	Post-peak (%)	Pre-peak (%)	Post-peak (%)
Employment bins				
Exit	-1.51	-1.23	0.56	0.47
Large contraction	-2.71	-2.62	1.29	1.20
Contraction	-2.51	-2.81	1.16	0.71
Static	0.00	0.00	0.28	-0.01
Expansion	3.06	2.53	-0.22	-0.72
Large expansion	3.02	2.47	-1.39	-1.20
Entry	1.50	1.02	-0.58	-0.44
Total	0.85	-0.64	1.10	0.01
Lagged sales bins				
Exit	-0.01	-0.02	0.00	0.00
Large contraction	-0.06	-0.20	0.05	-0.09
Contraction	-0.34	-0.54	0.39	-0.06
Static	0.00	0.00	0.00	0.00
Expansion	-0.06	-0.27	0.61	0.18
Large expansion	0.15	-0.12	0.18	0.08
Entry	0.17	0.05	0.09	0.04
Zero (both periods)	1.00	0.46	-0.22	-0.16
Total	0.85	-0.64	1.10	0.01

Note: Large contractions (expansions) relate to net changes of less than -0.3 (larger than 0.3).

Source: Authors' calculations.

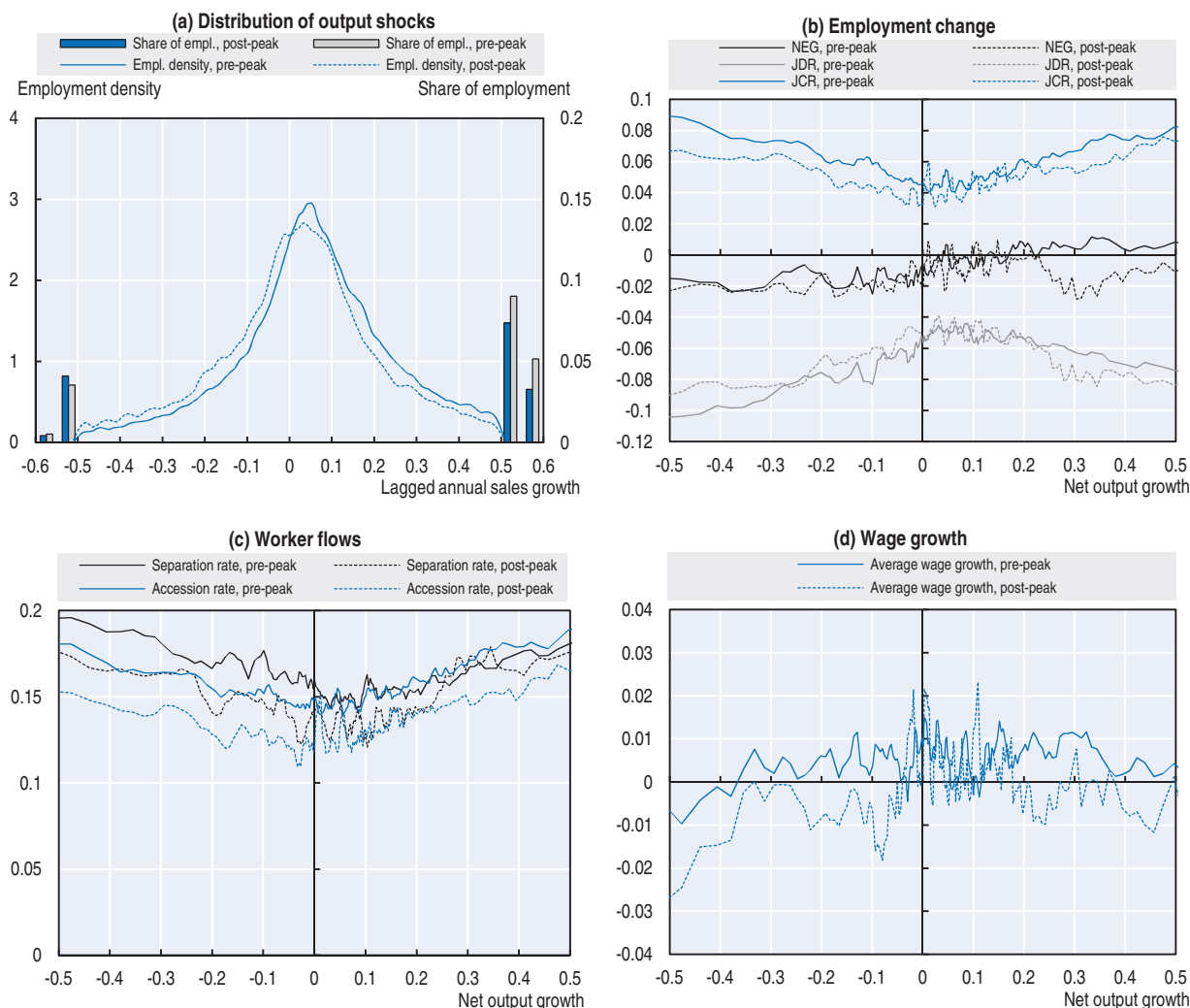
A similar decomposition is used to identify contributions to the reduction in wage growth, which dropped from 1.1% per quarter (nominal wage growth) before the crisis, to 0.01% after the crisis. The largest contributors to the reduction were from the changing contribution of firms with small employment expansions or contractions, or from firms facing small positive or negative output shocks.

The following sections summarise graphically the changes in the distribution of firms across the different growth bins and the changing patterns of employment and wage changes within bins. For those analyses, much finer employment and output shocks bins are defined than those shown in Table 5.4.

The impact of the crisis on NEG is assessed by examining the changing distribution of output shocks before and after 2007 Q4, and the changing response of employment change to a given level of output shock. Figure 5.6 summarises the observed patterns. The first panel shows that the distribution of output shocks shifted to the left – an increasing share of employment was in firms that experienced negative output shocks.¹⁵ The second panel shows the changing profile of NEG, conditional on the size of the output shock. Post-peak, employment change is less systematically related to output shocks than it was prior to the crisis, even for small changes in output – the elasticity of employment with respect to output for output shocks in the -0.05 to 0.05 range is only 0.02, compared with 0.2 prior to the crisis. Post-peak, employment declines were somewhat smaller for firms experiencing negative output shocks of -0.3 or more, due to a larger decline in JDRs than JCRs, though both declined. Paradoxically, firms with positive output shocks of around 0.3 or greater

show employment declines (around -0.02). For a given output shock, job creation was lower and job destruction higher during the crisis than before it. It may be that output shocks were unexpectedly short-lived, leading to reversals of employment growth in the year following an expansion of output.

Figure 5.6. **Post-peak changes conditional on output shock**

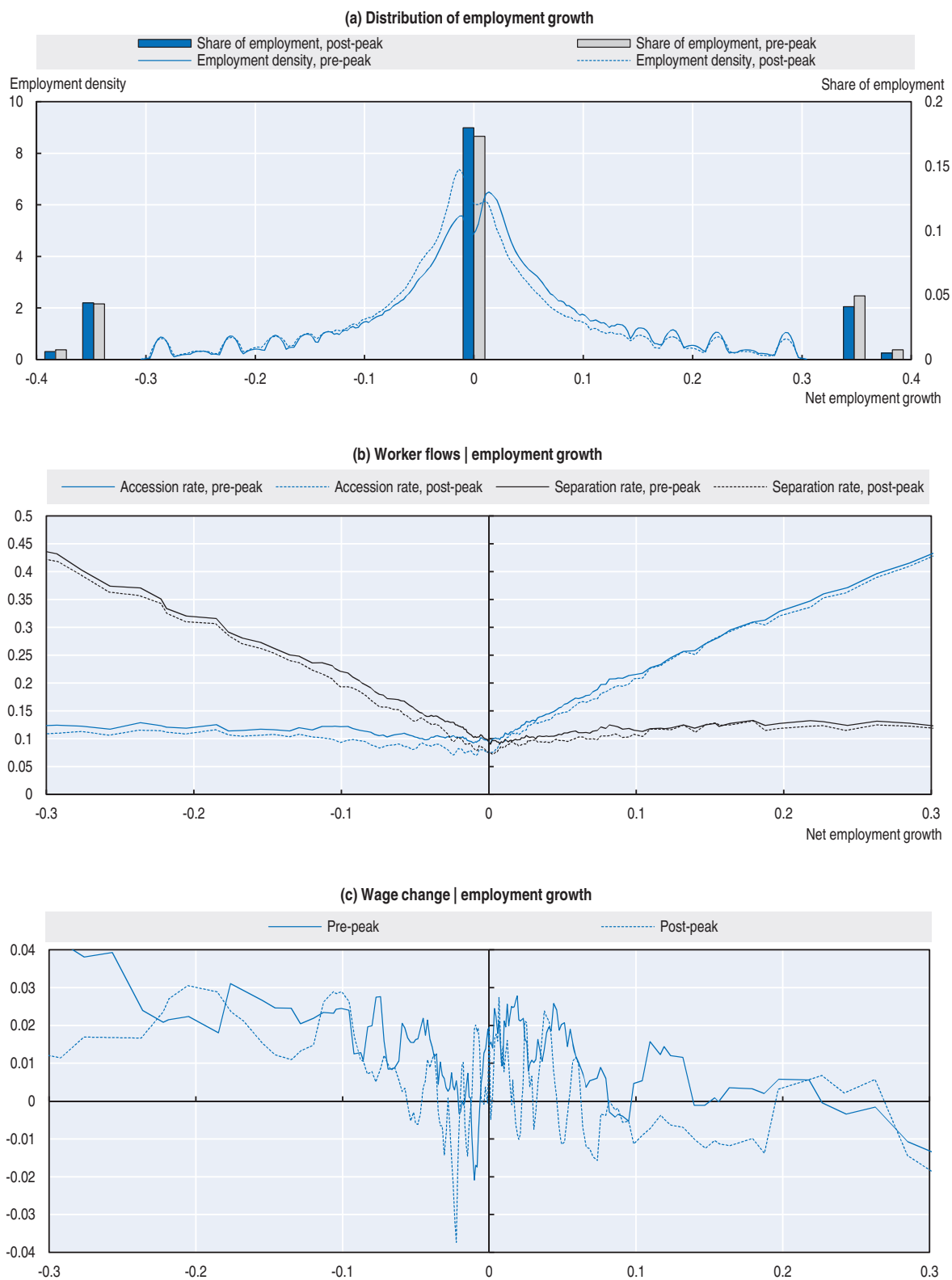


Notes: Output shocks are measured as lagged annual growth in sales, as described in the text. Figures are plotted using 181 discrete ranges ("bins") of output shocks, each containing approximately the same employment. Plotted lines are centred 5-bin moving averages. Dashed lines are for the post-peak period.

Source: Authors' calculations.

Consistent with the declines in overall accession and separation rates shown in the lower panel of Figure 5.2, the third panel of Figure 5.6 shows that, conditional on the size of the output shock, both accessions and separations are lower during the GFC, especially among firms facing larger negative shocks.

The first panel of Figure 5.7 shows that not only did the distribution of employment changes become more peaked, it also shifted to the left. There was a particularly sharp rise in the share of employment in firms with small employment declines, with a compensating reduction in the share with low to moderate increases. These distributional changes contribute to lower worker flows. However, as shown in the second panel of Figure 5.7, there

Figure 5.7. **Post-peak changes conditional on employment growth**

Notes: Figures are plotted using 181 discrete ranges ("bins") of NEG, each containing approximately the same employment. Plotted lines are centred on 5-bin moving averages. Dashed lines are for the post-peak period.

Source: Authors' calculations.

is an additional reason that overall worker flow rates dropped. Both accession rates and separation rates declined, even conditional on the NEG rate. Although the changes are small, they appear to be most pronounced for firms making small employment reductions.

The pattern of wage changes conditional on the size of employment change or output shock is relatively weak, as shown in the final panels of Figures 5.6 and 5.7. Wage growth is slightly lower for firms in which employment is growing (Figure 5.7). The wage measure is a monthly wage, so the slower growth may reflect reduced hours of work or greater use of part-time workers. Prior to the crisis, moderately large negative output shocks are associated with slower wage growth. During the downturn, this pattern is no longer evident, with wage growth being small and negative for a broad range of negative output shocks. Changes in average wage growth may arise not only from changes in wage growth but also from changes in the composition of the firm's workforce, and changes in average hours of work. Hours of work changes cannot be controlled, but it is possible to control for the changing composition of the workforce using a regression specification.

Modelling heterogeneous adjustment

The changing profile of worker flows and wages conditional on employment change, or of job and worker flows, employment and wage change conditional on output shocks does not necessarily represent a change in firms' reactions to the GFC. An alternative explanation is that the composition of firms within employment bins or output shock bins has changed. For instance, job and worker flow rates differ across industries for reasons unrelated to the crisis. The impact of the crisis also differed across industries. The GFC may have led to a re-ordering of firms across employment or output shock bins, leading to changes in average rates within a bin.¹⁶

In order to test the robustness of this analysis' main findings against firm heterogeneity, this analysis adopts a parsimonious regression specification that captures the key shifts. The regression can be readily extended to test whether particular firm characteristics are more strongly associated with shifts in the conditional profiles. Equation (1) shows the structure of the estimating equation:

$$\text{Flow}_{gt} = \alpha_g + \beta_t X_{gt} + \left[1(t=1) \begin{cases} \gamma^+ + \delta^+ G & \text{if } G > 0 \\ \gamma^0 & \text{if } G = 0 \\ \gamma^- + \delta^- G & \text{if } G < 0 \end{cases} \right] + e_{gt}. \quad (1)$$

Estimation is at the bin level, using one observation for each bin in each of two time periods – pre- and post-peak ($t = 0, 1$ respectively). The dependent variable is a job or worker flow rate, a measure of wage growth, or NEG (conditional on output shocks). Change bins (either NEG or output shock) are indexed by g . The shape of the profile across bins is non-parametrically identified by a full set of intercepts, α_g . The vector X_{gt} contains average employment-weighted industry or firm characteristics. The term inside the square brackets captures deviations of the post-peak profile from the pre-peak profile. The specification allows for a level shift, which can be different for negative bins (γ^-), positive bins (γ^+), or at the point of zero change (γ^0).¹⁷ Away from zero, the rise or decline in the profile is allowed to vary linearly with the bin value, G (employment growth or output shock). This is implemented by adding two slope parameters – one for negative bin values (δ^-), and one for positive bin values (δ^+). A residual term (e_{gt}) completes the specification. All regressions are weighted by the share of total average employment accounted for by the cell (g).

Table 5.5. **Changes in industry means**

	Pre-peak (%)	Post-peak (%)	Total (%)	Change (%)
Exporting	21.0	19.8	20.5	-1.2
Foreign direct investment	14.4	15.5	14.8	1.1
Collective employment contracts	30.5	31.1	30.8	0.6
High relative profitability	20.3	21.2	20.6	0.9
Stable or increasing profitability	62.8	54.4	59.6	-8.4
Sought finance	30.4	30.1	30.3	-0.3
x Finance terms acceptable	88.9	84.8	87.3	-4.1
x Finance terms unacceptable	6.7	15.2	9.9	8.5

Note: Reported values are employment-weighted averages based on quarterly data.

Source: Authors' calculations.

Table 5.6. **Modelling worker flows conditional on employment growth: Regression results**

	Accession rate		Separation rate		Monthly wage change	
shift if neg (γ^-)	-0.0229*** [0.002]	-0.0253*** [0.002]	-0.0218*** [0.002]	-0.0240*** [0.002]	-0.0108*** [0.004]	-0.0086 [0.006]
shift if zero (γ^0)	-0.0161*** [0.002]	-0.0225*** [0.002]	-0.0161*** [0.002]	-0.0229*** [0.002]	-0.0151*** [0.005]	-0.0133 [0.008]
shift if pos (γ^+)	-0.0117*** [0.002]	-0.0167*** [0.002]	-0.0124*** [0.002]	-0.0169*** [0.002]	-0.0157*** [0.004]	-0.0200*** [0.006]
Δ slope if neg (δ^-)	-0.0233*** [0.007]	-0.0189*** [0.005]	-0.0128* [0.007]	-0.0078 [0.005]	0.0160 [0.015]	0.0172 [0.017]
Δ slope if pos (δ^+)	0.0076 [0.007]	0.0000 [0.006]	0.0153** [0.007]	0.0068 [0.006]	0.0308* [0.016]	0.0546*** [0.020]
Industry effects	No	Yes	No	Yes	No	Yes
Region effects	No	Yes	No	Yes	No	Yes
Firm size effects	No	Yes	No	Yes	No	Yes
Observations	358	358	358	358	358	358
R ²	0.999	1.000	0.999	0.999	0.745	0.839
p(equal slope effects)	0.002	0.015	0.005	0.068	0.501	0.154
p(uniform level shift)	0.000	0.000	0.000	0.002	0.599	0.257

Notes: Standard errors in brackets. All regressions are employment-weighted using average quarterly employment. Significance: * = 10%; ** = 5%; *** = 1%. Observations are period-bin combinations, with two periods ("pre-peak" = 2004 Q3-2007 Q4; "post-peak" = 2008 Q1-2010 Q1).

Source: Authors' calculations.

Table 5.6 reports the estimates of profile changes for worker flows and wage growth, conditional on NEG. The first column summarises the shifts in the accession rate (seen in Figure 5.7[b]). For very small negative changes in employment, the accession rate was -2.3% lower after the crisis than before. There was a smaller decline (-1.2%) for small positive changes. There was also a significant change in the slope of the profile for negative values of NEG, meaning that the drop was larger for firms experiencing relatively small employment declines. A similar pattern is evident in the third column of the table for the separation rate, although the slope coefficient is not significant. These estimates provide a good summary of the visual patterns evident in Figure 5.7. Similarly, column 5 of Table 5.6 summarises the profile of wage growth across employment bins (Figure 5.7[c]), revealing the overall drop in wage growth, which is slightly greater for expanding firms. The second, fourth, and sixth columns of the table show the impact of controlling for changes in industry, region, and firm-size composition within each cell. For accession and separation rates, controlling for cell composition narrows the difference between the positive and

negative shift coefficients and reduces the estimated slope effect. It does not, however, change the qualitative pattern. Controlling for cell composition in the wage-growth regression raises the estimated decline within expanding firms and makes the decline for contracting firms insignificant. This suggests that industries with high average wage growth rates became more prevalent among expanding firms.

Table 5.7 presents regression estimates to summarise profiles conditional on the size of output shock (analogous to Figure 5.6[b-d]). All of the regressions in Table 5.7 control for changes in industry, region and firm-size composition. Apart from the lowering of accession and separation rates across the full range of output shocks, the only other significant (at 5% level) effect is a drop in the JDR and net employment change among firms experiencing a positive output shock, consistent with the tilting of the JDR profile evident in Figure 5.6(b).

Table 5.7. Modelling the response to output shocks: Regression results

	Net employment growth	Job destruction	Job creation	Accession rate	Separation rate	Monthly wage change
shift if neg (γ^-)	-0.0061 [0.008]	-0.0071 [0.005]	0.0010 [0.005]	-0.0254*** [0.005]	-0.0193*** [0.005]	-0.0118 [0.008]
shift if pos (γ^+)	-0.0110** [0.005]	-0.00719** [0.003]	-0.0038 [0.003]	-0.0236*** [0.003]	-0.0126*** [0.003]	-0.0061 [0.005]
Δ slope if neg (δ^-)	0.0093 [0.012]	0.0099 [0.007]	-0.0006 [0.007]	-0.0031 [0.008]	-0.0125 [0.008]	0.0007 [0.012]
Δ slope if pos (δ^+)	0.0038 [0.008]	0.0013 [0.005]	0.0025 [0.005]	0.0020 [0.005]	-0.0018 [0.005]	-0.0080 [0.008]
Industry effects	Yes	Yes	Yes	Yes	Yes	Yes
Region effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm size effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	362	362	362	362	362	362
R ²	0.722	0.921	0.895	0.956	0.929	0.738
p(equal slopes)	0.695	0.314	0.715	0.582	0.262	0.545
p(uniform level shift)	0.463	0.981	0.232	0.671	0.132	0.389

Notes: Standard errors in brackets. All regressions are employment-weighted using average quarterly employment. Significance: * = 10%; ** = 5%; *** = 1%. Observations are period-bin combinations, with two periods ("pre-peak" = 2004 Q3-2007 Q4; "post-peak" = 2008 Q1-2010 Q1). Source: Authors' calculations.

As noted above (see "Heterogeneity of adjustment"), there is considerable heterogeneity around the mean profiles that are summarised by these regressions. While the industry employment shares account for some of this variation, their coefficients are uninformative. Tables 5.8 and 5.9 present estimates from regressions where industry shares have been replaced by a range of firm and industry characteristics. The coefficients on these indicate whether there are significant differences in the behaviour of firms conditional on either employment growth or output shock.¹⁸ Tables 5.8 and 5.9 present results conditional on output shock and employment growth respectively. The results show the effects of average tenure composition, working proprietor and contractor share, and the share of workers who are female, young (less than 25 years of age), or old (55 or over), and industry averages derived from BOS data, as described in the data section. Means of the BOS variables are presented in Table 5.5, separately for the pre- and post-peak periods. The largest changes are that the proportion of employment in firms reporting stable or increasing profitability dropped during the crisis, and firms were more likely to face problems when seeking finance.

Table 5.8. **Firm and industry characteristics conditional on output shocks**

	Net employment growth	Job creation	Job destruction	Accession rate	Separation rate	Monthly wage change
shift if neg (γ^-)	0.296 [0.355]	0.045 [0.219]	0.251 [0.234]	0.102 [0.236]	-0.194 [0.242]	-0.154 [0.386]
shift if pos (γ^+)	0.288 [0.357]	0.042 [0.221]	0.246 [0.236]	0.102 [0.238]	-0.186 [0.244]	-0.148 [0.389]
Δ slope if neg (δ^-)	0.003 [0.013]	0.003 [0.008]	0.000 [0.008]	0.002 [0.008]	-0.001 [0.009]	-0.014 [0.014]
Δ slope if pos (δ^+)	0.007 [0.008]	0.005 [0.005]	0.001 [0.006]	0.004 [0.006]	-0.003 [0.006]	0.002 [0.009]
Industry means (x pre-peak)						
Exporting	0.209 [0.136]	0.188** [0.084]	0.021 [0.090]	0.216** [0.090]	0.007 [0.093]	0.156 [0.148]
Foreign direct investment	-0.363 [0.223]	-0.303** [0.138]	-0.060 [0.147]	-0.267* [0.148]	0.096 [0.152]	-0.168 [0.242]
Collective employment contracts	-0.262 [0.165]	-0.181* [0.102]	-0.082 [0.109]	-0.200* [0.110]	0.063 [0.112]	-0.157 [0.179]
Increase in relative profitability	0.441 [0.294]	0.384** [0.181]	0.057 [0.194]	0.331* [0.196]	-0.110 [0.200]	0.136 [0.319]
Increased profitability	0.163 [0.255]	0.042 [0.158]	0.121 [0.169]	0.104 [0.170]	-0.059 [0.174]	0.010 [0.278]
Sought finance	-0.044 [0.150]	0.136 [0.093]	-0.179* [0.099]	-0.031 [0.100]	0.013 [0.102]	0.029 [0.163]
Finance terms acceptable	0.148 [0.225]	-0.077 [0.139]	0.225 [0.149]	-0.003 [0.150]	-0.151 [0.154]	0.368 [0.245]
Finance terms not acceptable	-0.319 [0.547]	-0.423 [0.338]	0.105 [0.361]	-0.348 [0.364]	-0.029 [0.373]	0.195 [0.594]
Industry means (x post-peak)						
Exporting	-0.079 [0.109]	-0.021 [0.067]	-0.058 [0.072]	-0.030 [0.073]	0.049 [0.074]	0.107 [0.119]
Foreign direct investment	0.119 [0.189]	0.068 [0.117]	0.051 [0.125]	0.024 [0.126]	-0.096 [0.129]	-0.395* [0.205]
Collective employment contracts	-0.061 [0.133]	-0.049 [0.082]	-0.012 [0.088]	0.021 [0.089]	0.082 [0.091]	0.153 [0.145]
High relative profitability	-0.144 [0.291]	-0.076 [0.180]	-0.069 [0.192]	-0.264 [0.194]	-0.120 [0.199]	0.283 [0.317]
Stable or increasing profitability	-0.017 [0.166]	-0.060 [0.103]	0.043 [0.110]	-0.095 [0.111]	-0.079 [0.113]	0.113 [0.181]
Sought finance	-0.035 [0.162]	0.065 [0.100]	-0.100 [0.107]	-0.021 [0.108]	0.013 [0.110]	0.119 [0.176]
Finance terms acceptable	-0.029 [0.168]	-0.012 [0.104]	-0.017 [0.111]	0.019 [0.112]	0.048 [0.115]	0.335* [0.183]
Finance terms not acceptable	-0.102 [0.189]	-0.118 [0.116]	0.016 [0.124]	0.094 [0.126]	0.196 [0.129]	0.232 [0.205]
Firm characteristics						
Share of employees with tenure:						
< 1 year	0.008 [0.091]	0.149*** [0.056]	-0.141** [0.060]	0.282*** [0.061]	0.274*** [0.062]	-0.083 [0.099]
1 year to < 2 years	0.221* [0.113]	0.170** [0.070]	0.051 [0.074]	0.195** [0.075]	-0.026 [0.077]	-0.032 [0.122]
2 years to < 3 years	-0.176 [0.129]	-0.094 [0.080]	-0.082 [0.085]	-0.183** [0.086]	-0.007 [0.088]	0.012 [0.140]
3 years to < 4 years	0.268 [0.191]	0.154 [0.118]	0.114 [0.126]	0.173 [0.127]	-0.095 [0.131]	0.143 [0.208]
4 years to < 5 years	0.054 [0.186]	0.005 [0.115]	0.048 [0.123]	-0.015 [0.124]	-0.069 [0.127]	-0.267 [0.202]

Table 5.8. **Firm and industry characteristics conditional on output shocks (cont.)**

	Net employment growth	Job creation	Job destruction	Accession rate	Separation rate	Monthly wage change
Share of total employment:						
Working proprietors	0.620 [0.917]	0.792 [0.566]	-0.171 [0.605]	1.466** [0.611]	0.846 [0.626]	-0.155 [0.997]
Contractors	0.499 [0.304]	0.307 [0.188]	0.192 [0.201]	0.211 [0.202]	-0.289 [0.207]	0.526 [0.330]
Female	-0.022 [0.067]	-0.0696* [0.0413]	0.047 [0.044]	0.016 [0.045]	0.038 [0.046]	-0.034 [0.073]
Young (< 25 years)	-0.190 [0.116]	-0.109 [0.072]	-0.081 [0.077]	-0.067 [0.077]	0.123 [0.079]	0.158 [0.126]
Old (> 55 years)	0.148 [0.245]	0.214 [0.151]	-0.065 [0.162]	-0.068 [0.163]	-0.216 [0.167]	-0.086 [0.267]
Medium-sized firm share (20 to 50)	0.033 [0.207]	-0.060 [0.128]	0.092 [0.137]	0.110 [0.138]	0.077 [0.141]	0.209 [0.225]
Large-sized firm share (50+)	0.154 [0.174]	0.086 [0.107]	0.069 [0.115]	0.248** [0.116]	0.094 [0.119]	0.060 [0.189]
Auckland region share	0.041 [0.071]	-0.023 [0.044]	0.064 [0.047]	-0.017 [0.047]	-0.057 [0.048]	-0.066 [0.077]
Wellington region share	-0.163 [0.120]	-0.179** [0.0742]	0.016 [0.080]	-0.164** [0.080]	-0.001 [0.082]	0.200 [0.131]
Christchurch region share	-0.120 [0.121]	-0.116 [0.074]	-0.003 [0.080]	-0.072 [0.080]	0.048 [0.082]	0.099 [0.131]
Other North Island share	0.030 [0.076]	-0.003 [0.047]	0.033 [0.050]	0.035 [0.051]	0.005 [0.052]	-0.140* [0.083]
Observations	362	362	362	362	362	362
R ²	0.707	0.914	0.866	0.951	0.922	0.678
p(char effects are zero)	0.229	0.000	0.010	0.000	0.000	0.266
p(equal slope effects)	0.857	0.871	0.903	0.878	0.908	0.426
p(uniform level shift)	0.160	0.469	0.147	0.959	0.036	0.388

Notes: Standard errors in brackets. All regressions are employment-weighted using average quarterly employment. Significance: * = 10%; ** = 5%; *** = 1%. Observations are period-bin combinations, with two periods ("pre-peak" = 2004 Q3-2007 Q4; "post-peak" = 2008 Q1-2010 Q1).

Source: Authors' calculations.

Table 5.9. **Firm and industry characteristics conditional on employment change**

	Accession rate	Separation rate	Monthly wage change
shift if neg (γ^-)	0.241* [0.128]	0.249* [0.129]	-0.180 [0.413]
shift if zero (γ^0)	0.242* [0.128]	0.249* [0.129]	-0.177 [0.413]
shift if pos (γ^+)	0.249* [0.128]	0.256* [0.130]	-0.180 [0.415]
Δ slope if neg (δ^-)	-0.005 [0.007]	0.009 [0.008]	0.001 [0.024]
Δ slope if pos (δ^+)	-0.004 [0.008]	-0.001 [0.008]	0.0464* [0.027]
Firm characteristics			
Share of employees with tenure:			
< 1 year	0.205*** [0.031]	0.204*** [0.031]	0.093 [0.099]
1 year to < 2 years	0.116** [0.045]	0.110** [0.045]	-0.046 [0.144]
2 years to < 3 years	0.064 [0.049]	0.069 [0.050]	0.066 [0.160]

Table 5.9. **Firm and industry characteristics conditional on employment change**
(cont.)

	Accession rate		Separation rate		Monthly wage change	
3 years to < 4 years	0.120*		0.120*		0.324	
	[0.063]		[0.064]		[0.203]	
4 years to < 5 years	-0.021		-0.026		0.322	
	[0.076]		[0.077]		[0.245]	
Share of total employment:						
Working proprietors	-0.313		-0.405		-0.463	
	[0.288]		[0.291]		[0.931]	
Contractors	0.124		0.122		-0.039	
	[0.115]		[0.116]		[0.372]	
Female	0.015		0.020		0.105	
	[0.026]		[0.026]		[0.085]	
Young (< 25 years)	0.065		0.060		-0.137	
	[0.049]		[0.049]		[0.157]	
Old (> 55 years)	0.062		0.039		-0.225	
	[0.100]		[0.101]		[0.322]	
Medium-sized firm share	-0.003		0.013		-0.167	
	[0.044]		[0.045]		[0.143]	
Large-sized firm share	-0.009		-0.001		-0.129	
	[0.047]		[0.047]		[0.151]	
Auckland region share	-0.008		0.001		0.058	
	[0.026]		[0.027]		[0.085]	
Wellington region share	-0.017		-0.002		0.139	
	[0.044]		[0.045]		[0.142]	
Christchurch region share	-0.040		-0.039		-0.023	
	[0.043]		[0.043]		[0.137]	
Other North Island share	-0.067**		-0.057**		0.085	
	[0.028]		[0.028]		[0.090]	
Industry means	x pre	x post	x pre	x post	x pre	x post
Exporting	0.043	0.012	0.039	0.011	0.012	0.047
	[0.044]	[0.038]	[0.044]	[0.038]	[0.141]	[0.122]
Foreign direct investment	-0.043	-0.010	-0.033	-0.006	-0.199	0.371
	[0.073]	[0.070]	[0.074]	[0.071]	[0.236]	[0.226]
Collective employment contracts	-0.048	-0.045	-0.035	-0.040	0.288	0.026
	[0.057]	[0.048]	[0.058]	[0.048]	[0.184]	[0.154]
High relative profitability	-0.049	-0.060	-0.096	-0.089	0.119	0.486
	[0.094]	[0.116]	[0.095]	[0.117]	[0.303]	[0.375]
Stable or increasing profitability	0.153	-0.044	0.179*	-0.039	-0.074	-0.426*
	[0.103]	[0.078]	[0.104]	[0.079]	[0.332]	[0.252]
Sought finance	-0.075	-0.029	-0.096*	-0.043	-0.144	-0.697***
	[0.056]	[0.067]	[0.056]	[0.068]	[0.180]	[0.216]
Finance terms acceptable	0.032	-0.133*	0.029	-0.134*	0.095	0.402*
	[0.071]	[0.069]	[0.071]	[0.070]	[0.228]	[0.222]
Finance terms not acceptable	0.148	0.016	0.129	0.023	-0.866	0.741***
	[0.164]	[0.076]	[0.166]	[0.077]	[0.531]	[0.245]
Observations	358		358		358	
R ²	0.999		0.999		0.818	
p(char effects are zero)	0.000		0.000		0.011	
p(equal slope effects)	0.916		0.509		0.324	
p(uniform level shift)	0.001		0.005		0.927	

Notes: Standard errors in brackets. All regressions are employment-weighted using average quarterly employment. Significance: * = 10%; ** = 5%; *** = 1%. Observations are period-bin combinations, with two periods ("pre-peak" = 2004 Q3-2007 Q4; "post-peak" = 2008 Q1-2010 Q1).

Source: Authors' calculations.

Overall, there are relatively few statistically significant coefficients across the two tables. Prior to the cyclical peak, the job creation and accession rates were significantly higher in export industries, and in industries in which firms reported high relative profitability, controlling for the size of output shocks (Table 5.8). However, these patterns were absent post-peak. Conditional on output shocks, few firm characteristics were significantly related to job and worker flows. Worker flow rates are higher in firms with a high proportion of low-tenure workers, though this is not surprising if there is persistence in employee turnover rates over time. Low-tenure firms also have higher JCRs and lower JDRs, as expected. Firms in which working proprietors account for a high proportion of employment have higher worker accession rates, conditional on the size of their output shock, as do large firms. The only other significant pattern is that firms with a presence in the Wellington region experienced the lowest job creation and worker accession rates.

Due to the inclusion of both pre- and post-peak industry-level covariates, the level-shift coefficients (γ^- and γ^+) are not interpretable, although the difference between them is interpretable. For the output shock (Table 5.7), only in the case of the separation rate are the positive and negative shifts different from each other. Furthermore, none of the slope-change coefficients are significantly different from zero.

Table 5.9 shows the role of industry and firm characteristics in explaining patterns of job flows and wage growth, conditional on employment growth. As in Table 5.8, the post-peak shift parameters (γ) are not interpretable due to the inclusion of pre- and post-peak industry means. The difference between γ^- and γ^+ is significant for the accession and separation rates implying a wedge between the two, consistent with Table 5.6. The increase in slope of the wage-growth curve for positive employment change (δ^+), which was also evident in Table 5.6 and Figure 5.7 remains significant, though only at the 10% level. Few firm characteristics are significantly related to worker flows or wage growth, conditional on employment growth cells. Accessions and separation rates are higher for firms with a relatively high prevalence of low-tenure-workers, as would be expected in high turnover firms. Worker flows are lowest for firms in the North Island outside of Auckland or Wellington. Similarly, industry characteristics do not account for the heterogeneity of worker flow rates within employment growth cells. The only industry characteristics associated with heterogeneity of wage growth are finance-related. Wage growth was lower in industries where a high proportion of firms sought finance, though only post-peak. Puzzlingly, in industries where a high proportion of firms reported that finance terms were not acceptable, wage growth was lower.

Conclusions

New Zealand's labour market institutions favour flexibility and work incentives, and have relatively light levels of protection for those out of work. Given these settings, this chapter hypothesised that the output and employment declines associated with the 2008-09 financial crisis would have been accompanied by lowered worker flows (accessions and separations), and raised rates of firm exit. The first of these hypotheses is supported by the data but no evidence was found of significant adjustment in the form of firm exit. It is possible that this margin is important for firms outside the scope of the analysis – namely, very small (less than three employee) and potentially working proprietor-only businesses.

More generally, this chapter's analysis of firm micro-data highlights two key features of New Zealand labour market adjustment during the GFC. First, there was considerable heterogeneity across firms, both before and during the crisis, in the size of output shocks

that firms faced, the amount of employment adjustment in response to any given output shock, and in the size of worker flows given the firm's employment adjustment. For small changes in output (net change between -5% and 5%), the elasticity of employment change with respect to output change was, on average, 0.2 prior to the crisis. For larger output changes, the employment response was less systematic – perhaps reflecting transitory volatility in output. Output growth was, however, transmitted into employment growth for faster growing firms (those at the upper quartile of NEG for a given output shock), and output declines led to employment declines for slower growing firms. Conditional on the level of NEG, there is a clear relationship between worker turnover rates and wage levels. Firms with low worker turnover tend to have higher wage levels.

Second, the crisis not only moved the distribution of output shocks faced by firms, but also altered the relationship between output shocks and changes in job and worker flows and employment. Worker and job turnover rates, as well as wage growth, were lower during the crisis, even controlling for the size of firms' output shock or NEG.^{19, 20}

This study interprets slower worker turnover and wage growth post-peak as a reflection of workers' desire to retain jobs in the crisis. For workers who lost employment, the lower turnover rates would have made it more difficult to find jobs. Increased use of active labour market policies targeted at affected workers, such as youth, serves as a mechanism for ameliorating the impact on them. Recent studies have argued for increased generosity of unemployment benefit levels during recessions, on the grounds that the payment levels or durations help to fund extended job search, without smaller adverse work disincentives than would accompany generous payments in non-recessionary times.²¹

Notes

1. A recent review of theoretical and empirical findings on the impact of labour market institutions on job and worker flows, including the impact on cyclical adjustment patterns, can be found in Bassanini et al. (2010). See also Martin and Scarpetta (2011). Other relevant studies include Messina and Vallanti (2007); Gómez-Salvador, Messina and Vallanti (2004) and Salvanes (1997).
2. Acemoglu and Shimer (2000) argue that social insurance can encourage workers and firms to establish more productive jobs that require investments in specific and risky skills. Without such insurance, workers would favour less risky and less productive jobs.
3. Turning points were identified using the Bry-Boschan quarterly algorithm outlined in Harding and Pagan (2002), with (window = two quarters; minimum phase = three quarters; minimum cycle = five quarters). This was applied to seasonally adjusted real production GDP, and seasonally adjusted total employment derived by splicing the historical series in Chapple (1994) with the latest revision of the Household Labour Force Survey.
4. The recession starting in 1950 Q4 took 14 quarters to regain its previous peak, and the recession starting in 1976 Q2 took 18 quarters.
5. The relative rise in youth unemployment started at around the same time as the 1 April 2008 increase of the minimum wage for 16 to 17-year-olds to the level of the adult minimum wage (from USD 9 to USD 12 per hour) and the introduction of a new entrants' wage (USD 9.60 per hour).
6. Specifically, the measure compares employment on the 15th day of the month in the middle of a quarter to employment at the same point in the middle of the previous quarter.
7. This study uses official LEED statistics at the two-digit ANZSIC 2006 industry reallocated to ANZSIC 1996 industries using the algorithm in Grimes, Maré and Morton (2009). Each ANZSIC 2006 industry is allocated to an ANZSIC 1996 industry provided at least 82% of the source industry's employment is in the target industry, otherwise it is omitted. The resulting concordance omits 3.2% of employment and misallocates up to 1.5% of employment.
8. This study refines the longitudinal links in the LBD, making use of plant-level data, as outlined in Fabling (2011).

9. Net employment growth (N) is related to the more familiar percentage growth rate ($g = (E_t - E_{t-1})/E_{t-1}$) by the formula $N = 2g/(2+g)$.
10. Industry and firm size categories are defined to match the survey strata for BOS, from which industry-firm-size characteristics are drawn.
11. This measure of collective employment agreement coverage overstates the true measure of around 10% (Foster et al., 2011) because it counts all employees at affected firms – not just those on collective contracts.
12. Using ANZSIC 96, the excluded industries are M (government administration and defence), P92 (libraries, museums and the arts), and Q95-Q97 (personal and other services, and private households employing staff). Using ANZSIC 06, excluded industries are O (public administration and safety) R89-R90 (heritage and artistic services) and S95-S96 (personal and other services, and private households employing staff).
13. This study ranks by accession rate. The results are very similar using separation rates, since it is conditioning on a narrow net employment growth range. Quartiles are employment weighted so that each quartile contains approximately the same number of jobs.
14. Using the formula $(E_t - E_{t-1})/[(E_t + E_{t-1})/2]$ the smallest non-zero net employment growth for a firm of initial size n is an increase of $1/(n+0.5)$ or a decrease of $-1/(n-0.5)$. For a firm with employment of 20, the smallest non-zero change is an increase of 0.049 or a decrease of -0.051.
15. The output shock distribution excludes firms who entered during the quarter over which employment change is measured, because lagged sales are almost always unavailable for such firms. It also excludes firms that exited during the four-quarter period over which the output shock is measured, since such firms are not part of the sample for which employment change is observed (though firms with an output shock of -2 remain in the sample). Consequently, the proportion of employment in firms with -2 output shocks is underestimated.
16. This is, at best, a partial explanation. It cannot account for uniformly lower worker flow rates conditional on net employment growth.
17. The last of these only appears for net employment growth bins, since output shocks are seldom zero and, consequently, there is no separate zero bin for output shocks.
18. The industry and firm characteristics may also be related to which output shock or employment growth bin the firm is in but this relationship is not investigated in the current paper.
19. The puzzling exception is that firms facing a given large positive output shock had lower net employment growth post-peak, resulting from lower job creation and higher job destruction.
20. The impact of selected industry and firm characteristics is estimated on heterogeneous flow rates but few statistically significant relationships were found.
21. See e.g. Chetty (2008); Schmieder, von Wachter and Bender (2012); or Kroft and Notowidigdo (2011).

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Chapter 6

Employment dynamics in Costa Rica after the global financial crisis

by

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This chapter analyses employment patterns in Costa Rica in a post-crisis framework from a firm-level perspective. The analysis suggests that growth patterns in employment in Costa Rica differ across firms according to their size, economic activity, linkages to international markets and participation in special trade regimes. For instance, large manufacturing exporting firms have the highest relative concentration of growing firms, while agriculture has the highest concentration of non-growing firms. In the manufacturing sector, the Free Trade Zone (FTZ) regime shows a higher relative concentration of firms with positive growth, which suggests that FTZ favours job creation. In particular, larger differences in growth patterns can be found among MSMEs depending on their integration into international markets: the exporting ones grow faster than those that target the domestic market.

The views expressed in this chapter are those of the authors and do not necessarily reflect the views of the Ministry of Foreign Trade of Costa Rica. The authors bear full responsibility for any errors or omissions.

Introduction

The Costa Rican economy recovered relatively rapidly from the effects of the last major international financial crisis. Gross domestic product (GDP) increased by 5% in 2010 and revolved around 3% for the following years. However, the unemployment rate has not returned to its pre-crisis level and remains around 10%. The rigidity of the labour market seems to be linked with the business dynamics and the structural capacity of firms to increase their levels of employment.

Findings from previous studies in Costa Rica suggest some factors that may play an important role in firm dynamics, such as their initial size, economic sector, integration into international markets, and linkages to foreign capital. However, until very recently lack of data has prevented further analysis at a micro level on a time-series basis. This study uses a longitudinal dataset of firms to identify employment growth patterns among Costa Rican firms between 2010 and 2012. The sample used for this study was taken from the Directory of Companies and Establishments (DEE), which is a record of “private sector institutional units and establishments” developed by the National Institute of Statistics and Census (INEC). The sample chosen accounts for 45% of the total employment of all firms registered in the DEE.

It is important to bear in mind that large firms and the manufacturing sector are over-represented relative to their share at the national level in the sample used for this study. Consequently, this study’s dataset depicts a relatively larger manufacturing sector and a relatively smaller services sector and a higher share of larger firms relative to that observed in the whole population of firms. In order to prevent misleading conclusions, micro, small and medium-sized enterprises (MSMEs) and large firms were analysed separately.

The analysis focuses on the differences in firm performance based on employment growth according to economic sector, integration into international markets, and participation in special trade regimes. Estimates of annual growth rates were calculated applying two common methodological approaches: the geometric growth rate of employment – by group of firms – and the growth rate of employment, at the firm level (see Box 6.1 for further details). An analysis of net job creation in the period 2010-12 was also carried out by economic activity and exporting condition, using a methodology on job creation and destruction previously applied by Criscuolo, Gal and Menon (2014).

This chapter’s analysis suggests that growth patterns in firms’ employment differ across sectors, which holds as well when firms are grouped by size and exporting condition. For example, growth patterns between large firms differ when their economic activity is taken into account: large manufacturing exporting firms have the highest concentration of growing firms, while large exporting firms in agriculture have the highest concentration of non-growing firms. In the manufacturing sector, firms within the Free Trade Zone (FTZ) regime have a higher concentration of firms with positive growth than firms outside the FTZ regime, which suggests that FTZ tends to favour job creation. Differences can also be found among exporting MSMEs, for which an outstanding 93% of

services firms increased employment, way above the share of growing firms in agriculture and manufacturing (35%). As the economic activity does seem to be a key determinant in growth patterns of firms, larger differences in growth patterns can be found among MSMEs depending on their integration into international markets: the exporting ones grow faster than those that target the domestic market.

The next section of this chapter offers an overview of the recent economic situation of Costa Rica and the main facts on employment and firm dynamics. The third section describes the dataset used and presents the methodological approach followed, while the fourth section describes the main findings derived from a sample of firms included in the newly built DynEmp database for Costa Rica. Finally, the last section summarises the main conclusions.

A stable economy relying on open markets, still adapting to new industrial dynamics

The Costa Rican economy recovered relatively rapidly from the effects of the last major international financial crisis of 2008-09. In fact, real GDP recovered from a negative growth rate of 1% in 2009 to 5% in 2010, revolving around 3% for the following years and achieving 3.5% by 2014 (BCCR, 2014). Such growth has been mainly driven by manufacturing and services exporting activities. These sectors, including non-exporter activities, accounted for 94.8% of domestic production by the end of 2015. Manufacturing has shown an annual average growth of 5.3% and accounts for about 23.6% of GDP, while services have grown on average 4.0% per year, thus moving from 58.8% of GDP in 1995 to 71.2% in 2015.

Since 1999, exports of goods have grown at an annual average of 3.5%, driven mainly by exports of sophisticated goods (electronics and medical devices) and agricultural crops. On the other hand, for the same period, exports of services have shown an average growth rate of 9.2% per year. Although the United States remains the main trading partner (accounting for 40.4% of Costa Rica's total goods trade), the broad diversification of trading partners and products of the Costa Rican economy has clearly contributed to reduce its vulnerability to demand-driven shocks, as it was witnessed during the last major international financial crisis of 2008-09 (Ulate et al., 2013). Additionally, as found by da Costa Neto and Romeu (2011), diversification of products provided relief by preventing a higher decline in exports.

International insertion as a foundation for growth, diversification and sophistication

Perhaps the beginning of Costa Rica's structural shift dates back to the early 1980s, when the country installed an export promotion strategy with the aim of modernising and diversifying its productive structure – mostly reliant in those days on a few agricultural crops (e.g. coffee and bananas). FTZs were established with the main purpose of promoting exports of non-traditional goods and promoting stronger linkages with international markets through a transparent, stable and friendly business environment.

Internal reforms were followed by an active engagement in the multilateral trading system (Costa Rica joined the General Agreement on Tariffs and Trade [GATT] in 1991 and the World Trade Organization [WTO] in 1995) and the negotiation of several Free Trade Agreements (FTA) with strategic partners. The country is a member of the Information Technology Agreement (ITA), recently endorsed its expansion, and by 2015 had in place 13 FTA, comprising trade with 48 commercial partners – including the European Union (27),

the European Free Trade Association (EFTA), the United States, Canada, Mexico, Chile, the People's Republic of China (hereafter "China"), Peru, Singapore and others – collectively accounting for 81.5% of the country's imports and 85.5% of its exports (COMEX, 2015).

With the objective of attracting foreign direct investment in key industrial activities, the Costa Rican Investment Promotion Agency (CINDE) was created in 1982 as a non-government, non-profit, private sector-driven organisation. Using as leverage the healthy investment climate and a robust and comprehensive trading platform, CINDE has performed as one of the top foreign direct investment (FDI) attracting agencies in Latin America and has managed to attract more than 250 globally leading multinational companies in high technology, light manufacturing and sophisticated services – mostly operating in the FTZ regime.

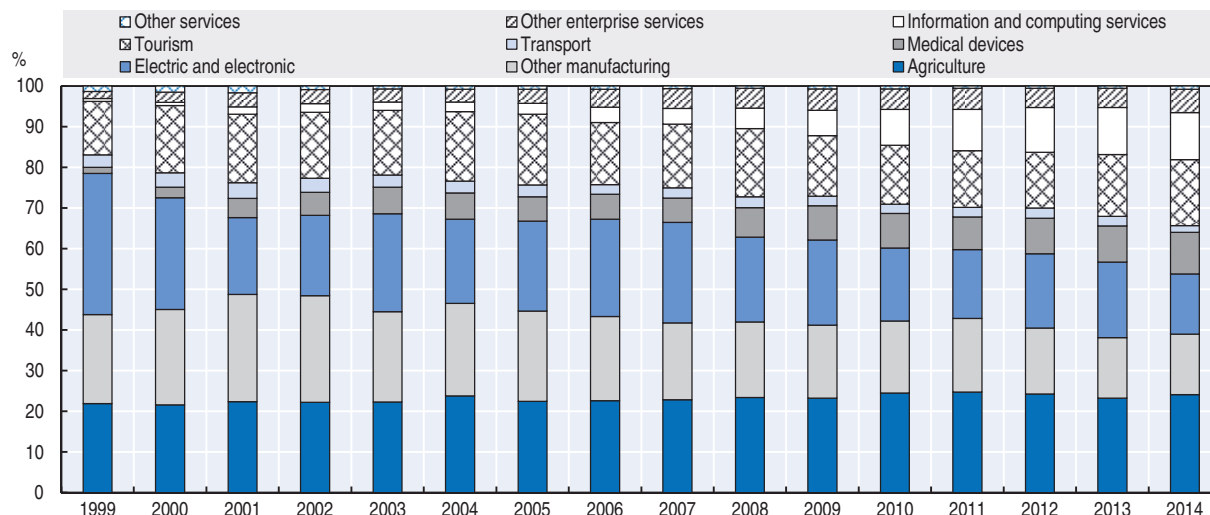
When created, the FTZ regime initially attracted textile and clothing companies, while the economy still relied heavily on agricultural exports. In 1995, FTZs accounted for 12.3% of total exports, and manufacturing represented 46.8% of total goods exports. However, by 2000 the FTZ regime accounted for half of total goods exports, and manufacturing represented 71.2% of goods exports. This transition accelerated as textiles and clothing activities were replaced by other activities with an increasing level of sophistication (therefore employing more medium and highly-skilled workers), such as electronics, back-office services and more recently a strong, vigorous and rapidly growing medical devices cluster. Over the last two years, the electronic components sector has undergone a significant transformation – shifting away from manufacturing towards high value-added sophisticated services – and the vigorous sustained growth of medical devices manufacturing and services activities have contributed to smooth the overall impacts of such transition. Along with the already mature tourism industry, the increasing importance of services exports has been boosted by the opening of the telecommunications sector to private investment in 2008, and the outstanding performance of information technology (IT) services and business support services exports (see Figure 6.1). In fact, the Economic Commission for Latin America and the Caribbean (ECLAC) has recently pointed out that Costa Rica is currently the top exporter of these two types of services in Latin America, accounting in both cases for over 40% of the total exported by the region.

The trading platform built by the country over the last two decades has provided the grounds for engaging more actively in the global economy, integrating in global value chains and starting to move towards upgrading in such global production networks. In fact, indicators of the *Trade in Value-Added* (TiVA) database show that from 1995 to 2011, domestic value-added content in Costa Rica's gross exports increased at an average rate of 7.6% per year. This can be related to the company of multinational companies in industries that are relatively intensive in the use of highly-skilled labour, such as medical devices and electronics (ECLAC, 2014). Moreover, one-third of the exported value of these sectors corresponds to imported inputs, which shows the complementarity of imports in the production process. The increase in value-added creation can be also attributed to the growing share of services in the economy.

Policies have also focused on promoting further integration of MSMEs into international markets and foster linkages with the multinational companies that operate in the country. For example, amendments to the FTZ Law (No 7210) allowed for more flexible outsourcing mechanisms (Monge-González, Rivera and Rosales-Tijerino, 2010). Also, the Foreign Trade Promotion Agency (PROCOMER) offers market intelligence support and training programmes that promote export capacity building and domestic value creation in MSMEs that export or

have the potential to export (Conejo, 2013). However, even though by 2012 around 80% of exporting firms were MSMEs, their share in total trade remained fairly low, at around 15% (Leiva, 2013).

Figure 6.1. **Structure of exports of goods and services**



Note: Preliminary data for 2014, subject to changes.

Source: COMEX, using data from PROCIMER and BCCR.

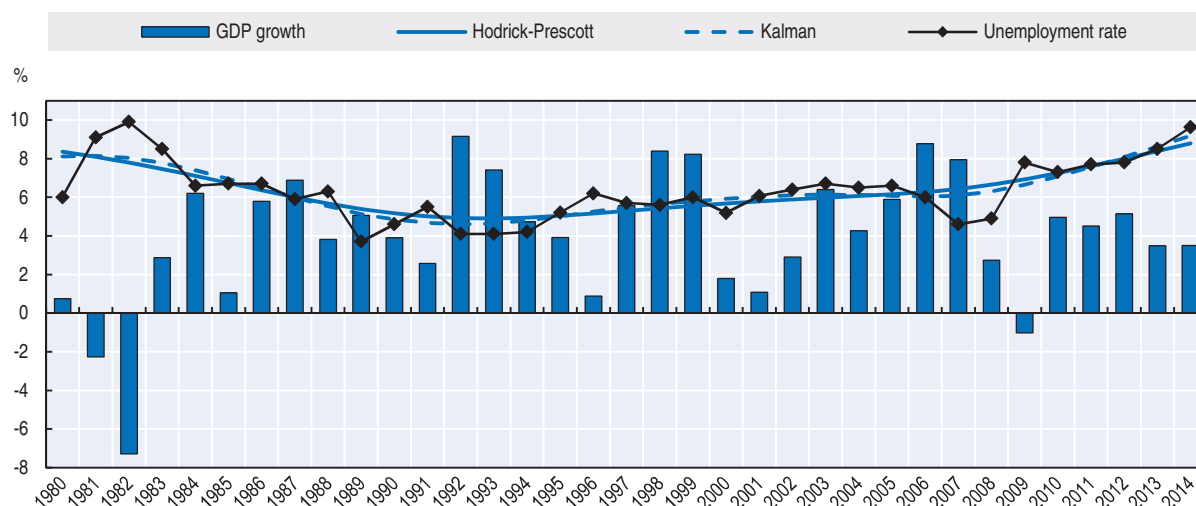
Growth with unemployment: a structural problem

Consistent and robust trade and investment policies have allowed Costa Rica to steadily increase its exports at an annual average of 7.4% since 1980, while per capita income rose from USD 3 167 in 1994 to USD 10 322 in 2014. In contrast, the unemployment rate has been reluctant to return to its pre-crisis level (see Figure 6.2). By 2014, the unemployment rate remained around 10%, a figure that exceeds the average for the last 35 years and which is only comparable to the unemployment rate during the crisis of the 1980s.

Moreover, unemployment among highly-skilled workers has traditionally been lower than for low-skilled workers. However, unemployment statistics by level of skills indicate that this gap diminished between late 2014 and early 2015 as a result of the increase in unemployment among the highly-qualified workforce (see Figure in Annex 6.A1).

These facts suggest a possible structural change in the level of unemployment in Costa Rica. To test it, the trend component of unemployment was estimated in Costa Rica using two statistical tools: the Kalman filter and the Hodrick-Prescott filter. The latter breaks down the observed series in two components: the trend and the cycle. In turn, the first method obtains the trend from a set of mathematical equations, as explained by Solera (2003), thus providing an efficient recursive solution to the least-squares method. This solution allows for computing a linear, unbiased and optimal estimator (minimum variance) of the state of a process at each point in time, based on information from the previous period.¹

The unemployment rate in Costa Rica has followed a growing trend since the early 1990s, which has clearly accelerated since the last international crisis of 2008-09 (see Figure 6.2). Both methods confirm that the increase in unemployment recorded since the latest international crisis does not represent a deviation with respect to its trend, but rather an increase of the trend itself.

Figure 6.2. Unemployment rate,¹ estimated trends² and GDP growth

1. Methodological changes after 2009 and the use of another survey after 2013 should be taken into account when comparing unemployment statistics.

2. A lambda value of 100 was used for the Hodrick-Prescott filter.

Source: COMEX, using data from INEC and BCCR.

The rate of structural unemployment in the last 35 years in Costa Rica was also estimated following the conceptual framework provided by “Okun’s Law”. The approach establishes the existence of an inverse correlation between unemployment and economic growth. The formal specification used to estimate this relationship is based on a study by Arias, Kikut and Madrigal (2002),² which assumes that the level of unemployment in a specific year is the result of a combination of four components: i) a fixed and unchanging-over-time “base” level; ii) a factor reducing unemployment in a fraction of the cyclical component of output growth; iii) a component of inertial nature which corresponds to a fraction of the unemployment registered in the immediately preceding year; and iv) a random component that causes a small fluctuation and follows a normal probability distribution with zero mean and constant variance.

Based on the behaviour of unemployment over time and once the coefficients for the first three components were estimated, structural unemployment (or long-term unemployment) of the economy can be calculated. However, before proceeding with the estimation it is necessary to check for evidence of significant structural changes in the period considered (1980-2014). The test of equality of coefficients or “Wald Test”³ was used for this purpose. The results for this indicator showed that there is a structural change in the unemployment trend in Costa Rica that took place in 2009.

Therefore, the rate of structural unemployment was estimated for the period 1980-2008 and for 2009 onwards. The results⁴ show a structural unemployment rate of 5.8% between 1980 and 2008, and one of 8.6 % from 2009 onwards.

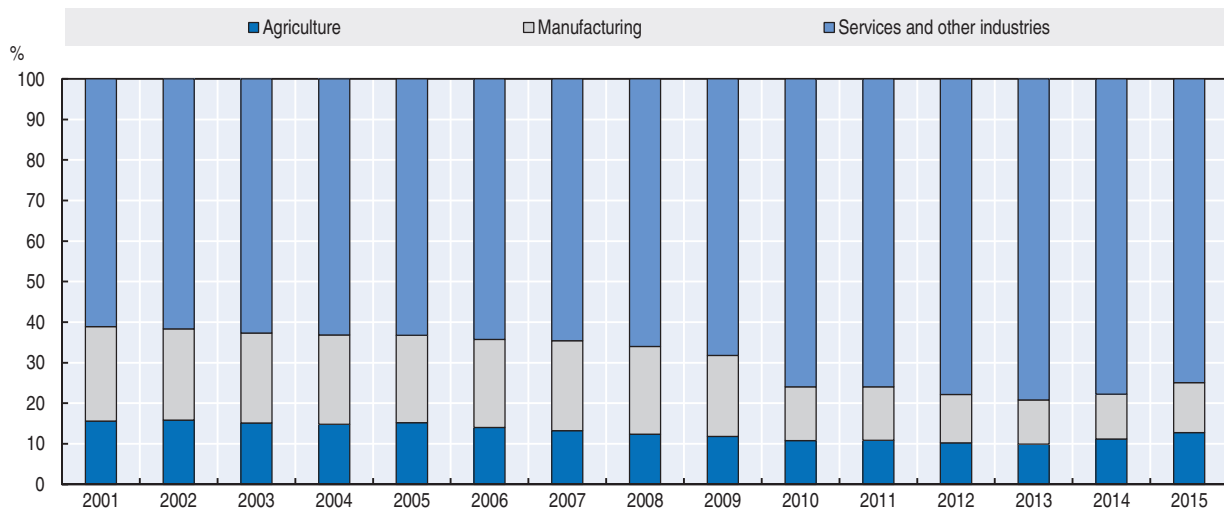
According to the Central Bank of Costa Rica (BCCR, 2016):

“the unemployment situation seems to be related to a mismatch between supply and demand of labour given structural change in the economy, both in terms of economic activity and institutional sector. Also, it could be influenced by the lack of geographical mobility and the mismatch between supply and demand in terms of positions, salaries, education level, age and specialisation.”

The vulnerabilities in the labour market from a demand perspective were confirmed by a survey carried out on a quarterly basis since 2011 by INEC, where a consistent figure of 60% of the unemployed workforce reported having working experience but being unable to find a job due to market reasons, such as competition or closure of business. Since 2015, 30% of newly unemployed people mentioned layoff as the cause of their condition, a figure that has been growing since 2014, when it reached its lowest point of 17.3% (BCCR, 2016). As the majority of the employed population (around 62.7%) is working in the private sector (INEC, 2013),⁵ it is plausible that activities that have been able to absorb important quantities of workers in the past are capable of absorbing less nowadays, while the more dynamic ones are focusing on a much more skilled and qualified workforce.

Indeed, Costa Rica is increasingly becoming a services-oriented economy: by the end of 2015 its services sector is expected to account for 71.2% of the GDP, 74.9% of total employment (see Figure 6.3) and around 40% of total exports. In contrast, manufacturing accounted in 2015 for 23.6% of GDP, 12.4% of total employment and 38% of total exports. Even though the agricultural sector accounted only for 5.2% of GDP in 2015, it concentrates 22% of total exports and 12.7% of total employment. Agriculture has been very successful in integrating into international markets, to the extent that Costa Rica exports USD 7.2 of agricultural products for each imported dollar of such products. The agricultural sector remains indeed an important absorber of low-skilled labour and any loss of its absorption capacity would have a big impact on employment dynamics. This is particularly relevant as the shift of workers towards manufacturing and services might not flow smoothly in light of the differences in skills levels.

Figure 6.3. **Costa Rica, employment structure by industry**



Note: Methodological changes after 2009 and the use of another survey after 2013 should be taken into account when comparing periods.
Source: COMEX, using data from INEC.

There are a few studies about employment dynamics of Costa Rican firms that shed some light on these phenomena. Monge-González and Torres-Carballo (2015) explored the dynamics of entrepreneurship based on firm entry, exit and growth rates of employment. The authors used a panel data of firms between 2001 and 2012 from the Caja Costarricense de Seguro Social to explore the relationship between growth rate and firm size. They applied an ordinary least square (OLS) regression model that controlled for fixed effects and firm age. A negative relationship between growth and firm size was found and, according to the

authors, this suggests that small and young firms grow faster than other firms. Monge-González and Torres-Carballo also identified the types of firms that generate more jobs while sustaining high growth rates, better known as “gazelles”. The estimated probability of being a gazelle suggested that the size of firms and their condition as exporters are positive determinant factors, while linkages with multinational companies were not statistically significant in this case. Also, using an OLS model with fixed effects, the authors found that firm growth has a positive relationship with the exporting status regardless of firm size, while linkages with multinational firms have a positive effect on employment growth for micro-enterprises. These relationships were also tested for firms in different economic activities, being significant in the manufacturing and services sectors, while the mining and agricultural sectors showed non-significant results.

Another study by Monge-González et al. (2011) explores the role of innovation in products and processes on growth of employment for manufacturing firms. The authors test whether innovation strategies in firms create or displace employment, and the existence of significant differences in labour demand according to firm size, skills and gender. A database from a survey of innovation applied to Costa Rican firms in 2006-07 was used to estimate a two-step model with instrumental variables. In the first stage, innovation strategies affect innovation outputs; in the second stage, innovation outputs affect employment growth. Two innovation strategies were tested: in-house innovations (research and development (R&D) or activities such as training, engineering, industrial design and management) and innovations externally acquired (licensing, external R&D, hardware, software, consultancies and machinery and equipment). The results show a positive effect of innovation in products and processes on employment growth. Product innovation generates employment growth in all firms regardless of their size. In the analysis of skilled/unskilled demand of workers, demand of skilled labour relates positively to product innovation, while unskilled labour relates positively to innovations in products and processes.

In turn, Padilla and Alvarado (2013) focus on firm productivity and its relationship to foreign trade. The authors analyse differences in labour productivity between exporting firms and non-exporting firms by using a Heckman-type two-stage model: in the first stage, the probability of exporting for every firm is estimated; in the second stage, the method corrects for selection bias and estimates the relationship between the decision to export and firm productivity (measured in annual sales per employee, in Costa Rica colones).⁶ The productivity gap between exporting and non-exporting firms was estimated using the Oaxaca-Blinder methodology. Results show a gap of 27.7% in favour of exporting firms. However, exporting firms are, on average, more productive due to their larger size and they also pay higher salaries; while non-exporting firms are less productive due to their smaller size and tend to focus on the domestic market. The authors suggest the existence of a circular relationship between productivity and firm size in every group, a circle that behaves negatively for non-exporting firms and positively for the exporting ones.

Data and methodological approach

About the dataset

To conduct the analysis, a database of companies operating in Costa Rica between 2010 and 2012 was used. Data were drawn from the DEE, which comprises more than 50% of the firms operating in the country, thus accounting for approximately 45 000 firms. The database contains characteristics of firms such as year of registration, economic activity and number of employees.

Nonetheless, since 2008, only a limited percentage of the DEE firms are consulted every year to update their information. Updates vary depending on the year, as firms were drawn from a larger pool of firms according to their size and location (INEC, 2011a, 2011b, 2012):

- For 2010 and 2011: 100% of “large”⁷ firms and almost 40% of the remaining firms were contacted (prioritising the amount of workers and the last date of update).
- For 2012: the update was conducted following regional distribution criteria (Huetar, North, Atlantic, Central Pacific and Chorotega regions).

Despite the interest in analysing the evolution of firms’ employment over time, it was not possible to use the entire database: firms were chosen based on the existence of information for the three years, while including new firms that appeared either in 2011 or in 2012. The final sample consists of over 2 000 firms, and even though this number is considerably lower than the total registered in the DEE, it represents 45% of the total employment comprised in the DEE. According to estimates of the Ministry of Economy, Industry and Commerce (MEIC, 2013) based on the DEE 2012, companies with more than 100 employees accounted for 5% of all firms. However, in the sample dataset, around 30% of firms have 100 or more employees. A comparison of the composition of the initial dataset and the final sample can be found in Annex 6.A5.

The DEE dataset was enriched with the inclusion of more firm-level information on goods exports, participation in special export regimes, and information on exports of services obtained from the BCCR. More details on all variables can be found in Annex 6.A6.

Some clarifications concerning the data are necessary before engaging in the analysis. First, the over-representation of large companies in the DEE sample could influence the distribution of employment across activities, thus producing a biased figure of each one’s share in national employment. With the aim of assessing how relevant such bias might be, the distribution of the DEE sample was compared with a similar sample drawn from the Continuous Employment Survey (ECE), which is a representative survey of the workforce at the national level produced also by INEC. The comparison shows an over-representation of employment in the manufacturing sector in the DEE distribution with respect to the ECE distribution (27.5% versus 12.0%, respectively), which happens at the expense of the services sector’s share in employment (58.7% versus 76.2%). In fact, services activities are particularly under-represented for construction (2.3% for the DEE versus 8.0% for the ECE), education (2.4% versus 8.0%, respectively), and other services (0.4% versus 4.3%, respectively). It is worth noting that activities such as information and communication services, on the one hand, and financial and insurance services, on the other, are not under-represented but instead over-represented (3.9% for the DEE versus 2.1% for the ECE; and 5.2% versus 2.6%, respectively). A detailed comparison for all sectors is available in Annex 6.A7.

Second, the variables linked to the firms’ age and year of entry refer to the moment when they were legally registered. This moment does not necessarily match with the year they began operating. Even though mismatches were manually corrected when they could be identified, INEC (2012) reported that 2.8% of the firms comprised in the DEE in 2011 changed their register identification number between 2011 and 2012. Third, the process of updating is based on registers and telephone calls made between February and November of every year that do not cover the entire dataset, but rather a fraction. Therefore, a repeated value for employment in two consecutive years for a firm in the DEE does not necessarily imply that employment did not change, and there is also a chance that some of the changes observed on employment could be due to intra-year business cycle seasonality.

General insights from the data

The Costa Rica DynEmp database provides valuable information in terms of composition of firms and employment dynamics. Tables 6.1 and 6.2 show the descriptive statistics according to firm size. For large firms and MSMEs, the average number of employees differs substantially, scoring 736 versus 47, respectively. On average, large firms were legally registered by 1982, while small firms are ten years younger. There are also important differences across sectors as large firms are distributed more evenly than MSMEs: 50% of large firms are concentrated in services, 32.5% in manufacturing and 17.5% in agriculture. In turn, 70.6% of MSMEs are in the in services sector, 15.1% in manufacturing and 14.3% in agriculture.

Table 6.1. **Descriptive statistics of firms by size**

Variable	All firms	MSMEs	Large firms
Number of employees (average)	136	47	736
Initial year (mean)	1992	1993	1982
Initial year (median)	1996	1997	1987
Economic activity (% of firms)			
Agriculture	14.7	14.3	17.5
Manufacturing	17.3	15.1	32.5
Services	68.0	70.6	50.0
Firm size (% of firms)			
Micro	37.2	42.7	0.0
Small	20.8	23.9	0.0
Medium	29.1	33.4	0.0
Large	12.9	0.0	100.0
External trade variables (% of firms)			
Non-exporter	63.7	68.1	33.9
Exporter	36.3	31.9	66.1
Exporter of goods	33.4	29.3	61.6
Exporter of services	0.5	0.6	0.3
Exporter of both goods and services	2.3	2.0	4.1
Regime			
Outside special trade regimes	30.9	27.7	53.1
FTZ regime	4.5	3.5	11.3
Inward-processing regime	0.8	0.7	1.7
Total number of observations	2 270	1 978	292

Note: See variable description in Annex 6.A6.

Source: Authors' calculations, using data from INEC, PROCIMER and BCCR.

Table 6.2. **Average age and condition of activity of firms, by size and year**

Variable	All			Micro, small and medium			Large		
	2010	2011	2012	2010	2011	2012	2010	2011	2012
Inactive firms (%)	0.2	1.2	2.6	0.3	1.3	2.8	0.0	0.3	0.7
Entrant firms (%)	0.8	2.1	6.9	0.9	2.4	7.9	0.0	0.0	0.0
Age (average)	20.2	20.7	20.2	18.8	19.4	18.7	28.4	29.4	30.4
Observations	2 069	2 113	2 270	1 777	1 821	1 978	292	292	292

Source: Authors' calculations, using data from INEC.

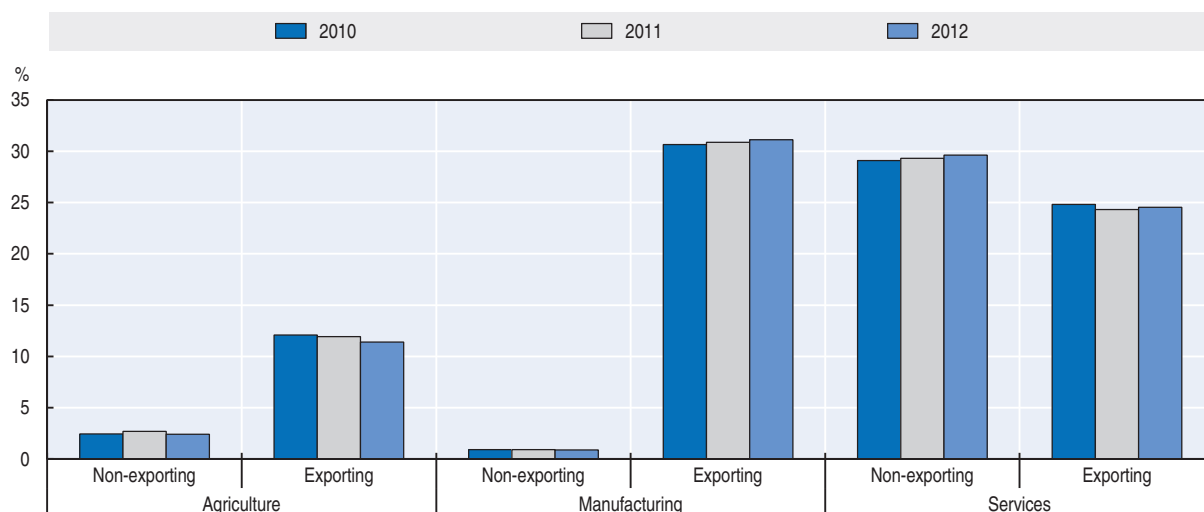
Large firms are more likely to be engaged in international trade (exporting) and benefit from the FTZ regime more than MSMEs: nearly two-thirds of large firms are exporters and most of them (93%) export only goods. Among such exporting firms, 80% do not operate in

a special trade regime, 17% operate under the FTZ regime and the rest under the inward-processing regime. In contrast, less than one-third (31.9%) of MSMEs are exporters (the share that export goods alone [92%] does not differ substantially from that of large firms though), and out of them 86.8% do not operate in a special trade regime, 10.9% operate under the FTZ regime and the rest under the inward-processing regime.

MSMEs also show an increasing percentage of inactive and entrant firms (see Table 6.2) with a tendency to increase over the period. As the number of firms increases every year, the average age of this group decreases. No large firms were registered as entrants during the period, even though some became inactive.

The data also reveals the share of employment that firms account for in each sector (bearing in mind the considerations on the data referred to in the previous subsection). Participation is observed by group of exporting and non-exporting firms in the period 2010-12. Companies in the services sector generated 53.9% of total employment, where the largest portion was created by non-exporting firms. The manufacturing sector accounted for 31.5% of jobs generated in companies in 2010, most of which were created by exporting firms. In turn, companies in the agricultural sector generated 14.5% of the jobs and most of that came from exporting companies.

Figure 6.4. **Share of employment by economic sector and exporting condition of businesses**



Note: The services sector includes construction and other services activities (see Annex 6.A6).

Source: Authors' calculations, using data from INEC.

Methodological approach

A descriptive comparison of employment growth rates at sector and firm level according to economic activity, exporter condition and trade regime was developed in this analysis. Estimates of average annual growth were calculated using the geometric growth rate of employment by group of firms and the growth rate of employment at the firm level.

The geometric growth rate is commonly used in the analysis of population growth. It assumes that the growth rate remains constant every year, which can be taken as a valid assumption in this case given the relatively short period of analysis (three years). Meanwhile, the average rate of employment growth has been widely applied in the empirical analysis of employment at the firm level (some of its advantages are listed in Box 6.1). Both indicators

Box 6.1. Estimation of indicators for descriptive comparison analysis

Geometric growth rate of employment by group of firms

The sector's average annual growth is estimated using the geometric rate formula, which is defined as:

$$g_{jt} = \left(\frac{E_{jt}}{E_{jt-n}} \right)^{1/n} - 1,$$

where g_{jt} represents the average annual growth rate of employment by the group of firms j at moment t . E is the number of employees; n represents the number of periods between t and the first year of the period. This formula represents the average employment growth between two points in time.

Growth rate of employment at the firm level

The growth rate of every firm was estimated using the “average” year method. This is a standard formula used to analyse empirically, growth rates at the firm level. This formulation was proposed by Davis, Haltiwanger and Schuh (1996) and defines growth as:

$$r_{it} = \frac{E_{it} - E_{it-1}}{0.5 * (E_{it} + E_{it-1})},$$

where r_{it} represents the growth rate of firms i at moment t . E is the total number of employees; t represents the present year, $t-1$ represents the previous year. The denominator is the average size of firm i in t and $t-1$. As mentioned by Dixon and Rollin (2012), some properties make this method desirable: the symmetry of the distribution of growth over firms; the limits of the distribution are placed in -2 (the growth of deaths) and 2 (the growth of birth firms); it is possible to compare the results to log growth rate for values superior or inferior to 50%.

Bravo-Biosca, Criscuolo and Menon (2013) apply this method to describe the distribution of growth of employment in firms and analyse differences between countries.

Relative gross and net job creation and destruction

This method is based on the standard formulation of the OECD (Criscuolo, Gal and Menon, 2014) to calculate net and gross job creation and destruction from t to $t+1$, but a variation is implemented in order to consider changes in a three-year period analysis. The average gross job creation from year t to $t+2$ relative to employment levels in year t within sector j is represented as:

$$RJC_{jt} = \frac{|\sum_{i=1}^I 0.5 * \Delta E_{i,(t,t+2)}^+| + |\sum_{i=1}^I \Delta E_{i,(t+1,t+2)}^+|}{\sum_{i=1}^I E_{it}},$$

where RJC_{jt} represents the relative gross job creation, which is calculated as the sum of all average positive job variations at firm level from year t to $t+2$ ($0.5 * \Delta E_{i,(t,t+2)}^+$), and for year $t+1$ to $t+2$ ($\Delta E_{i,(t+1,t+2)}^+$) for units created in 2011. This formula represents the average gross employment generation between two points in time in sector j .

On the other hand, the average gross job destruction from year t to $t+2$ relative to employment levels in t within sector j is represented as:

$$RJD_{jt} = \frac{|\sum_{i=1}^I 0.5 * \Delta E_{i,(t,t+2)}^-| + |\sum_{i=1}^I \Delta E_{i,(t+1,t+2)}^-|}{\sum_{i=1}^I E_{it}},$$

where RJD_{jt} represents the gross job destruction, which is calculated as the sum of all average negative job variations at firm level from year t to $t+2$ ($0.5 * \Delta E_{i,(t,t+2)}^-$), and from year $t+1$ to $t+2$ ($\Delta E_{i,(t+1,t+2)}^-$) for units created in 2011; within the sector j . This formula represents the average gross employment destruction between two points in time in sector j . Then, the average relative net job creation is the difference between gross job creation and gross job destruction:

$$RNJC_{jt} = RJC_{jt} - RJD_{jt}.$$

have the virtue of being very simple to apply and of producing results that are easy to understand. Using these two methods, the percentage annual change in employment 2010-12 by sector and exporting group was analysed.

This document also presents an analysis of net job creation for the period 2010-12, divided by economic activity and exporting condition. For this purpose, this analysis follows Criscuolo, Gal and Menon (2014)⁸ and calculates gross job creation and destruction separately and the net job creation as the difference between the two. However, a slight modification to the original formula was introduced to cover the three-year period and to show changes in employment relative to the first year of analysis (see Box 6.1). The basic idea this indicator raises is the net balance of all the positive and negative changes in employment, shown as net job creation and reflecting the dynamics of the behaviour of firms within each group (Criscuolo, Gal and Menon, 2014).

Finally, the employment structure was characterised by the age of firms – young, mature and old – within each sector. This makes it possible to know which companies employ relatively more people within each economic sector and export group. The share of old firms can also be accounted for by economic sector, as by exporting and non-exporting groups.

Findings

In order to compare the aggregate results on employment dynamics across sectors, the employment growth rate is first analysed according to firms' exporting condition and economic sector.

Leaders and laggards: uneven recovery across sectors

Between 2010 and 2012 employment grew at an annual average rate of 3.1% for non-exporting activities in general. In fact, non-exporting firms recorded employment growth in all sectors, and was close to 2% in agriculture and manufacturing, reaching 3.3% in services (see Figure 6.5). On the other hand, exporting firms showed lower rates of growth in all activities, except manufacturing, where the 3.3% growth by exporting firms outscored the 1.8% registered for non-exporting firms. Also, employment of exporting agricultural firms and of some services activities – such as construction – recorded negative growth rates during the same period, probably influenced by the evolution of foreign demand and FDI inflows.

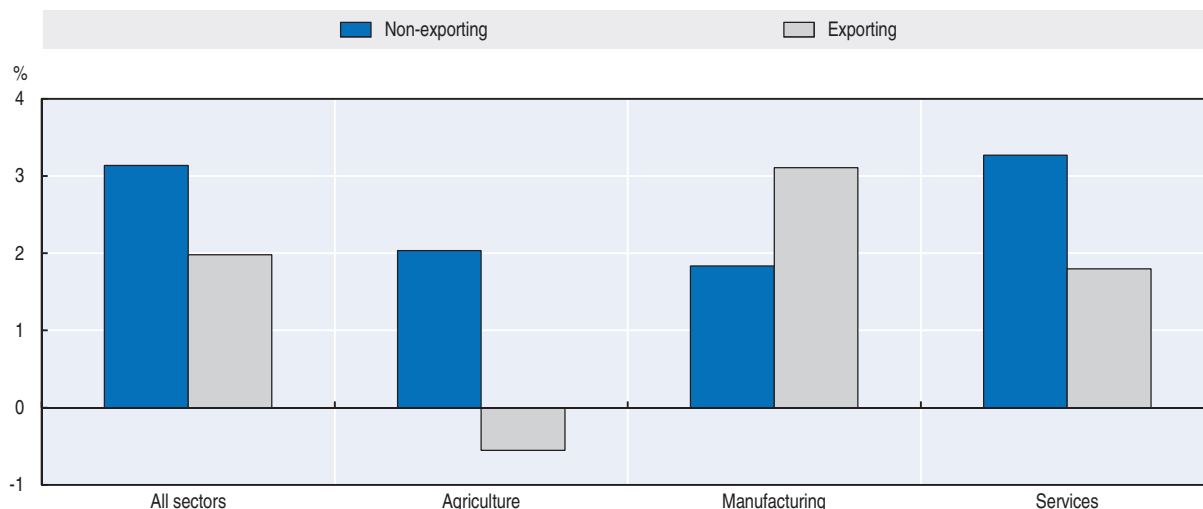
For the economy as a whole, non-exporting firms increased employment by 3.1%, while exporting firms did so by 2%. The overall results are very similar to those for services, in light of this sector's large share in employment generation. A plausible explanation for this can be found in the fact that exporting activities in agriculture and some services depend to a larger extent on the dynamism of foreign demand, which had not fully recovered in the period analysed. Manufacturing shows a different result in light of the steady dynamics of high-demand industries integrated in global value chains, such as electronics and medical devices. In turn, non-exporting activities are oriented to the domestic market, which dealt much better with the crisis than foreign markets thanks to the high level of diversification of the Costa Rican economy that has been achieved through trade liberalisation and allows for less exposure to systemic risks.

Job creation and destruction

The process of creation and destruction of jobs within firms drives changes in sectoral employment. The balance of both processes is the net change in employment. However,

both processes should be reviewed separately, as in some cases a null net growth could be the result of identical forces of job creation and destruction within a sector.

Figure 6.5. **Employment growth rate by exporting and non-exporting group, according to economic sector, 2010-12**

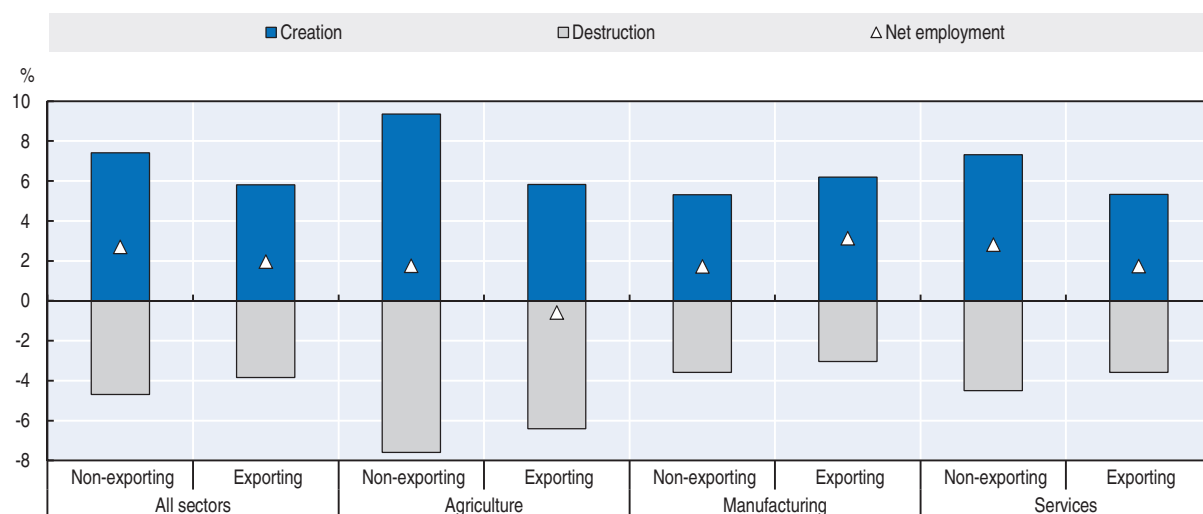


Note: Services sector includes construction and other services activities (see Annex 6.A6).

Source: Authors' calculations, using data from INEC.

Figure 6.6 shows the percentage of annual creation and destruction of jobs in the exporting and non-exporting firms, by economic sector. Further details on the methodology for the calculations can be found in Box 6.1. In general, it is observed that job creation and destruction do occur simultaneously. Even though the non-exporting group generates relatively more employment than the exporting group in all sectors except manufacturing, the latter destroys relatively less employment. This result could be related to the existence of more stable jobs in the exporting firms.

Figure 6.6. **Relative creation, destruction and net variation of employment in businesses according to economic sector and exporting condition**



Note: Services sector includes construction and other services activities (see Annex 6.A6).

Source: Authors' calculations, using data from INEC.

Net job creation, relative to employment levels in 2010, is very similar between exporters and non-exporters in the manufacturing and services sectors. Agriculture shows a different result, with relatively small job destruction in exporting firms that contrasts with the job creation observed in non-exporting firms. This could be explained by the fact that exporting agricultural firms are more exposed to systemic shocks in foreign demand than either manufacturing or services exporting firms.

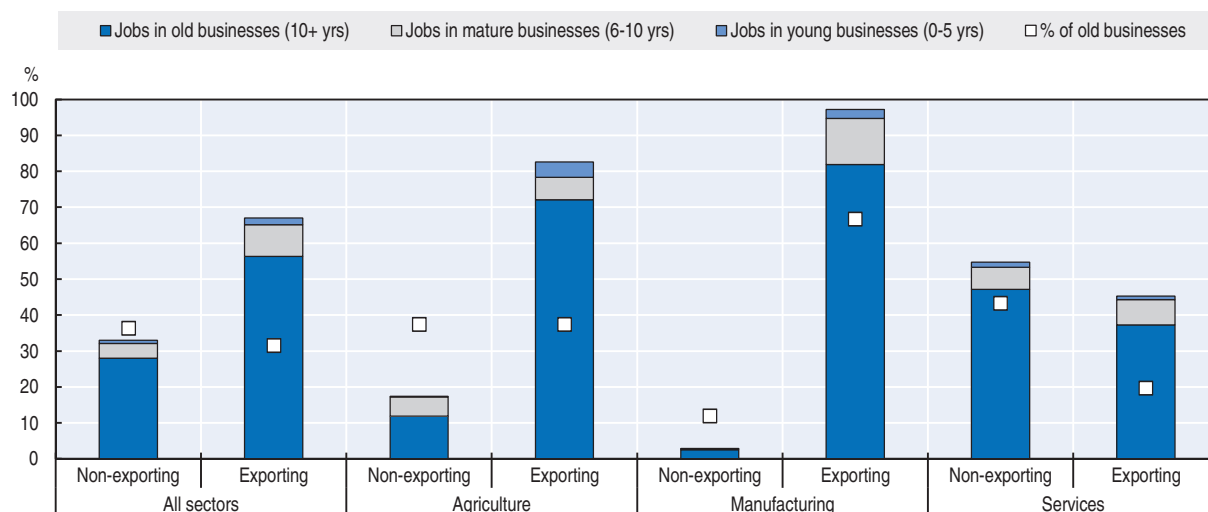
In the group of non-exporting agribusinesses, job losses took place mainly in palm oil, melon and pineapple production, while job creation occurred to a larger extent in pig breeding and in production of crops such as bananas, pineapples and ferns. In turn, production of crops such as coffee, ornamental plants, foliage, and melon suffered more job destruction in exporting firms, while production of bananas, oranges and pineapples showed higher job creation.

In the services sector, the positive result of the non-exporters is attributed to hiring in administration and support, the wholesale and retail trade, and in education activities and construction. In the group of exporting firms, wholesale and retail trade, transportation and storage and construction companies reduced employment levels.

Older firms account for most existing jobs

The distribution of employment by age of firms reveals that old firms account for most of the employment, but their weight varies across sectors (see Figure 6.7). This finding is consistent with similar results for OECD countries (Criscuolo, Gal and Menon, 2014). In manufacturing, about two-thirds of firms are both old and exporters, and these firms account for 81% of the sectors' employment. In the services sector, the share of old firms is higher among non-exporters; however, the level of employment accounted for by both groups is similar. Both old and exporter firms account for 37% of total employment, while both old and non-exporting firms account for 47%. In agriculture, old exporting and non-exporting firms were found to have similar shares, but the total employment accounted for by old exporting firms is much higher (72.1%).

Figure 6.7. **Total employment according to firm age, by economic sector and exporting condition, 2012**



Note: Services sector includes construction and other services activities (see Annex 6.A6).

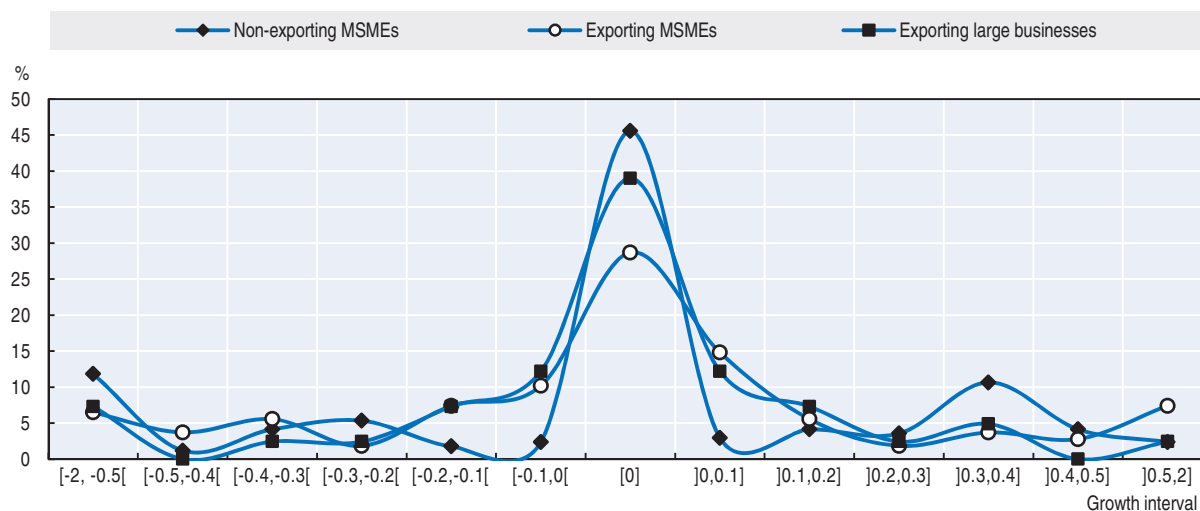
Source: Authors' calculations, using data from INEC.

Employment dynamics in the agricultural sector

Figure 6.8 shows the distribution of employment growth for agricultural firms in the three-year period observed, by size (MSMEs and large firms) and exporting conditions. Each point represents the share of companies for the corresponding growth interval. Results show different growth patterns across the groups of exporting and non-exporting firms. Non-exporting agricultural MSMEs have the highest relative concentration of firms with no growth in employment (45%). In turn, 11% of companies cut the number of employees in more than half, and 17% increased their employment level by 30% or more. In all three cases, at least 80% of companies were micro, and over 60% were old. All non-exporting companies analysed are MSMEs, probably because all large companies export.

Agricultural exporting firms, both MSMEs and large firms, have similar distributions for employment growth. For both groups, between 2010 and 2012, around a quarter of firms increased hiring up to 40% and 20% of companies laid off up to 30% of workers. However, the tails of the distribution are wider for MSMEs than for large firms, indicating that there is a larger share of MSMEs that either increased or decreased employment at a rate of 30% or more. This seems reasonable considering that changes in MSMEs' employment are larger in relative terms than for large companies. Also, the group of exporting MSMEs have the lowest share of agricultural enterprises with zero growth (about 30%). FTZ firms were not considered for this part of the analysis, since agricultural exporting firms operate outside such regimes.

Figure 6.8. **Share of agriculture businesses by employment growth, size and exporting condition**



Source: Authors' calculations, using data from INEC.

An FTZ regime that promotes growth of both MSMEs and large firms

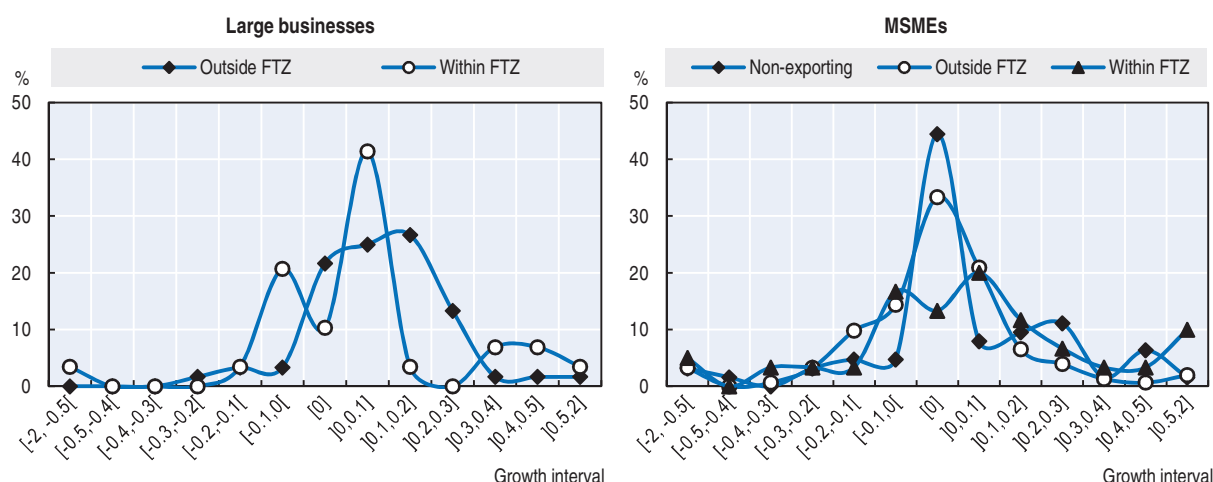
The vast majority of large companies in the manufacturing sector are exporting firms (98%) and 65% of them do not operate in the FTZ regime, 31% operate within such a regime and the remaining 4% operate in the inward-processing regime. For the first group, 70% of firms recorded an increase in employment, at rates as high as 20%. About 22% of companies did not increase employment and only 8% of firms reduced their payroll. This suggests a low concentration of firms cutting employment, but in absolute terms the

reduction can be somewhat significant because companies in this situation have 250 workers or more and thus they account for a fair share of employment.

Large exporting firms that operate in the FTZ regime have a different employment growth pattern: only 10% of them scored zero growth during the period considered, and more than 40% grew as much as 10%. In turn, 20% of firms in the FTZ regime reduced their number of workers by up to 10%. For MSMEs operating in the FTZ regime, 32% decreased employment and 55% increased it (about 10% did so at rates above 50%).

On the other hand, MSMEs operating outside the FTZ regime show a very balanced behaviour, since a third scored no employment growth, 35% grew and 32% decreased. For the group of non-exporting MSMEs, 44% had zero employment growth, 38% increased hiring and only 17% cut employment (Figure 6.9).

Figure 6.9. **Share of manufacturing businesses by employment growth, size and exporting condition**



Source: Authors' calculations, using data from INEC.

Services firms: selling abroad does make a difference for MSMEs

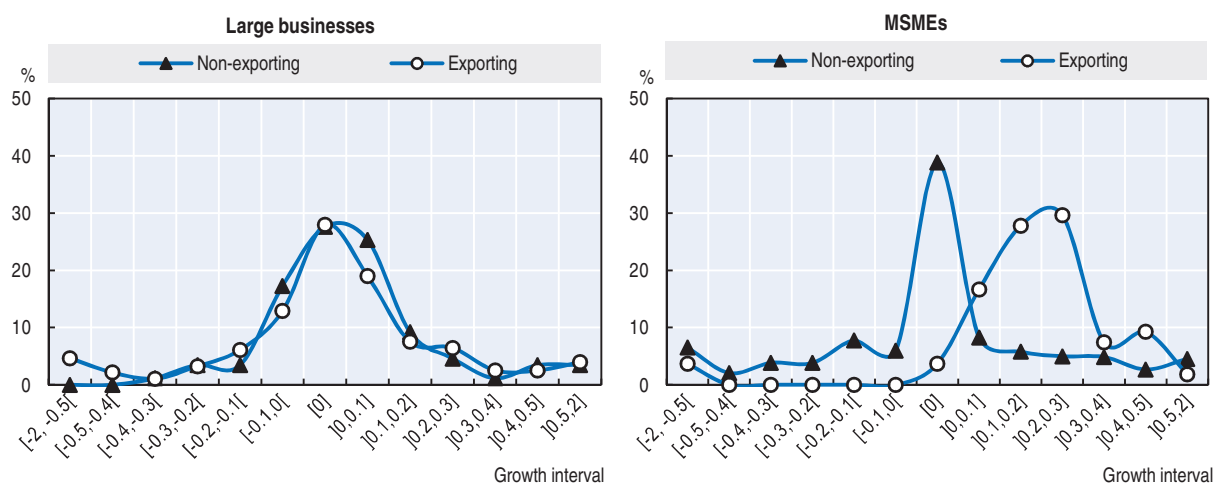
Both the exporting and non-exporting groups of large firms in the services sector show similar distributions of employment growth, although non-exporting firms seem to have a slightly better performance than exporting ones. In fact, in the non-exporting group of large services firms 25% scored negative growth rates and 47% scored positive rates, while in the exporter group of large services firms scored 30% and 42%, respectively. For both groups, 28% of companies did not grow. Most of the exporting firms analysed in the services sector operate outside the FTZ regime.

An important finding is the outstanding performance shown by services exporting MSMEs (Figure 6.10): 93% of companies scored employment growth and more than half did so at rates between 20% and 40%. Only 4% of this kind of companies did not show any employment growth and the remaining 3% cut their employment. In turn, the distribution for non-exporting MSMEs is quite symmetrical, since 39% of companies had no employment growth, and the shares that increased and decreased jobs scored 30% and 31%, respectively.

These findings should not be surprising, given the small size of the Costa Rican domestic market. As it is the case for trade in goods, services exporting MSMEs find much

better foundations for sustained growth if their products are targeted to a much larger market than the domestic one. This is relevant from a policymaking perspective, as it suggests that a strategy aimed at improving employment prospects of MSMEs in the services sector – which accounts for the largest share of economy-wide employment in Costa Rica – should focus on export capacity building.

Figure 6.10. **Share of services businesses by employment growth, size and exporting condition**



Source: Authors' calculations, using data from INEC.

Sectoral differences in employment dynamics: manufacturing leads for large exporting firms and services lead for exporting MSMEs

A comparison of large exporting firms' performance across economic activities reveals that manufacturing leads by a long way in employment generation during the period analysed, with 70% of its firms scoring positive growth rates. In turn, 58% of services companies showed negative or zero growth in employment, and the same holds true for 72% of agricultural firms (Figure 6.11).

The employment growth patterns of exporting MSMEs depict a services sector with an outstanding 90% of companies that increased hiring during the period analysed, while only 35% of agricultural and manufacturing MSMEs did so. Although agricultural and manufacturing MSMEs show similar employment growth patterns, the former displays a larger concentration in extreme ranges – both increases and decreases surpass 30%. This may be related to seasonal contracts, a particular feature usually inherent in crop harvesting.

Although non-exporting MSMEs show more balanced employment growth patterns across activities, a slightly higher concentration of companies in positive growth ranges was observed in manufacturing.

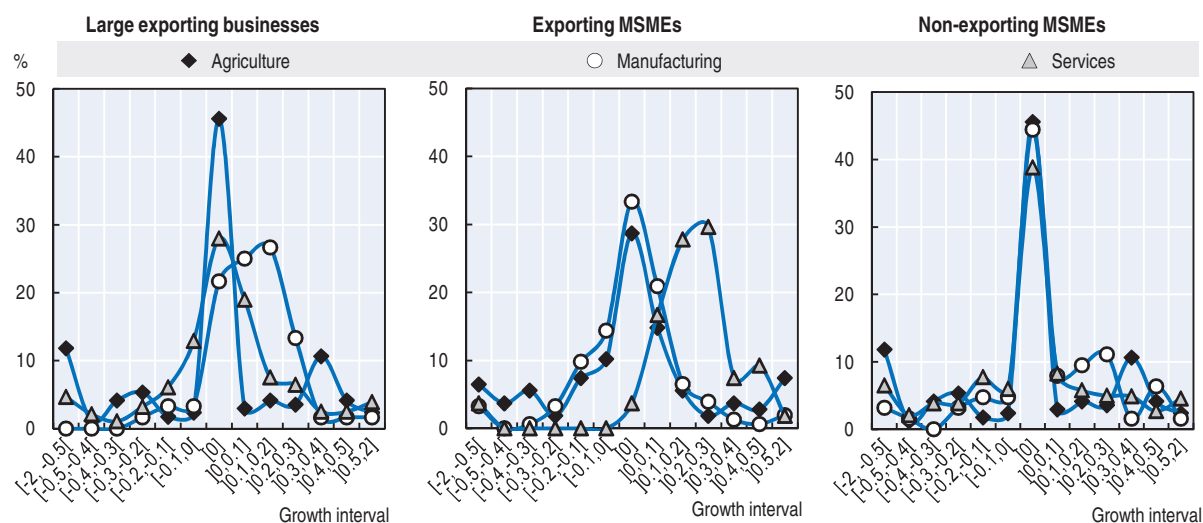
Conclusions

The labour market in Costa Rica is still adjusting to a structural change brought about by the last international crisis of 2008-09, during which the structural unemployment rate shifted upwards from 5.8% for the period between 1980 and 2008, to 8.6% after 2009.

Increased unemployment seems to respond to a mismatch between supply and demand for labour. Costa Rica is gradually and increasingly becoming a services-oriented

economy, with a more dynamic labour demand in higher value-added services and advanced manufacturing, activities with strong links to international markets, global value chains and FDI operations. Agriculture has succeeded in becoming integrated in international trade and remains an important absorber of low-skilled labour, so any reduction of its absorption capacity may have a relevant impact on employment dynamics. This is particularly relevant as employment shifts across sectors are more costly for relatively lower levels of skills.

Figure 6.11. **Share of businesses by employment growth rate, size, exporting condition and economic activity**



Source: Authors' calculations, using data from INEC.

The data analysed show that non-exporting firms increased employment by 3.1%, while exporting firms increased by 2%. These results were mainly driven by services firms in the group of non-exporters, and by increases in employment in manufacturing and services in the exporting group. Exporting firms generated relatively more employment than non-exporting ones in manufacturing, as opposed to the other activities, and relatively less employment was destroyed by the former. Net job creation, relative to employment levels in 2010, was very similar between exporters and non-exporters in the manufacturing and services sectors, as opposed to agriculture.

Old firms account for most of the employment, an outcome that is consistent with findings for OECD countries (Criscuolo, Gal and Menon, 2014). Higher shares of employment are accounted for by manufacturing and agriculture.

Firms' employment growth patterns seem to differ significantly across activities. Large exporting manufacturing firms had the highest concentration of growing employment, while agriculture had the highest concentration of firms with non-growing employment. Growth patterns also differ across exporting MSMEs according to economic activity: an outstanding 93% of services firms increased employment, while agriculture and manufacturing have a smaller share of growing firms (35%).

Larger differences can be found in employment growth patterns among MSMEs when their integration into international markets is taken into account: those that export are growing faster than those that focus on the domestic market. FTZ regime has kept on

pushing towards job creation: firms operating within the FTZ regime had a higher concentration of companies with positive growth than firms outside the regime.

Notes

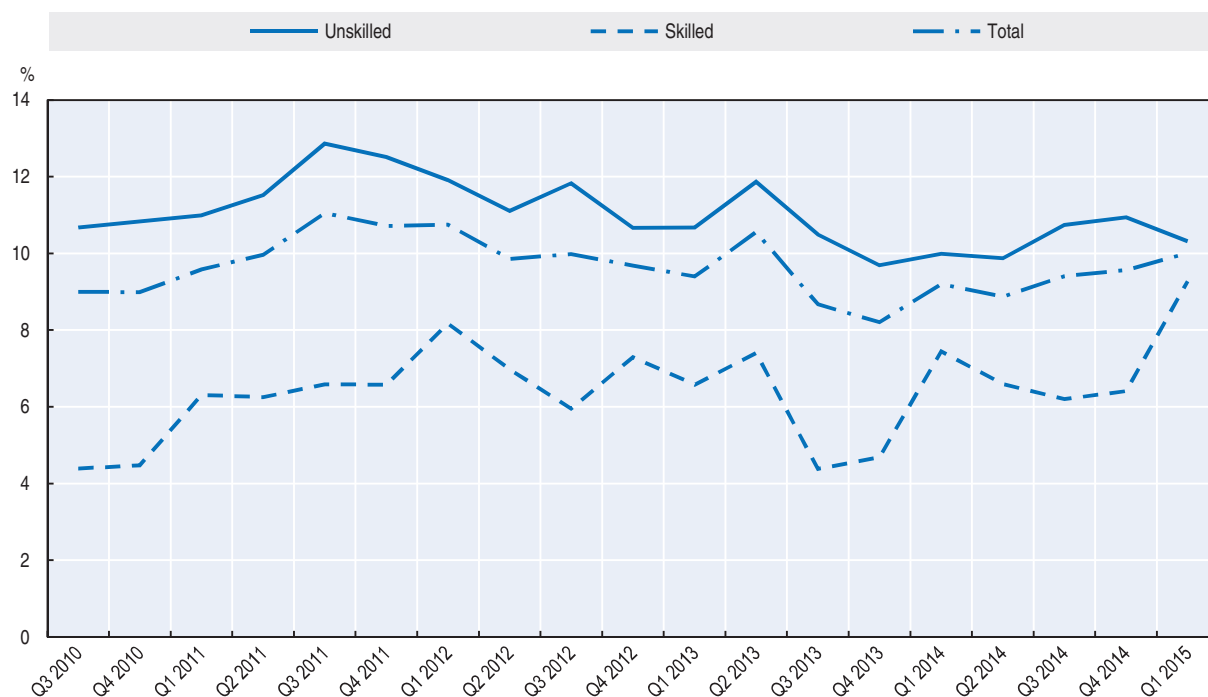
1. See Solera (2003) for further methodological details.
2. See the technical note in Annex 6.A2.
3. See Annex 6.A3.
4. Idem.
5. This excludes private households. Calculations are based on data from the Continuous Employment Survey (2012).
6. Costa Rica's legal currency.
7. INEC defines firms as large when they have more than 30 employees in accommodation and food service activities; more than 50 employees in construction, wholesale and retail, motor vehicle and motorcycle repair, transportation and storage, information and communication, professional, scientific and technical activities; and more than 100 employees in the rest.
8. See the OECD original formulation in Criscuolo, Gal and Menon (2014).

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ANNEX 6.A1

*Unemployment rate by skills level, 2010-15*Figure 6.A1.1. **Costa Rica: unemployment rate by skills level**

Note: Skilled employment refers to people with complete secondary, or higher education studies.

Source: COMEX, using data from INEC.

ANNEX 6.A2

Technical note: Estimation of long-term or structural unemployment rate

The formal specification used to estimate an inverse correlation between the unemployment rate and economic growth is based on a work of Arias, Kikut and Madrigal (2002). This assumes that the level of unemployment in a specific year (u_t) can be expressed as:

$$u_t = \bar{\rho} - \rho_y \hat{y}_t + \rho_u u_{t-1} + \varepsilon_t,$$

where ($\bar{\rho}$) represents a fixed and unchanging-over-time “base” level; (ρ_y) is a factor that reduces unemployment in a fraction of the cyclical component of output growth ($\hat{y}$); (ρ_u) is a component of inertial nature which corresponds to a fraction of the registered unemployment the immediately preceding year (u_{t-1}); and (ε_t) represents a random component that causes a small fluctuation and follows a normal probability distribution with zero mean and constant variance.

On the premise of behaviour for the level of unemployment over time and once coefficients $\bar{\rho}$, ρ_y y ρ_u are estimated, structural unemployment (or long-term unemployment) of economy can be calculated (in the absence of major structural changes) as:

$$\bar{u} = \frac{\bar{\rho}}{1 - \rho_u}.$$

ANNEX 6.A3

Estimated values and statistic tests from unemployment equation

**Table 6.A3.1. Costa Rica: estimated values and statistic tests
from unemployment equation**

Dependent variable: Unemployment rate

Method: Least squared

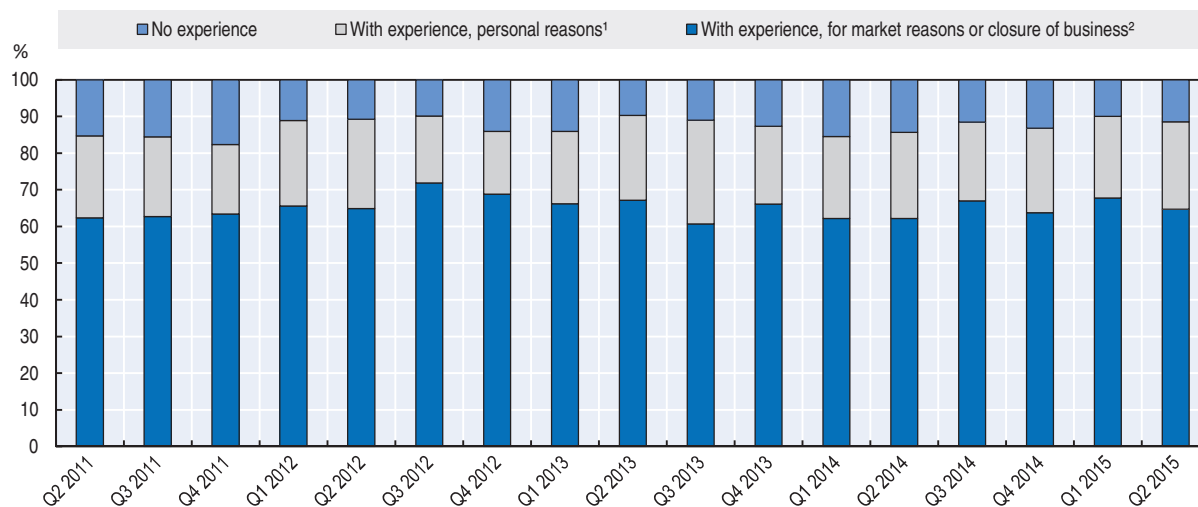
Adjusted sample: 1981-2014

Included observations: 34 after adjustment

Variable	Coefficient	Standard dev	t- statistic	Probability
Dummy 1 (2009-14)	0.04	0.005	8.46	0.00
Dummy 2 (1981-2008)	0.03	0.005	5.88	0.00
GDP gap	-0.20	0.052	-3.88	0.00
Dummy 3 (1980-81)	0.04	0.002	21.83	0.00
Dummy 4 (1989)	-0.02	0.001	-14.95	0.00
Unemployment (-1)	0.50	0.080	6.20	0.00
Statistics from the regression				
R ²	0.87	Mean of dependent variable		6.36
Adjusted R ²	0.85	Standard dev. of dependent variable		1.58
Durbin-Watson Statistic	1.91			
Null hypothesis	Test	t/F Statistic	Probability	
Normal residual distribution	Jarque-Bera	0.34	0.84	
Homoscedastic residuals	White (cross terms)	1.13	0.38	
No autocorrelated residuals	Breusch-Godfrey	0.53	0.44	
Coefficients are equal (V.D1=V.D2)	Wald Test	-5.34	0.00	
Calculus of structural unemployment rates (natural or long-term rate)	Mean	Maximum	Minimum	
1981-2008	5.78	7.71	3.85	
2009-14	8.61	10.61	6.62	

Source: COMEX, using data from INEC.

ANNEX A.64

*Unemployment structure by type, 2011-15*Figure 6.A4.1. **Costa Rica: unemployment structure by type**

1. Includes voluntary resignation, long-term disablement, retirement or bad labour relationships.

2. Includes, closures, bankruptcy, company relocation, restructuring, downsizing, forced or agreed resignation, end of casual or seasonal work, end of contract, lack of clients, excessive competition or lack of capital.

Source: COMEX, using data from INEC.

ANNEX 6.A5

*Resulting final sample*Table 6.A5.1. **Costa Rica: resulting final sample**

Description	2010	2011	2012
DEE sampling frame	43 404	42 979	48 981
Data not used due to information not being up to date	41 335	40 866	46 711
Final sample	2 069	2 113	2 270

Source: Authors' calculations, using data from INEC.

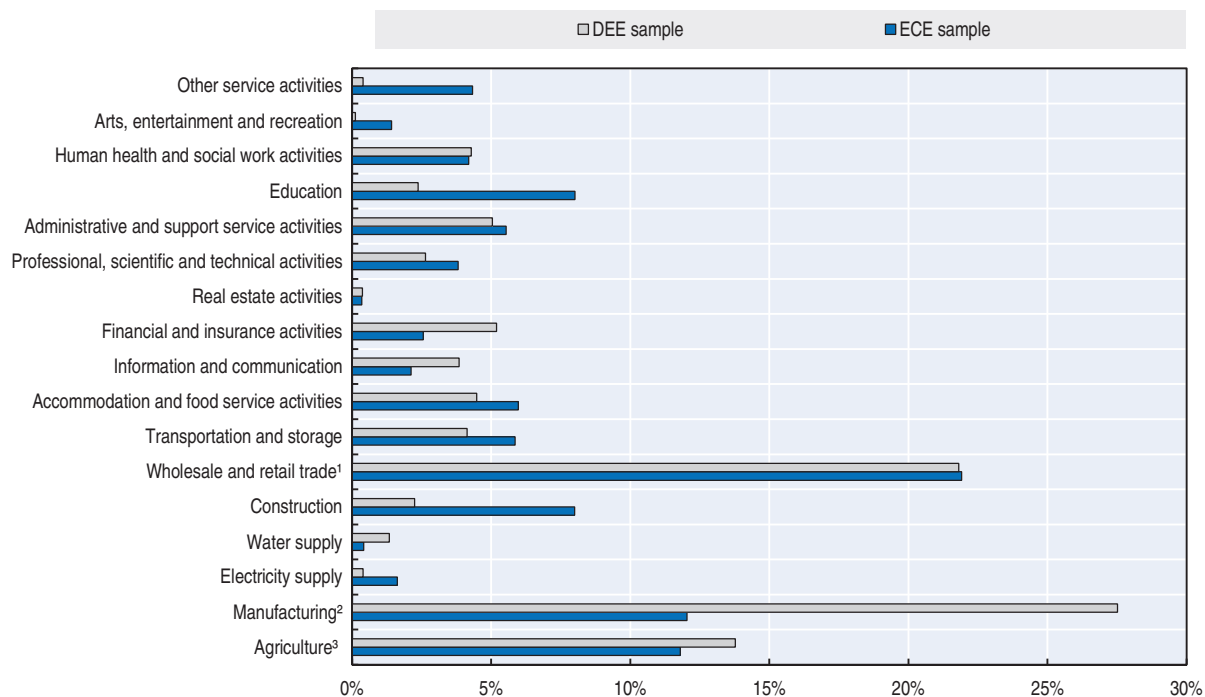
ANNEX 6.A6

*List of variables*Table 6.A6.1. **Costa Rica: list of variables**

Variable	Description
Number of employees	Total number of employees in the firm at the time of the survey (headcount).
Economic activity	Sector based on the International System of Industrial Classification (ISIC Rev.4). Firms were classified in three groups at the two-digit level: Agriculture (1-3, 5-9), manufacturing (10-33) and Services (services: 45-47, 49-53, 55-56, 58-63, 68-75, 77-82; construction: 41-43; other services: 35-38, 64-66, 85-88, 91-96). Economic activity of firms could change over time ¹ ; however, when changes occurred, the last sector registered by the firm was used.
Firm size	Based on the average number of employees in the period. Four groups of size were created: Micro (1-9 employees), Small (10-49), Medium (50-249) and Large (250+).
Exporter of goods	Firms that exported at least USD 12 000 of goods during the period under analysis. Data was drawn from a confidential exports database from the Customs authorities.
Exporter of services	Firms that exported services at least one year during the period under analysis. Data was drawn from the surveys carried out by the BCCR.
Exporter	Refers to a firm that exported goods and/or services for at least one year during the period under analysis.
Regular regime	Refers to firms that exported outside a special trade regime.
FTZ regime	Refers to firms that exported under a special trade regime. The main characteristic is the tax exoneration in the export and import of goods for intermediate consumption.
Inward-processing regime	Refers to firms that exported under a special trade regime. The main characteristic is the tax exoneration in the import of final goods that receive a treatment that adds value, such as repairing or upgrading and are then re-exported.
Inactive firms	Firms that in a given year report to be inactive. Employment is considered to be zero for these firms. Enterprises are considered as exiting firms after three consecutive years of inactivity; due to the time period covered by the data no firm can be considered to be an exit yet.
Initial year	Year in which the firm is registered with their legal name.
Age	Number of years since the firm registered with the legal name.
Entrants	Firms with initial year equal to 2010, 2011 or 2012.

Note: Over the period 2011-12, 3.2% of firms in the DEE registered changes on their economic activity, INEC (2012).

ANNEX 6.A7

*Share of employment by economic activity*Figure 6.A7.1. **Costa Rica: share of employment by economic activity, 2012**

1. Wholesale and retail trade sector also includes repair of motor vehicles and motorcycles.

2. Electricity supply includes gas, steam and air conditioning supply.

3. Agriculture also includes forestry and fishing activities and the mining and quarrying sector.

Source: Authors' calculations, using data from INEC.

Chapter 7

The growth of Canadian firms: Evidence using different growth measures

by

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This chapter presents a multidimensional empirical analysis of firm growth using administrative data on Canadian manufacturing firms from 2000 to 2013. A reduced-form VAR analyses the co-evolution of organic employment, asset, sales, profits and labour productivity growth rates, both at the median and at the positive and negative extremes. It finds that while the organic growth performance of employment, profits and labour productivity is difficult to maintain at the median, with positive growth usually leading to negative growth, success breeds success (and failure begets failure) for sales. It also finds that sales growth is positively correlated with future growth of all other variables, suggesting that sales success is an important driver of a firm's success or failure. Growth in profitability does not seem to matter to subsequent growth for most firms. However, it may help small firms by insulating them against growth reversals.

Introduction

An economy's ability to reallocate resources from less productive to more productive firms is an important determinant of productivity growth. Mindful of the importance of productive firms, policy makers are increasingly seeking to replace policies that support broad classes of firms (such as small firms) with firms targeting productive businesses with high growth potential. Unfortunately, the research on firm growth that should inform these policies has produced at best limited results. Geroski (2005) surveys almost half a century of empirical firm growth research and concludes that "corporate growth rates are very nearly random".

Due to data constraints, many of these studies look at firm growth along a single dimension (usually employment or sales, but occasionally assets), and focus on the relationship between firms' initial characteristics (such as size) and their subsequent growth (see Sutton [1997] for a summary). But as Coad, Rao and Tamagni (2011) emphasise, firm growth is a dynamic and complex process. It is the consequence of forward-looking strategies and strategic adjustments to market feedback that come at unpredictable times. Because of the heterogeneity and inherent dynamism of factors influencing the growth process, the one-dimensional growth to initial level approach taken in much of the literature is unlikely to be sufficient to shed light on them. McKelvie and Wiklund (2010) and Delmar, Davidsson and Gartner (2003) argue (the latter in the context of high-growth firms) that understanding the causes of firm growth first requires a multi-dimensional description of how firms grow.

Papers by Bottazzi et al. (2011) and Coad, Rao and Tamagni (2011) provide just such a description for manufacturing firms in France and Italy, respectively. The authors proceed on the assumption that further insight into firms' growth processes can be gained from simultaneously exploring the co-evolution of different variables. To that end, they investigate manufacturing firms' growth in employment, sales, gross operating surplus and productivity respectively using reduced-form vector autoregressions (VARs). In general they find that employment growth is followed by sales growth, which is then followed by profits. Profits, in contrast to financial accelerator models of firm growth, do not seem to have much impact on growth. Labour productivity growth also has little impact on future employment growth prospects.

One interesting feature of these papers is that the authors use quantile regression to look at firms' performance along the entire distribution of outcomes. It is important to take the distribution into account for two reasons. First, research has uncovered the striking regularity that firm growth distributions are non-Gaussian (see Bottazzi and Secchi [2006] for a summary). They are aptly described by a double exponential distribution with most firms' growth outcomes around zero, and more of them than usual in the tails. Second, while the stochastic nature of firm growth may make firm outcomes difficult to predict, there may nonetheless be regularities in the range of outcomes. For example, in a world where firms may choose one of two strategies, a "risky" firm following a risky strategy may experience

similar outcomes to a “safe” firm most of the time. The difference between them is that a risky strategy will produce rare spectacular successes and failures more frequently. The effect on the mass of firms choosing riskier strategies will be found in the higher moments of the distribution, which quantile methods can detect. Coad, Rao and Tamagni (2011) and Bottazzi et al. (2011) also find evidence of asymmetries in relationships across the growth distribution.

This chapter applies Coad et al.’s methods to data from Statistics Canada’s T2-LEAP (constructed from the linkage of information from the T2 corporate tax form with the Longitudinal Employment Analysis Program data) to provide a multifaceted picture of how Canadian firms grow. In order for the analysis in this chapter to be comparable with that conducted in the DynEmp project, continuing firms in three aggregate industry sectors are examined (construction, manufacturing and services) for the years 2000-13 (see Criscuolo, Gal and Menon [2014] for details on the DynEmp project). Using a reduced-form VAR model the paper looks at the correlations at leads and lags between the growth rates of employment, assets, sales, profits and labour productivity. The advantages of this empirical framework are that it is explicitly both multi-dimensional and dynamic, and that it does not impose any prior restrictions on the patterns between variables. It makes it possible to compare the resulting correlations with the predictions of various theories, which the next section will explore.

Like Coad et al., This analysis also looks for asymmetries in the growth process by comparing firms at the median to those at the 10th and 90th percentiles. Given the policy interest in the growth potential of small and young firms, it also allows for variation in patterns across firms of different sizes and ages.

The chapter’s fifth section presents main results. First, there is very little, if any real organic growth in any of the variables for the median firm.¹ Second, and most strikingly, success breeds success (and failure begets failure) for sales, as sales appear to drive growth in all other variables. It is positively correlated with future growth of all the other variables, including labour productivity. This last result is consistent with models where demand shocks are particularly important for firms’ productivity growth, sometimes referred to as micro-level Kaldor-Verdoorn effects.² Third, for employment, profits and labour productivity measures, greater than median growth performance is difficult to maintain, with positive growth leading subsequently to negative growth rates (and vice versa). Fourth, profit growth is positively correlated with subsequent growth in labour productivity, as predicted by financial accelerator models. But the magnitudes of these positive correlations are very small at the median. They are, however, larger in the tails, indicating that profit growth is important for protecting small firms from negative outcomes.

The following section discusses the key theoretical and empirical findings in the literature. It explores the models of firm growth that can be tested in this study’s growth-growth VAR framework. The fourth section reviews the VAR methodology and this study’s empirical specifications and the third section discusses the T2-LEAP database. The last section concludes.

Models of firm growth

Many theories of firm growth draw a causal line from firms’ innate productivity (or perceptions thereof) to their choice of inputs and to their profitability. However, some theoretical contributions have suggested feedback mechanisms, including some by which

firm growth and profitability may affect subsequent productivity. This study reviews these theories below, highlighting their implications for intertemporal correlations between variables. It also considers the issue of persistent growth: to what extent there is reversion to the mean (i.e. growth in one period to be followed with contraction) or whether “success breeds success”.

Evolutionary and “equilibrium” evolutionary models

A body of theoretical work on firm growth posits initial productivity as the measure of a firm’s “evolutionary” fitness, and thus the determinant of a firm’s future growth or decline. Models include Metcalfe (1994) in the evolutionary vein, and the equilibrium models of Hopenhayn (1992), Jovanovic (1982) and Ericson and Pakes (1995). High productivity firms reveal themselves as more productive by being more profitable than their lower productivity counterparts, which both encourages them and gives them the resources to grow. In the process they take market shares from less productive and profitable firms, which shrink. These models thus predict positive correlations running from initial productivity (in levels) to changes in firm size (measured by employment, assets and/or sales) and profit growth and then from profit growth to subsequent changes in firm size.

Ericson and Pakes (1995) extend the logic of these models by allowing continuing firms the possibility of increasing their productivity through investments with uncertain outcomes, such as investment in research and development (R&D). If they are successful, investing firms’ productivity will rise. Ericson and Pakes (1995) models therefore predict a positive correlation between productivity growth and subsequent growth in profitability and size.

Micro-level Kaldor-Verdoorn effects and dynamic increasing returns

The relationships between productivity and firm growth predicted by evolutionary models may be joined by other forces. One such force is articulated in Lord Kaldor’s formulation of Verdoorn’s Law, which draws a causal connection between the expansion of demand for the output of the manufacturing sector and subsequent increases in sectoral productivity. Extended by analogy to the firm-level, the effect could arise if expanding output stimulates learning-by-doing within the firm. Growth in demand for firms’ products encourages the firm to expand, and the process of expanding is associated with the build-up of the firm’s stock of organisational or knowledge capital, raising productivity. Micro-level Kaldor-Verdoorn effects may thus induce a positive correlation running from firms’ current sales to their future growth in employment/assets and productivity.

Penrose effects

Penrose (1959) argues that the correlations run both ways between productivity and firm growth, but that the relationship is negative instead of positive. In Penrose’s conception of the firm, the main constraint to firm growth is the limited attention of capable managers. Adding additional resources to the firm requires training additional managers to manage them. Existing managers must spend their limited time training new managerial resources, distracting them from optimising the configuration of the firm’s resources, resulting in a tension between growing productivity and growing the firm. Depending on the length of time needed to reproduce managerial talent and to integrate new resources, Penrose effects may show up in the data as a negative correlation between changes in firm size and productivity growth.

Financial market imperfections

Productive firms' growth may be complicated by financial market failures interfering with the positive link between productivity and firm growth. For example, asymmetries in information about investment opportunities may make lenders reluctant to lend even to promising firms. Financing of productivity-enhancing investments should be especially sensitive to financial market imperfections. Unable to adequately fund growth and investment through borrowing, firms may be constrained to invest out of retained earnings. Financial market imperfections should thus be associated with a positive correlation between positive profit growth and subsequent productivity increases. In a world without financial frictions, on the other hand, firms will be able to borrow freely in advance of expected (by both borrower and lender) profits, so current profits would be uncorrelated with future firm growth.

Managerial waste

Coad, Rao and Tamagni (2011) note that a branch of the management literature suggests many firms may suffer from principal-agent problems between firms' owners and managers. Depending on their severity increasing firm profitability (the owner's presumed goal) may be relegated in favour of the manager's goals. If managers enjoy the prestige of managing a larger firm, they may put firm growth above profits and so generate a negative correlation between firm growth and future profitability in firms where owners and managers' incentives are not sufficiently aligned.

Growth persistence

Finally, this study looks at the implications for the persistence of growth rates. There are three possible relationships with respect to variables' own correlations. If there is no correlation between growth rates at leads and lags, then growth follows a random walk.³ A random walk growth process suggests that idiosyncratic shocks have a one-off impact and permanently affect the levels of the variables (as opposed to growth rates). A negative correlation, on the other hand, implies instead that the responses of shocks are characterised by reversion to the mean. In other words, higher than expected growth in one period is likely to lead to lower growth in the future. In an environment where the median firm does not grow, a negative correlation implies that a typical firm that shrinks in one period will grow in the next period.

A positive correlation may mean that a firm's fortunes tend to build on themselves: the more good or bad fortune a firm has the more of the same it is likely to have. Alternatively, it may indicate that it takes time for firms to fully absorb shocks. For example, capital assets take time to build (and depreciate), so any unanticipated change in firm fortunes would take time to be fully reflected in the firm's capital stock, inducing a positive autocorrelation at leads and lags.

Data

This analysis uses a vintage of Statistics Canada's T2-LEAP covering the years 2000-13. This administrative database includes all statistical enterprises in the Canadian economy that have issued at least one "statement of remuneration paid", or T4 slip. It covers both incorporated and unincorporated businesses, but excludes self-employed individuals or partnerships where the participants do not draw salaries. It is a longitudinal file, which means that firm variables are tracked over time on an annual basis.

An important feature of the T2-LEAP file is that it covers only organic growth. It removes “spurious” births and deaths that arise when there is corporate restructuring such as occurs, among other things, during mergers, acquisitions, spinoffs, and divestitures. False births and deaths, marked by firms changing legal status rather than physically appearing or disappearing, are removed through a “labour-tracking” process: clusters of employees appearing and disappearing from the data in a given year are compared to clusters of employees found in other firms in the previous year (for appearing firms) or the following year (for disappearing firms). If a significant portion of an appearing or disappearing firm’s employees are found under another firm’s identifier, a connection is made between the firms involved and the structure of the firm in year t is applied to the data in year $t-1$ and all preceding years.

Labour tracking’s main advantage is that it abstracts almost completely from firms or parts of firms changing hands. Its main disadvantage is the fact that each vintage of the T2-LEAP pushes the market structure of its last year back in time. For example, if a large firm acquires a small firm in 2007, the 2013 vintage of the LEAP will treat them as if they were always a single firm, even prior to 2007, when they were not.

While the ability to isolate organic growth is an asset for many applications, it comes at a cost. The first disadvantage is that there is a risk of incorrectly characterising the nature of growing and shrinking firms. In the example above, a small or young firm’s growth is attributed to its larger older purchaser even prior to its purchase. If small or young growing firms are more likely to be acquired, the results for small firms may be biased by their unjustified absence from the data. The second disadvantage is that this analysis misses mergers and acquisitions (M&As), which can also be an important mode by which firms grow. Thus, this study can only offer insights into one facet of firm dynamics, rather than the more complete picture that would be desirable.

Variables

The variables examined are employment, total assets, total sales, profits and labour productivity. For employment, the LEAP’s average labour unit (ALU) is used.⁴ It is constructed by dividing a firm’s payroll by the average wage paid by firms in the same province, industry and size class. It is not a head count, and is best thought of as a proxy for the actual number of employees. It can vary along two dimensions: through the number of workers in the firm and their average remuneration. The latter differs across firms because of longevity of employment over a year, number of hours worked, and the wage rate paid. Small firms with a small ALU count may have fewer employees, and larger ones may indeed have more; but firms may also appear small because they pay lower wages than their counterparts, or larger because they pay more. Therefore the ALU measure also takes into account job quality, as measured by the wages firms’ pay.

One issue with the ALU is that when firms are active for only part of the year, their employment is underestimated by the ALU measure. This underestimation is especially important for start-ups created near the end of a calendar year, and for exiting firms that close down in the first months of the year. Growth rates for new firms, especially, tend to be overestimated. Because of this data limitation, only firms that are two years old or older are included in this analysis. In addition, the data contain a large number of firms that never exceed one ALU. The growth rates of these firms are very volatile due to the small-base problem. In such cases, infinitesimal changes in employment can result in very high or very low growth rates, often with no changes in the number of employees.⁵ They are excluded in this analysis.⁶

Total assets, total sales and profits (net income after taxes) come directly from the data. Firms' (revenue) labour productivity is their value-added divided by their employment. It is assumed that firms use constant returns to scale technology and hire from competitive input markets, so that their value-added is the sum of their payroll and profits.

Growth rates

Growth rates are calculated using the "average-year" methodology outlined by Davis, Haltiwanger and Schuh (1996) (hereafter DHS) to calculate the growth rate for each of the variables above. The DHS growth rate of firm i from year $t-1$ to year t for variable x is defined as:

$$y_{it} = 2 \frac{x_{it} - x_{it-1}}{x_{it} + x_{it-1}}. \quad (1)$$

This formulation ameliorates the effects of short-term reversion to the mean, or the tendency of growing and declining firms to return to a mean level. For variables that always take on positive values, the growth rate used yields similar results to log growth rates, at least for firms expanding or contracting employment by up to 50% (by log/average measures). The chief difference with log growth is that the DHS growth rate is linear and bounded between -2 (exit) and 2 (entry) at the extreme ends. As a result, entries and exits make up distinct subsets of observations that are not directly comparable with other observations.

Profits can take on negative as well as positive values, creating problems for the transformation above. Coad, Rao and Tamagni (2011) and Bottazzi et al. (2011) use log growth rates and exclude firms with negative profits. However, a large number of Canadian firms posted at least one year of negative profits over the period 2000-13. In order to accommodate firms with negative profits, this analysis transforms the profit variable using the inverse hyperbolic sine transformation before taking first differences (see Pence [2006] for an application). The transformation for variable x is defined as:

$$y_{it} = \Delta \log(x_{it} + \sqrt{x_{it}^2 + 1}). \quad (2)$$

The resulting growth rates are consistently defined for negative profits and are similar to log growth rates over most of the distribution, although they are not bounded between 2 and -2 at the extremes as the other variables are.

Methodology

Following Coad et al. (2011), this analysis uses reduced-form vector autoregression (VAR). The regression equations take the following basic form:

$$\Gamma_{it} = A_t + \sum_{l=1}^L B_l \Gamma_{it-l} + E_{it}, \quad i = 1, \dots, N, \quad t = 1, \dots, T, \quad (3)$$

where Γ_{it} is an $(m \times 1)$ vector of growth variables for firm i at time t . The number of lags is given by $l = 1, \dots, L$ and the estimated coefficient matrix B_l corresponds to an $(m \times m)$ matrix of slope coefficients. In this case, $m = 5$ and Γ corresponds to the vector $[\gamma \text{Employment}, \gamma \text{Assets}, \gamma \text{Sales}, \gamma \text{Profits}, \gamma \text{Productivity}]$, where γ are growth rates and are computed using Equation (1). The matrix A_t contains constants and year dummies. E_{it} is an $(m \times 1)$ vector of disturbances. In the case that the variables are contemporaneously uncorrelated and $E(e_{it}^j e_{it}^k) = 0$, for variables $j \neq k$ then E_{it} represents a vector of structural shocks and B_l would be the structural reaction to previous unanticipated shocks. Asset and employment shocks are difficult to interpret, but profits and sales shocks may be due to unanticipated increases in demand. Productivity shocks may be due to unanticipated success or failure of technology investments.

However, given the low (yearly) frequency of the data and construction of the variables, it is highly unlikely that the shocks will be uncorrelated in the data, even if they are for the firm.⁷ The correlations β_1 should thus be taken as merely indicative of possible underlying processes.

Estimation

The specification above also includes year dummies to control for the shifts driven by the business cycle. Equation (3) is estimated first using equation-by-equation ordinary least squares (OLS). However, as discussed in the introduction, the growth of all variables is usually non-Gaussian. Thick-tailed distributions create problems for estimation and inference based on OLS. Since, as with those in other countries, the distribution of Canadian firms' growth rates are non-Gaussian (see Dixon and Rollin [2012]), this discussion focuses on the results from using quantile regressions, which are more robust, to non-normality of the distribution. The model is estimated at one and two lags, but for brevity report only the first lag results.

Quantile regression allows for robust inference under non-normality. It is also easily extended to look at parts of the distribution other than its central tendency. This study uses it to look at asymmetries in growth patterns between growing and shrinking firms, as well as for firms that grow rapidly (firms with growth in the 90th percentile) and those that shrink rapidly (firms with growth in the 10th percentile). Finally, because the literature on firm growth identifies size and age as proxies for factors affecting firm growth, separate regressions are run on firms according to their number of employees, and by their number of years in operation. The results are also analysed by broad industry category.

Results

The sample consists of 30 221 376 observations for the period 2000-13. The growth rates for firms' employment, assets, sales, profits and labour productivity are summarised in Table 7.1.

Table 7.1. **Unconditional growth rates: summary statistics**

Growth of	Mean	St. dev.	p10	p50	p90	Skewness	Kurtosis	N
Employment	-0.011	0.326	-0.851	-0.029	0.342	-0.54	13.92	30 221 376
Assets	0.011	0.213	-0.357	0.008	0.339	-0.48	14.84	30 221 376
Sales	0.023	0.263	-0.462	0.007	0.285	-0.02	8.53	30 221 376
Profits	-0.004	0.808	-13.396	0.013	11.121	-0.03	2.39	30 221 376
Productivity	0.034	0.459	-0.443	0.015	0.474	0.16	11.23	30 221 376

Source: Author's calculations based on Statistics Canada (2016), T2-LEAP, 2000 to 2013 (database), www.statcan.gc.ca/eng/cder/data#a10.

Two important features of the data stand out. First, the median growth rate for the nominal variables is around 1% (at 0.7% for sales to 1.5% for revenue productivity), which are around the inflation in producer prices (of 1.2%). The results are broadly consistent with most firms growing little or not at all in real terms.⁸ Thus, most of the firms below the median are shrinking in real terms, while the firms above it are growing.⁹

Second, the distributions for almost all the variables are negatively skewed, and have thicker than normal tails. The exceptions are labour productivity, which is positively skewed, and profits, which exhibit less than normal kurtosis.¹⁰ The non-Gaussian nature of the distributions creates problems for OLS regression and motivates the use of quantile regression instead.

Aggregate results at the median

The results at median from estimating at one lag using quantile regressions are presented in Table 7.2. This study experimented on a different lag structure, but found that higher lags generally took the same sign as the first lag and were quantitatively smaller or statistically insignificant. The regression results presented in this section are generally significant at conventional levels of significance, mostly at far below the 1% level, so it does not report standard errors (they are available from the authors upon request). Instead it marks coefficients that are significant at least at the 5% level in bold. As is typical for firm-level regressions using large datasets, R^2 s are low, especially for the profit equation (at 0.02).

Table 7.2. **Quantile regression: results at the median, all firms**

	Employment _t	Assets _t	Sales _t	Profits _t	Productivity _t
Employment _{t-1}	0.015	0.017	0.040	-0.106	-0.044
Assets _{t-1}	0.129	0.132	0.071	-0.236	-0.052
Sales _{t-1}	0.221	0.039	0.100	0.129	0.036
Profits _{t-1}	-0.0004	0.0005	-0.0002	-0.0217	0.0001
Productivity _{t-1}	-0.003	0.004	-0.008	-0.147	-0.189
Constant	-0.029	0.008	0.007	0.013	0.015
Observations	30 221 376				
R ²	0.167	0.102	0.110	0.019	0.109

Note: Bold numbers indicate coefficients statistically significant at the 0.05 level.

Source: Author's calculations based on Statistics Canada (2016), T2-LEAP, 2000 to 2013 (database), www.statcan.gc.ca/eng/cder/data#a10.

The constant in each regression at a given quantile gives the growth of the variable in the absence of other lagged variables, which correspond to the values shown in Table 7.1 (for instance, the constant coefficient for the regression at the median will correspond to values in p50 in Table 7.1.)

Growth persistence

The values along the diagonal of Table 7.2 measure the growth persistence at the median of a given variable, in other words how much of the previous growth (over and above the median) would reverberate in the next period. For the employment growth persistence, Table 7.1 shows that a 10 % employment growth in the previous period would be followed by a small employment growth (over and above the median) of 0.15% in the next period. This positive growth fails to offset the unconditional median tendency (at -0.29%) of median firms to shrink. Moreover, the coefficient of the second lag (not reported) is negative, suggesting that the persistence is short-lived.

Persistence for assets and sales, on the other hand, is larger (and occurs at both the first and second lags). As can be seen from the coefficients in the diagonal of Table 7.2, growth of 10% in the previous period for assets and sales are associated with increased median growth of 1.3% for assets and 1% for sales in the following period. For assets, the results are consistent with capital taking time to build. For sales, they suggest that success predicts success.

The negative coefficients for profits and productivity on their own lags (in the fourth and fifth columns/rows respectively), on the other hand, suggest that high growth in one year is likely to be followed by a subsequent retrenchment, or reversion to the mean.

Cross-correlations

How changes in one variable affect the other variables can be seen by looking at the coefficients along the appropriate rows of Table 7.2. The most important result can be seen from the third row. It shows that lagged sales growth is the best predictor of firm growth along all dimensions. With a coefficient of 0.22, sales growth is associated most strongly with employment growth: a 10% growth in sales is associated with an increase at the median of 2.2% in firm employment. Moreover, employment, assets and sales growth appear to be mutually reinforcing: growth in sales leads to increases in asset and employment growth, both of which lead (see column 3) to subsequent increases in sales. The positive impact of sales on future labour productivity, on the other hand is consistent with output growth driving productivity increases.

Neither profits nor productivity are strongly associated with subsequent growth. In particular, profit growth has a negative impact on future employment and sales, and a negligible impact on assets and productivity. The lack of impact of labour productivity on employment growth is particularly surprising, given the emphasis of many models on productivity as the prime driver of resource reallocation. With respect to profits, while the correlations themselves suggest a relationship between profits and investment in tangible assets and in increasing productivity, the measured impact is small: a doubling of profits shifts predicted labour productivity by less than one hundredth of 1%.

Size and age results at the median

Tables 7.3 and 7.4 look at the employment, sales and productivity regressions, broken up by size and age class. This study's measure of size is employment, or the number of ALU. Complete results for each breakdown are available in Annex 7.A1. Overall, at the median, there seem to be more noticeable differences by firm size than by age.

Persistence

The first observation from the first row of the first panel of Table 7.3 and Table 7.4 is that employment growth persistence happens for all firm sizes and all firm ages (the sole exception is for firms with 20 to 100 ALU). However, while the impact increases by firm size (e.g. coefficients increase by firm size, meaning that 1% employment growth in the previous period led to higher growth in the next period as firm size increases), it decrease with firm age. Sales growth (third line of the second panel in both tables) persistence is also more prevalent for the smallest firms with a coefficient of 0.10, than for firms in larger size classes (e.g. a coefficient of 0.03 for firms with more than 250 ALU). Sales persistence follows the same pattern by firm age, although the trend of diminishing impact as firms age is much less pronounced. Finally, reversion to the mean for productivity seems to increase as firms age (fifth row of the third panel in Table 7.4), suggesting that revenue productivity shocks are more persistent for younger firms.

Cross-correlations

The aggregate results (Table 7.2 in the previous sub-section) suggested that sales were an important driver of firm growth. This result is confirmed for small firms but the impact of lagged sales growth on employment growth fades quickly as firm size increases. Table 7.3 (third line in first panel) shows that the coefficient of lagged sales is almost 0.25 for the smallest firms, but drops to 0.10 for firms with 20 to 100 ALU and to a mere 0.03 for the largest firms. There is no such pattern for firms by age.

Table 7.3. **Select median regressions, by firm employment**

Firm size (ALU)				
Employment _t	< 20 ALU	20-100	100-250	250+
Employment _{t-1}	0.016	-0.015	0.034	0.070
Assets _{t-1}	0.143	0.076	0.058	0.031
Sales _{t-1}	0.246	0.096	0.054	0.030
Profits _{t-1}	-0.0005	0.0000	0.0000	0.0000
Productivity _{t-1}	-0.009	0.031	0.033	0.023
Constant	-0.037	0.017	0.009	0.006
Observations	26 127 336	3 453 732	449 238	191 070
R ²	0.18	0.14	0.13	0.12

Firm size (ALU)				
Sales _t	< 20 ALU	20-100	100-250	250+
Employment _{t-1}	0.038	0.053	0.078	0.080
Assets _{t-1}	0.071	0.073	0.066	0.041
Sales _{t-1}	0.101	0.090	0.052	0.032
Profits _{t-1}	-0.0003	0.0000	-0.0001	0.0000
Productivity _{t-1}	-0.008	0.003	0.007	-0.002
Constant	0.005	0.022	0.018	0.024
Observations	26 127 336	3 453 732	449 238	191 070
R ²	0.10	0.17	0.15	0.12

Firm size (ALU)				
Productivity _t	< 20 ALU	20-100	100-250	250+
Employment _{t-1}	-0.045	-0.022	-0.019	-0.032
Assets _{t-1}	-0.059	-0.017	-0.023	-0.015
Sales _{t-1}	0.034	0.040	0.036	0.027
Profits _{t-1}	0.0001	0.0001	0.0000	0.0000
Productivity _{t-1}	-0.191	-0.165	-0.165	-0.172
Constant	0.014	0.016	0.028	0.026
Observations	26 127 336	3 453 732	449 238	191 070
R ²	0.10	0.17	0.15	0.12

Note: Bold numbers indicate coefficients statistically significant at the 0.05 level.

Source: Author's calculations based on Statistics Canada (2016), T2-LEAP, 2000 to 2013 (database), www.statcan.gc.ca/eng/cder/data#a10.

A notable difference between the disaggregated and aggregate results at the median can be seen from the fifth line of the first panel of Table 7.3. For firms larger than 20 ALU, there does appear to be a significantly positive correlation between lagged productivity growth and employment growth, while it is negative for smaller firms. By contrast, there appears to be little difference in the impact of productivity on firm growth by age.

Finally, there does not seem to be clear differences in the relationship between profit growth and future employment or productivity growth by either size or age. The third panel of Table 4 hints that there may be a relationship between profits and productivity growth for firms older than 5 years, but again, the coefficient is small.

Distributional effects by size and age

Median results may be less informative about the true effect of shocks than their impact on the shape of the distribution. Tables 7.5 and 7.6 examine the impact of lagged

growth in the variables on the shape of the distribution of employment, sales and productivity growth, broken down by size and age.

Table 7.4. **Select median regressions, by firm age**

Employment _t	2-5 years	6-10 years	10+ years
Employment _{t-1}	0.038	0.015	0.005
Assets _{t-1}	0.137	0.143	0.118
Sales _{t-1}	0.256	0.253	0.192
Profits _{t-1}	-0.0003	-0.0005	-0.0003
Productivity _{t-1}	0.001	-0.006	-0.002
Constant	-0.040	-0.015	-0.022
Observations	6 248 334	7 776 354	16 196 688
R ²	0.20	0.19	0.14
Sales _t	2-5 years	6-10 years	10+ years
Employment _{t-1}	0.036	0.035	0.044
Assets _{t-1}	0.069	0.073	0.070
Sales _{t-1}	0.114	0.106	0.089
Profits _{t-1}	-0.0002	-0.0002	-0.0002
Productivity _{t-1}	-0.001	-0.008	-0.011
Constant	0.000	0.007	0.006
Observations	6 248 334	7 776 354	16 196 688
R ²	0.12	0.11	0.10
Productivity _t	2-5 years	6-10 years	10+ years
Employment _{t-1}	-0.034	-0.044	-0.051
Assets _{t-1}	-0.053	-0.055	-0.050
Sales _{t-1}	0.026	0.032	0.043
Profits _{t-1}	-0.0004	0.0002	0.0003
Productivity _{t-1}	-0.145	-0.192	-0.210
Constant	0.024	0.011	0.018
Observations	6 248 334	7 776 354	16 196 688
R ²	0.09	0.11	0.12

Note: Bold numbers indicate coefficients statistically significant at the 0.05 level.

Source: Author's calculations based on Statistics Canada (2016), T2-LEAP, 2000 to 2013 (database), www.statcan.gc.ca/eng/cder/data#a10.

The coefficients at the 10th and 90th percentiles are important when they differ from the median and from each other. If all three quantiles are the same, lagged growth has no effect on the shape of the contemporaneous growth distribution: it simply shifts it leftwards (for negative coefficients) or rightwards (for positive ones). If the coefficients increase from the lower to the higher quantiles, it suggests that lagged growth increases the variance, while decreasing coefficients suggest decreasing variance. If the magnitude of the coefficients is larger at the lower (higher) quantiles, it implies that shocks cause the distribution to become more negatively (positively) skewed.

Shape of growth distributions by size and age

The constant terms give the unconditional quantiles of the growth distributions for the three variables across size and age classes. They suggest that the variance of the distributions becomes smaller as firm size and firm age increase.¹¹ For example, the constant term in the first panel of Table 5 for the smallest firms (less than 20 ALU) is -0.94 at the 10th percentile, but only -0.186 for the largest firms. Similarly, the coefficients at the

90th percentile are 0.36 and 0.205 respectively. The distance between the two quantiles is much greater for smaller firms, indicating a larger variance, with much of the difference coming from the much greater probability of negative outcomes for smaller firms. Moreover, the 10th percentile of small firms' growth distribution is much further away from the median of -0.037 (see the constant term for small firms in the first panel of Table 3) than the 90th percentile, suggesting negative skewness. The constant terms for the other firm sizes are more symmetric.

Persistence

The first line of Table 7.5 (top panel) shows that the main effect of lagged employment growth on subsequent growth for the smallest firms is to reduce the variance of subsequent outcomes (the coefficient on the 10th percentile is higher than the coefficient on the 90th percentile) and this reduction of variance occurs by reducing negative skewness: that is making negative outcomes less likely. The effect on the other firm sizes, by contrast, is to increase the variance of outcomes (the coefficient on the 10th percentile is lower than the coefficient on the 90th percentile). As firms increase in size, employment

Table 7.5. **Select regressions at the 10th and 90th quantile, by firm employment**

Firm size (ALU)								
	< 20 ALU		20-100		100-250		250+	
Employment _t	10th	90th	10th	90th	10th	90th	10th	90th
Employment _{t-1}	0.493	-0.184	-0.085	0.014	-0.050	0.072	-0.042	0.081
Assets _{t-1}	0.326	0.160	0.091	0.138	0.076	0.103	0.040	0.063
Sales _{t-1}	0.356	0.194	0.087	0.085	0.044	0.035	0.042	0.028
Profits _{t-1}	-0.005	0.0002	0.000	-0.0004	0.000	-0.0004	0.000	-0.0005
Productivity _{t-1}	0.007	-0.015	0.042	0.033	0.047	0.033	0.039	0.029
Constant	-0.940	0.360	-0.254	0.260	-0.221	0.216	-0.186	0.205
Observations	26 127 336		3 453 732		449 238		191 070	
R ²	0.91	0.20	0.14	0.22	0.14	0.19	0.12	0.14
Sales _t	10th	90th	10th	90th	10th	90th	10th	90th
Employment _{t-1}	0.291	0.006	0.070	0.106	0.064	0.150	0.017	0.161
Assets _{t-1}	0.266	0.121	0.099	0.139	0.068	0.133	0.037	0.114
Sales _{t-1}	0.247	-0.069	0.009	0.003	0.011	-0.044	0.072	-0.058
Profits _{t-1}	-0.003	-0.0004	0.000	-0.0004	0.000	-0.0002	0.000	-0.0003
Productivity _{t-1}	-0.001	-0.023	-0.007	-0.004	-0.010	-0.003	-0.025	-0.002
Constant	-0.510	0.297	-0.215	0.227	-0.197	0.213	-0.174	0.232
Observations	26 127 336		3 453 732		449 238		191 070	
R ²	0.55	0.07	0.13	0.20	0.12	0.19	0.11	0.14
Productivity _t	10th	90th	10th	90th	10th	90th	10th	90th
Employment _{t-1}	0.093	-0.220	-0.021	-0.025	-0.013	-0.048	0.013	-0.080
Assets _{t-1}	-0.089	-0.150	-0.047	-0.023	-0.076	-0.044	-0.079	-0.039
Sales _{t-1}	0.147	0.017	0.065	0.069	0.059	0.061	0.055	0.043
Profits _{t-1}	0.005	0.0022	0.002	-0.0004	0.002	-0.0005	0.002	-0.0003
Productivity _{t-1}	-0.254	-0.359	-0.215	-0.253	-0.215	-0.276	-0.236	-0.311
Constant	-0.479	0.507	-0.266	0.284	-0.276	0.356	-0.317	0.380
Observations	26 127 336		3 453 732		449 238		191 070	
R ²	0.15	0.40	0.11	0.19	0.12	0.24	0.15	0.32

Note: Bold numbers indicate coefficients statistically significant at the 0.05 level.

Source: Author's calculations based on Statistics Canada (2016), T2-LEAP, 2000 to 2013 (database), www.statcan.gc.ca/eng/cder/data#a10.

growth increases the variance of growth outcomes, and skews them increasingly more towards positive results. It implies that, for small firms at least, employment growth in one period makes median growth prospects slightly more likely, but that its main impact is to make growth reversals much less likely.

Looking at the corresponding rows and panels of Table 7.6 shows that the impact of lagged employment growth on subsequent growth does not vary much by age, having at all ages the effect of reducing both the variance and negative skewness.

Table 7.6. **Select regressions at the 10th and 90th quantile, by firm age**

Employment _t	2-5 years		6-10 years		10+ years	
	10th	90th	10th	90th	10th	90th
Employment _{t-1}	0.478	-0.181	0.484	-0.192	0.480	-0.178
Assets _{t-1}	0.302	0.174	0.346	0.156	0.333	0.125
Sales _{t-1}	0.319	0.204	0.370	0.192	0.379	0.139
Profits _{t-1}	-0.0026	0.0000	-0.0048	0.0002	-0.0055	0.0003
Productivity _{t-1}	0.004	-0.007	0.010	-0.016	0.023	-0.009
Constant	-1.153	0.421	-0.875	0.383	-0.645	0.287
Observations	6 248 334		7 776 354		16 196 688	
R ²	0.906	0.2118	0.9402	0.1974	0.8076	0.1644
Sales _t	2-5 years		6-10 years		10+ years	
	10th	90th	10th	90th	10th	90th
Employment _{t-1}	0.284	0.006	0.273	0.003	0.296	0.002
Assets _{t-1}	0.261	0.138	0.274	0.120	0.234	0.107
Sales _{t-1}	0.228	-0.054	0.263	-0.071	0.212	-0.075
Profits _{t-1}	-0.0019	-0.0009	-0.0026	-0.0003	-0.0030	-0.0001
Productivity _{t-1}	0.022	-0.020	0.003	-0.024	-0.010	-0.026
Constant	-0.639	0.336	-0.531	0.297	-0.377	0.247
Observations	6 248 334		7 776 354		16 196 688	
R ²	0.585	0.0804	0.5562	0.066	0.4728	0.0594
Productivity _t	2-5 years		6-10 years		10+ years	
	10th	90th	10th	90th	10th	90th
Employment _{t-1}	0.097	-0.195	0.090	-0.213	0.104	-0.250
Assets _{t-1}	-0.099	-0.145	-0.090	-0.153	-0.064	-0.138
Sales _{t-1}	0.106	0.037	0.151	0.012	0.154	0.016
Profits _{t-1}	0.0057	-0.0015	0.0047	0.0027	0.0030	0.0027
Productivity _{t-1}	-0.227	-0.272	-0.245	-0.369	-0.251	-0.386
Constant	-0.508	0.598	-0.475	0.494	-0.386	0.419
Observations	6 248 334		7 776 354		16 196 688	
R ²	0.1338	0.3354	0.1398	0.4032	0.1626	0.4026

Note: Bold numbers indicate coefficients statistically significant at the 0.05 level.

Source: Author's calculations based on Statistics Canada (2016), T2-LEAP, 2000 to 2013 (database), www.statcan.gc.ca/eng/cder/data#a10.

With respect to sales, the third line of the second panel of Table 7.6 shows that lagged sales growth's effect on the distribution of subsequent sales growth follows a similar pattern to that of employment for small firms. Taken together with the median results in Tables 7.3 and 7.4, it shows that sales success tends to breed success and helps insure against failure.

Cross-correlations

Most of the cross-correlations appear to be similar across quantiles, suggesting that their impact is well-summarised by the median coefficients. There are three interesting exceptions. The first is that lagged sales growth appears to reduce the variance and skewness of employment growth for small firms and firms of all ages (third line of the first panel in both tables). In other terms, sales success makes subsequent employment growth more likely and subsequent growth reversals much less likely for small firms.

The second exception is the impact of lagged sales on productivity growth for small firms and firms of all ages. While the previous section on aggregate results has shown that sales growth increases median productivity for all firms at all ages (Tables 7.4 and 7.6, third panels), the coefficients on lagged sales in the third panel of Tables 7.5 and 7.6 suggest that sales growth has more influence on the negative tail of the distribution than on the positive tail – i.e. sales growth makes future productivity growth reversals proportionately less likely.

The third observation is that the effect of lagged profit growth on productivity growth, which was negligible at the median, is noticeable in the tails. The coefficient on the profits in the third panel of both Tables 7.5 and 7.6 suggests that profits may reduce the variance of productivity growth, primarily by reducing the probability of productivity reversals. The impact on skewness is particularly large for young firms.

Conclusions

Firm growth is a heterogeneous, dynamic and unpredictable phenomenon. Research projects such as OECD's DynEmp seek to advance the understanding of how firms grow by examining employment dynamics in an international perspective. This study seeks to augment their approach by exploring the growth processes of Canadian firms over several dimensions. Examining the co-evolution of the distribution of key variables such as growth of employment, sales, profits, assets and labour productivity, while not conclusive, yields some interesting results.

The most striking result is the positive impact of sales growth on other variables. Sales growth tends to be persistent, and it is correlated with both subsequent employment and productivity growth. The correlation with employment raises the prospect that changes in demand for firms' products play a significant role in firm's decision to grow. This suggests that opening markets and improving access to consumers may be important goals for policy makers seeking to foster firm growth. The correlations with labour productivity growth, on the other hand, leave open the possibility of micro Kaldor-Verdoorn effects: i.e. output growth drives technical progress and this leads to higher productivity. The impacts on employment and productivity growth are especially important to small firms of all ages.

This chapter's results do not show a significant impact of profit growth for any firms at the median, either in terms of subsequent employment or productivity growth. However, profitability may still matter, especially for small firms. In particular, while profit growth does not seem to do much for increasing median firm growth, it seems to protect firms against growth reversals. One reason may be that financial markets fail firms especially when the firms get into trouble. If so, policy makers may wish to consider designing financial aid programmes to specifically target firms with high profit volatility.

Finally, past productivity growth does not seem to be a good predictor of future growth in the short term. This chapter's results show that productivity growth is very hard to

maintain: coefficients from regression on productivity on its own lags are negative, meaning that productivity growth in one period is more likely to be followed by negative productivity growth in the next period. In particular for young and small firms, productivity growth in the previous period does not translate in employment or sales growth in the next period. Overall, previous sale growth seems to be a better predictor of future growth.

This study has a number of limitations. One major issue is that the empirical model is reduced-form, rather than structural. As a result, the correlations are suggestive but causality cannot be firmly established. However, the work here demonstrates the value of a multi-dimensional approach that moves beyond median effects in shedding light on how firms grow.

Notes

1. Unlike many studies that look at total firm growth, this chapter examines only organic growth, and abstracts from growth through merging with or acquiring other firms. The following sections discuss the reasons and consequences of focusing on organic growth.
2. The Kaldor-Verdoorn effect refers Kaldor's (1966) formulation of Verdoorn's Law (the statistical relationship between long-run labour productivity and output growth in the manufacturing sector), in which output growth drives technical progress and thus leads to higher productivity at the industry level.
3. Note that a random walk for growth rates is not the same as Gibrat's Law, which argues that there is no relation between growth and initial firm size.
4. The LEAP has two measures of employment: the ALU and the individual labour unit (ILU). The ILU treats each worker as one unit, regardless of how many hours they work in a year, or for how many firms. In aggregate, ILUs are generally higher than, and their growth generally leads, ALUs. Other than their levels and the timing of their growth, they follow similar patterns.
5. A comparison of ALUs and ILUs shows that these micro-firms overwhelmingly consist of one physical employee or two-person partnerships, and the variation in their ALU is primarily due to variation in hours the person or partners work or the wages they pay.
6. Note that in the core model of DynEmp, such small firms have also been treated separately.
7. For example, revenue productivity and sales are likely to exhibit a high degree of contemporaneous correlation in response to a sales shock. Note that the structural coefficients can be recovered if one is willing to assume a causal order for the variables. However, in the absence of compelling theories, the ordering will be arbitrary.
8. It was decided not to deflate the nominal variables. In the absence of firm or establishment level prices, there is the possibility that industry-wide deflators will skew the results for smaller firms with less pricing power.
9. The median employment growth of -2.9% is lower than found by Dixon and Rollin (2012) for all firms, who found practically no growth for the median firm. The difference may reflect the inclusion of the aftermath of the 2008 recession in the current data set.
10. Normal distributions are symmetric (zero skewness) and have a kurtosis of 3.
11. For example, the constant term in the first panel of Table 7.5 for the smallest firms (less than 20 ALU) is -0.94 at the 10th percentile, but only -0.186 for the largest firms. Similarly, the coefficients at the 90th percentile are 0.36 and 0.205 respectively. The distance between the two quantiles is much greater for smaller firms, indicating a larger variance, with much of the difference coming from the much greater probability of negative outcomes for smaller firms.

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ANNEX 7.A1

*Full median VAR regressions by size and age*Table 7.A1.1. **Median regressions by firm employment**

Size < 20 ALU					
	Employment _t	Assets _t	Sales _t	Profits _t	Productivity _t
Employment _{t-1}	0.016	0.014	0.038	-0.106	-0.045
Assets _{t-1}	0.143	0.142	0.071	-0.259	-0.059
Sales _{t-1}	0.246	0.037	0.101	0.131	0.034
Profits _{t-1}	-0.0005	0.0005	-0.0003	-0.0226	0.0001
Productivity _{t-1}	-0.009	0.003	-0.008	-0.145	-0.191
Constant	-0.037	0.006	0.005	0.014	0.014
Observations	26 127 336				
R ²	0.18	0.11	0.10	0.02	0.11
Size 20-100 ALU					
	Employment _t	Assets _t	Sales _t	Profits _t	Productivity _t
Employment _{t-1}	-0.015	0.046	0.053	-0.091	-0.022
Assets _{t-1}	0.076	0.071	0.073	-0.093	-0.017
Sales _{t-1}	0.096	0.044	0.090	0.115	0.040
Profits _{t-1}	0.00002	0.0006	-0.00005	-0.0172	0.0001
Productivity _{t-1}	0.031	0.0018	0.003	-0.108	-0.165
Constant	0.017	0.029	0.022	0.025	0.016
Observations	3 453 732				
R ²	0.14	0.08	0.17	0.01	0.09
Size 100-250 ALU					
	Employment _t	Assets _t	Sales _t	Profits _t	Productivity _t
Employment _{t-1}	0.034	0.066	0.078	-0.051	-0.019
Assets _{t-1}	0.058	0.011	0.066	-0.072	-0.023
Sales _{t-1}	0.054	0.033	0.052	0.112	0.036
Profits _{t-1}	-0.00002	0.0004	-0.0001	-0.0141	0.00001
Productivity _{t-1}	0.033	0.0027	0.007	-0.138	-0.165
Constant	0.009	0.018	0.018	-0.002	0.028
Observations	449 238				
R ²	0.13	0.06	0.15	0.01	0.09

Table 7.A1.1. **Median regressions by firm employment (cont.)**

Size > 250 ALU					
	Employment _t	Assets _t	Sales _t	Profits _t	Productivity _t
Employment _{t-1}	0.070	0.056	0.080	-0.118	-0.032
Assets _{t-1}	0.031	-0.015	0.041	-0.040	-0.015
Sales _{t-1}	0.030	0.036	0.032	0.124	0.027
Profits _{t-1}	-0.00003	0.0003	0.00003	-0.0142	-0.00004
Productivity _{t-1}	0.023	0.016	-0.002	-0.239	-0.172
Constant	0.006	0.024	0.024	0.026	0.026
Observations	191 070				
R ²	0.12	0.05	0.12	0.01	0.10

Note: Bold numbers indicate coefficients statistically significant at the 0.05 level.

Source: Author's calculations based on Statistics Canada (2016), T2-LEAP, 2000 to 2013 (database), www.statcan.gc.ca/eng/cder/data#a10.

Table 7.A1.2. **Median regressions by firm age**

Age 2-5 years					
	Employment _t	Assets _t	Sales _t	Profits _t	Productivity _t
Employment _{t-1}	0.038	0.014	0.036	-0.073	-0.034
Assets _{t-1}	0.137	0.142	0.069	-0.227	-0.053
Sales _{t-1}	0.256	0.040	0.114	0.136	0.026
Profits _{t-1}	-0.0003	0.0005	-0.0002	-0.023	-0.0004
Productivity _{t-1}	0.001	0.004	-0.001	-0.082	-0.145
Constant	-0.040	0.016	0.000	0.081	0.024
Observations	6 248 334				
R ²	0.20	0.11	0.12	0.02	0.09

Age 6-10 years					
	Employment _t	Assets _t	Sales _t	Profits _t	Productivity _t
Employment _{t-1}	0.015	0.014	0.035	-0.099	-0.044
Assets _{t-1}	0.143	0.135	0.073	-0.245	-0.055
Sales _{t-1}	0.253	0.043	0.106	0.124	0.032
Profits _{t-1}	-0.0005	0.0006	-0.0002	-0.0218	0.0002
Productivity _{t-1}	-0.006	0.003	-0.008	-0.137	-0.192
Constant	-0.015	0.007	0.007	0.008	0.011
Observations	7 776 354				
R ²	0.19	0.10	0.11	0.02	0.11

Age 10+ years					
	Employment _t	Assets _t	Sales _t	Profits _t	Productivity _t
Employment _{t-1}	0.005	0.019	0.044	-0.131	-0.051
Assets _{t-1}	0.118	0.122	0.070	-0.246	-0.050
Sales _{t-1}	0.192	0.036	0.089	0.128	0.043
Profits _{t-1}	-0.0003	0.0005	-0.0002	-0.0210	0.0003
Productivity _{t-1}	-0.002	0.004	-0.0011	-0.184	-0.210
Constant	-0.022	0.009	0.006	0.024	0.018
Observations	16 196 688				
R ²	0.14	0.10	0.10	0.02	0.12

Note: Bold numbers indicate coefficients statistically significant at the 0.05 level.

Source: Author's calculations based on Statistics Canada (2016), T2-LEAP, 2000 to 2013 (database), www.statcan.gc.ca/eng/cder/data#a10.

Chapter 8

Employment dynamics and labour productivity growth in the Norwegian economy: Evidence from firm-level data

by

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This chapter proposes a new decomposition of employment and labour productivity growth. The decomposition is an extension of a standard method that is frequently used, for example, by the OECD. It identifies three main sources of productivity growth: within-firm productivity growth, between-firm reallocation effects and entry/exit dynamics. The contributions from different industries are quantified; from SMEs versus large firms; and non-exporting versus exporting firms. The analyses reveal that the strong employment growth in labour-intensive service industries during the last decade – partly driven by labour immigration – mainly affected productivity growth through the channel of entry/exit dynamics. In particular, net entry of employees into new firms in some service industries in the period 2002-07 is associated with an annual one percentage point reduction in productivity growth. However, these developments by no means explain the strong downward trend in productivity growth during the last decade.

Introduction

The government appointed productivity commission¹ reports that productivity growth in the Norwegian mainland business sector declined after 2005 compared to 1996-2005. The commission cites official statistics showing that average annual labour productivity growth was 0.8% during 2006-14, down from 3% during 1996-2005 (see Figure 1.1 in NOU [2016]). This productivity slowdown is assumed to reflect strong employment growth in labour-intensive industries such as construction, transportation, retail trade and other service industries, which became particularly strong in the wake of the European Union (EU) expansion in 2004. As is noted in the report, the downward trend in labour productivity during the last ten years or so is by no means a Norwegian peculiarity. For all the OECD countries combined, the trend growth in annual labour productivity declined steadily from 1.8% in 2000 to 0.4% in 2014.

The data reported by the commission – and in other official productivity statistics – come from the National Accounts (NA). The purpose of this chapter is to analyse productivity growth patterns and employment flows using firm-level registry data for the total population of Norwegian incorporated firms over the period 1996-2014.

An important benefit of firm-level data is the possibility to decompose employment and output growth – and hence also aggregate growth in labour productivity – additively according to different types of sources, such as contributions from entry and exit, within-firm reallocations, exporting versus non-exporting firms, and so on. This chapter proposes and explore a new decomposition, which is an extension of the decomposition outlined in OECD (2001, p. 145). This study's decomposition identifies three main sources or channels of productivity growth: i) within-firm productivity growth; ii) between-firm reallocation effects; and iii) firm turnover effects (entry/exit dynamics). The decomposition into parts i) and ii) is somewhat abstract, as it attempts to separate between the (counterfactual) productivity growth that would have occurred without any reallocation of labour between existing firms on the one hand and the effect of such labour reallocations on the other. The chapter also quantifies the contributions from the different industries; from small and medium-sized enterprises (SMEs) versus large firms; and non-exporting versus exporting firms.

This analysis' findings with regard to employment and labour productivity growth in Norway in the period 1996-2014 correspond well with the findings of the productivity commission cited above. For example, calculations show that growth in labour productivity (real value-added per employee) during 2005-14 was 1.3% annually in the mainland Norwegian economy, compared to 3.2% during 1996-2004. Hence this study also finds a strong productivity slowdown during the last decade. It is the purpose of the rest of this chapter to look further into the sources of this slowdown.

Productivity growth decompositions

The seminal paper of Foster, Haltiwanger and Krizan (2001) outlines a framework for decomposing productivity growth based on weighted average productivity levels to identify the contribution of firm turnover, e.g. entry/exit dynamics, to aggregate productivity growth.

It has been used by many – e.g. Foster, Haltiwanger and Syverson (2008) – to quantify the impact of different sources of productivity growth, for example the contributions from reallocation of labour inputs among existing firms versus turnover (exit and entry). Possible drawbacks of their decomposition method have been pointed out by several authors, for example Katayama, Lu and Tybout (2003), who point out that productivity indices based on nominal variables may have little to do with actual productivity levels. Alternative aggregation methods exist in the literature. A recent proposal is von Brasch (2015) who outlines a decomposition that identifies the contribution of entering and exiting firms to aggregate productivity growth using a Constant Elasticity of Substitution (CES) framework. In contrast to the method in Foster, Haltiwanger and Syverson (2008), which is based on the assumptions that inputs and outputs are homogenous across firms, the framework in Brasch (2015) allows for both heterogeneous outputs and heterogeneous inputs. The contribution of entering and exiting firms to aggregate productivity growth is in this framework shown to be based on the profitability of entering and exiting firms relative to the profitability of continuing firms.

This chapter extends a well-known framework (see OECD [2001, p. 145]) for decomposing aggregate productivity growth rates at the sectoral level into between-industry reallocation effects and within-industry productivity growth. It does so by incorporating firm-level dynamics. The method is different from Foster, Haltiwanger and Krizan (2001) who decompose productivity growth levels rather than productivity growth rates. This study's extension incorporates the effects from entering and exiting firms in a similar way to von Brasch (2015), but is algebraically much simpler (requiring no reliance on, or understanding of, complicated index theory). However, like Foster, Haltiwanger and Syverson (2008), it assumes homogeneous output and input.

It starts its analysis by introducing some definitions and notation. First, let Q_{it} and L_{it} be output (e.g. value-added in real prices) and labour input (e.g. number of employees) of firm i in period t , respectively. For simplicity, capital input is not taken into account. Aggregate output and input in t and $t-1$ can be decomposed as:

$$Q_t = \sum_{i \in C(t)} Q_{it} + \sum_{i \in E(t)} Q_{it}, \quad L_t = \sum_{i \in C(t)} L_{it} + \sum_{i \in E(t)} L_{it},$$

and

$$Q_{t-1} = \sum_{i \in C(t)} Q_{i,t-1} + \sum_{i \in X(t)} Q_{i,t-1}, \quad L_{t-1} = \sum_{i \in C(t)} L_{i,t-1} + \sum_{i \in X(t)} L_{i,t-1},$$

where $C(t)$ is the set of continuing firms (firms that exist in both $t-1$ and t), $X(t)$ is the set of exiting firms (existing in $t-1$ but not t) and $E(t)$ the set of entering firms (existing in t but not $t-1$). Output and input weights of continuing and exiting firms are also defined as follows:

$$s_{C(t)}^Q = \frac{\sum_{i \in C(t)} Q_{i,t-1}}{Q_{t-1}}, \quad s_{X(t)}^Q = \frac{\sum_{i \in X(t)} Q_{i,t-1}}{Q_{t-1}},$$

$$s_{C(t)}^L = \frac{\sum_{i \in C(t)} L_{i,t-1}}{L_{t-1}}, \quad s_{X(t)}^L = \frac{\sum_{i \in X(t)} L_{i,t-1}}{L_{t-1}}.$$

Let Δ be the backward difference operator, for example, $\Delta Q_t = Q_t - Q_{t-1}$. Relative output and input growth is then given by:

$$\begin{aligned}\frac{\Delta Q_t}{Q_{t-1}} &= \frac{1}{Q_{t-1}} \left[\sum_{i \in C(t)} \Delta Q_{it} + \sum_{i \in E(t)} Q_{it} - \sum_{i \in X(t)} Q_{i,t-1} \right] \\ &= s_{C(t)}^Q \frac{\sum_{i \in C(t)} \Delta Q_{it}}{\sum_{i \in C(t)} Q_{i,t-1}} + s_{X(t)}^Q \frac{\left(\sum_{i \in E(t)} Q_{it} - \sum_{i \in X(t)} Q_{i,t-1} \right)}{\sum_{i \in X(t)} Q_{i,t-1}},\end{aligned}\quad (1)$$

and

$$\begin{aligned}\frac{\Delta L_t}{L_{t-1}} &= \frac{1}{L_{t-1}} \left[\sum_{i \in C(t)} \Delta L_{it} + \sum_{i \in E(t)} L_{it} - \sum_{i \in X(t)} L_{i,t-1} \right] \\ &= s_{C(t)}^L \frac{\sum_{i \in C(t)} \Delta L_{it}}{\sum_{i \in C(t)} L_{i,t-1}} + s_{X(t)}^L \frac{\left(\sum_{i \in E(t)} L_{it} - \sum_{i \in X(t)} L_{i,t-1} \right)}{\sum_{i \in X(t)} L_{i,t-1}},\end{aligned}\quad (2)$$

Labour productivity growth (at the aggregate level) is defined as:

$$\frac{d \ln(Q(t)/L(t))}{dt} = \frac{\Delta Q_t}{Q_{t-1}} - \frac{\Delta L_t}{L_{t-1}},$$

where

$$\begin{aligned}\frac{\Delta Q_t}{Q_{t-1}} - \frac{\Delta L_t}{L_{t-1}} &= s_{C(t)}^Q \left(\frac{\sum_{i \in C(t)} \Delta Q_{it}}{\sum_{i \in C(t)} Q_{i,t-1}} - \frac{\sum_{i \in C(t)} \Delta L_{it}}{\sum_{i \in C(t)} L_{i,t-1}} \right) \\ &\quad + (s_{C(t)}^Q - s_{C(t)}^L) \frac{\sum_{i \in C(t)} \Delta L_{it}}{\sum_{i \in C(t)} L_{i,t-1}} + \psi_t,\end{aligned}\quad (3)$$

with ψ_t representing the net contribution from the entering and exiting firms, that is, the firms in the set $E(t)$ and $X(t)$, respectively. An expression for ψ_t is given below.

Next, firms are classified directly into different industries $J \in \{1, \dots, M\}$ and let $J(i)$ denote the industry of firm i . The following weights need to be defined:

$$\begin{aligned}s_{it}^Q &= \frac{Q_{i,t-1}}{\sum_{k \in J(i) \cap C(t)} Q_{k,t-1}}, \quad \alpha_{J|C(t)}^Q = \frac{\sum_{i \in J \cap C(t)} Q_{i,t-1}}{\sum_{i \in C(t)} Q_{i,t-1}}, \quad \alpha_{J|X(t)}^L = \frac{\sum_{i \in J \cap X(t)} L_{i,t-1}}{\sum_{i \in X(t)} L_{i,t-1}} \\ \alpha_{J|X(t)}^Q &= \frac{\sum_{i \in J \cap X(t)} Q_{i,t-1}}{\sum_{i \in X(t)} Q_{i,t-1}}, \quad s_{it}^L = \frac{L_{i,t-1}}{\sum_{k \in J(i) \cap C(t)} L_{k,t-1}}, \quad \alpha_{J|C(t)}^L = \frac{\sum_{i \in J \cap C(t)} L_{i,t-1}}{\sum_{i \in C(t)} L_{i,t-1}}.\end{aligned}$$

In practice, the second term in (3) will be small in absolute value (less than 0.001 in this analysis' data) and contributes negligibly to aggregate productivity growth. Ignoring this term, Annex 8.A1 shows that an approximate decomposition can be made as follows:

$$\begin{aligned}\frac{\Delta Q_t}{Q_{t-1}} - \frac{\Delta L_t}{L_{t-1}} &= \sum_J s_{C(t)}^Q \alpha_{J|C(t)}^Q \sum_{i \in J \cap C(t)} s_{it}^Q \left(\frac{\Delta Q_{it}}{Q_{i,t-1}} - \frac{\Delta L_{it}}{L_{i,t-1}} \right) \\ &\quad + \sum_J \left[s_{C(t)}^Q \left(\alpha_{J|C(t)}^Q - \alpha_{J|C(t)}^L \right) \frac{\sum_{i \in J \cap C(t)} \Delta L_{it}}{\sum_{i \in J \cap C(t)} L_{i,t-1}} + \sum_{i \in J \cap C(t)} s_{it}^Q \alpha_{J|C(t)}^Q (s_{it}^Q - s_{it}^L) \frac{\Delta L_{it}}{L_{i,t-1}} \right] + \sum_J \psi_{Jt},\end{aligned}\quad (4)$$

where

$$\psi_{Jt} = - \left(s_{X(t)}^Q \alpha_{J|X(t)}^Q - s_{X(t)}^L \alpha_{J|X(t)}^L \right) + \left(\frac{\sum_{i \in E(t) \cap J} Q_{it}}{Q_{t-1}} - \frac{\sum_{i \in E(t) \cap J} L_{it}}{L_{t-1}} \right). \quad (5)$$

The terms in the first summation in (4) reflect the within-firm productivity growth among continuing firms, summed over all the industries, J . The different terms within the

squared bracket (in the second summation) reflect the combined reallocation effects among the continuing firms. These are decomposed into two parts: i) reallocation between continuing firms across industries (inter-industry reallocation); and ii) reallocation between firms in the same industry (intra-industry reallocation). Finally, the term Ψ_{jt} represents the net contribution to productivity growth from firm turnover (entry/exit dynamics) in industry J .

The turnover effect, Ψ_{jt} , can furthermore be decomposed into two parts: The first part is the negative of the expression in the first parenthesis in Equation (5), which is the contribution to productivity growth from exiting firms. This contribution is positive if the initial output share of the exiting firms is *smaller* than their initial input share. Since the terms $s_D^Q \alpha_{jD}^Q - s_D^L \alpha_{jD}^L$ sum to zero overall $D \in \{C(t), X(t)\}$ and $J \in \{1, \dots, M\}$, this is tantamount to saying that the contribution is positive if the initial productivity level of the exiting firms is lower than the aggregate productivity level over all firms. The second part is the contribution to productivity growth from entering firms. For a given industry, J , this contribution is positive if the productivity level of the entering firms is higher than the initial aggregate productivity level of the whole industry.

A problem with the interpretation of the turnover effect Ψ_{jt} (and the corresponding entry and exit contributions), is related to the definition of an entering firm. An entering firm is a new legal entity (the corporation), but it may still (partially or fully) be a continuation of an old firm, for example through a merger or demerger. Obviously, this has potentially wide impacts on the interpretation of productivity decompositions, especially the importance of new versus old firms.

To take one step towards separating genuine start-ups from firms that are just new legal units, this study uses the possibility it has in its data to match firms to establishments, i.e. production units (e.g. plants) with own identification numbers in the statistics. It defines an entering firm as a fake entry if it consists of at least one establishment that previously belonged to another firm. All other entering firms (at t) belong to the set $E^{gen}(t)$ of genuine entering firms – a subset of $E(t)$. Summing the entry-effects in Equation (5) only over firms in $E^{gen}(t)$, this analysis defines the (genuine) entry-effect as follows:

$$\text{Entry-effect}_{jt} = \frac{\sum_{i \in E^{gen}(t) \cap J} Q_{it}}{Q_{t-1}} - \frac{\sum_{i \in E^{gen}(t) \cap J} L_{it}}{L_{t-1}}.$$

Next, it defines the net exit-effect as the residual term:

$$\text{Exit-effect}_{jt} = \Psi_{jt} - \text{Entry-effect}_{jt},$$

where Ψ_{jt} is defined as before (in Equation (5)). Thus, the turnover effect (entry plus exit-effect) is unchanged, so Equation (4) is still valid. Note that in the (likely) case that a fake entry has a counterpart in the form of a “fake exit” (i.e. the legal unit is liquidated, but the activity continues under a new firm), the contributions from the two firms automatically cancel out in the turnover effect, Ψ_{jt} . However, not eliminating the fake entries before calculating the entry-effect would mean that in absolute value both the entry- and exit-effect will be overstated (but their sum is unchanged).

The decomposition in Equation (4) and the decomposition of Ψ_{jt} into a (genuine) entry-effect and a (net) exit-effect are the basis for all this study’s empirical analyses in the third section. Note that both output, Q , and the industry-specific weights $\alpha_{jC(t)}^Q$ are based on deflated current values and hence depend on the method of deflation.²

Data

This study's population is limited to the incorporated firms (including public-owned firms) in the mainland economy.³ This population accounts for about 80% of employment in the market-based industries in Norway. This study defines (labour) productivity as value-added per employee in real prices. Value-added is defined as the gross value of production minus the value of intermediate inputs. Intermediate input is not a variable in the accounts statistics, but is calculated residually as total operating costs minus the sum of labour costs and capital costs (such as depreciation). Value-added can be interpreted as the contribution of labour and capital inputs to operating income (before taxes) during the year. This chapter's data source regarding employment is Statistics Norway's employer-employee register, which is a matched employer-employee data set. Registry data for total number of employees may differ slightly from the National Accounts (NA) figures, which include employed foreigners on short-term contracts that are not residents of Norway. The latter information is obtained through surveys.

This analysis deflates value-added in current prices using (implicit) industry-specific price indices of value-added from NA. That is:

$$\text{price index} \times \text{value-added in real prices} = \text{value-added in current prices}.$$

When value-added is measured in real prices, the aggregation from the individual industries to the mainland economy is based on real weights (share of real value-added and share of employees) as mentioned in the second section of this chapter.

There are many sources of potential discrepancies between this study's micro-based productivity calculations and official statistics from NA. One is that NA, in accordance with international standards, uses the method of double deflation of gross product and intermediate inputs at a detailed product level (see OECD [2001]) to obtain value-added in real (constant) prices. On the other hand, output growth calculated from firm-level data must rely on simple deflation, as there is no data with regard to the composition of gross product or intermediate input in the business accounts. This chapter uses the ratio of value-added in current and real prices as published by NA at the industry level as the price index of value-added. Then, if NA were to use simple deflation of value-added instead of double deflation, value-added in real prices would be the same with both methods of deflation. The method of deflation should then in principle not be a source of discrepancy between this chapter's approach and NA with regard to productivity measurement.

Productivity growth in the Norwegian mainland economy 1996-2014

The upper chart of Figure 8.1 shows average annual productivity growth rates for the period 1996-2014. The period has been split into intervals covering three years each, except the interval 2011-14. Thus, with reference to this study's formal framework, $t = 1$ corresponds to 1995 (the first base year used in the calculations), $t = 2$ corresponds to 1998, $t = 3$ to 2001, etc.⁴ The indicators on the solid orange curve show the average annual growth rate in the corresponding time interval. A (grey) curve indicating average annual real wage growth in mainland Norway (obtained from official statistics) has also been included.

First, the marked downward trend in productivity growth over the period 2005-14 can be noted, compared to 1996-2004. Next, the divergent pattern of real wage and real productivity growth during the last ten-year period can be noted. To understand this development, it is useful to observe the growth rates of the aggregate mainland GDP deflator and the CPI deflator in the same period, depicted as the pink and green curves in

Figure 8.1. **Annual productivity growth in mainland economy decomposed into contributions by industry**



Note: Transportation and storage does not include transport via pipeline, passenger ocean transport and freight ocean transport.

Source: Authors' calculations and Statistics Norway.

the lower chart of Figure 8.1. On average, producer prices (represented by the GDP deflator) have annually increased about 1.5 percentage points more than consumer prices (the CPI deflator). This gap accounts for the difference between productivity growth and real wage growth in the first two three-year intervals, 1996-98 and 1999-2001.

The period 2005-07 coincides with the peak of the oil-fuelled boom-period that lasted from 2001 until the financial crisis of 2008 (when oil prices surged from USD 20 to more than USD 100 per barrel). The extraordinary real wage growth rate of 7% annually (compared to 2% productivity growth) was much debated in Norway at the time. It can be attributed to several factors. First, it reflects a “catching-up” effect from the low real wage growth during 2002-04, when productivity growth was 4.5% annually and real wage growth 3%. Second, the gap between annual producer price growth and inflation was almost 2 percentage points during 2005-07.

While the difference between real wage and productivity growth in the next three-year period, 2008-10, can be explained fully by the difference between the (mainland) gross domestic product (GDP)-deflator and inflation, the last time interval, 2011-14, stands out as truly extraordinary. In this interval productivity growth was virtually zero, while real wages grew by 4% annually in real terms. This discrepancy could not be sustained. It is not surprising that the steep fall in oil prices from above USD 100 in August 2014 to USD 30 in January 2016, not only affected the oil industry, but also spurred a halt in real wage growth in mainland Norway (which is expected to be close to zero in 2016). The prospect of very low productivity growth, permanently low oil prices and an ageing population is arguably the biggest challenge for the Norwegian economy in the years to come.

Reallocation effects and entry/exit dynamics

The bar graphs of Figure 8.1 show an (additive) decomposition of total productivity growth into contributions from the different industries. The sum of the positive contributions (the bars above the horizontal axis) and the negative contributions (the bars below the axis) equals total productivity growth (the orange curve). The contribution from each industry depends on the productivity growth in that industry and the weight it carries in the mainland economy (see Equation (4)). The most striking development over time is with regard to manufacturing. From 1996-2007, manufacturing was the main driver of productivity growth in the mainland economy. Since 2007 its contribution has dropped gradually to virtually zero in 2011-14.

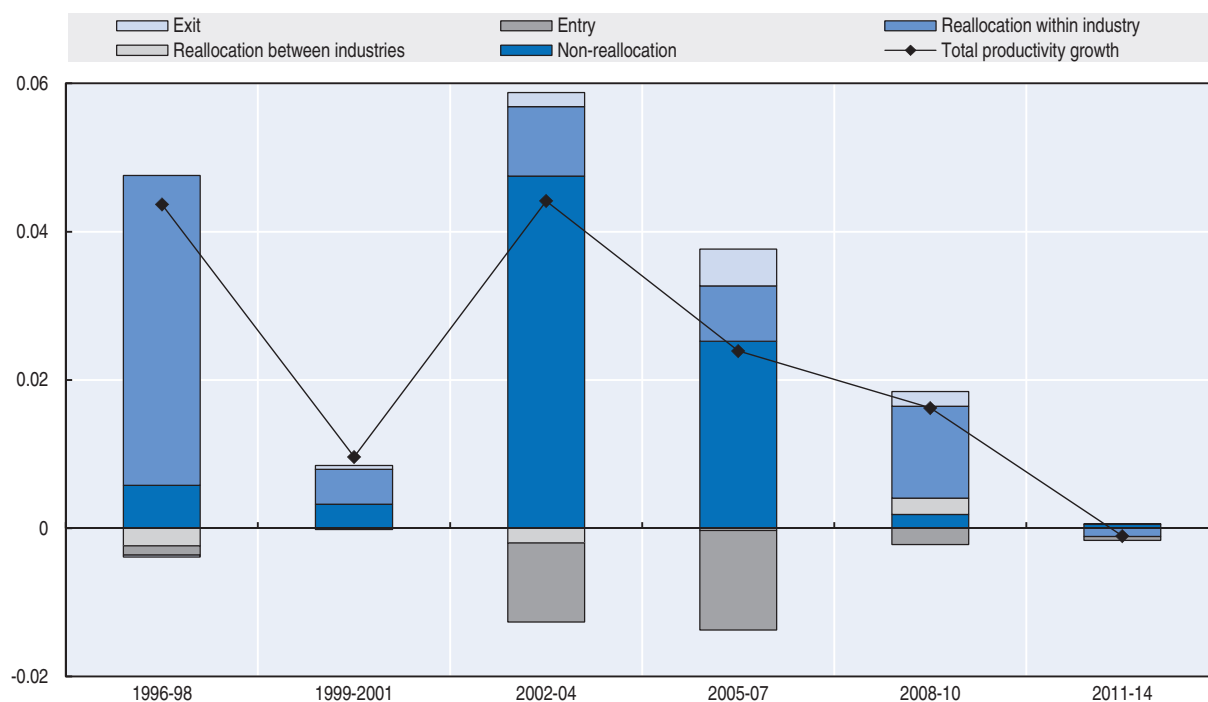
Another important contributor is the wholesale and retail trade, especially since 1999, but also in this industry productivity growth fizzled out in the last interval. A third important industry is information and communication. After the collapse of the dot-com bubble in 2000-01, the industry went through a period of sustained productivity growth. Information and communication accounted for the highest contribution (0.24 percentage points) to productivity growth in 2011-14, when total productivity growth in mainland Norway was -0.11%.

The productivity growth figures of the different industries (not shown here) reveal that during 1996-2014, manufacturing, the wholesale and retail trade, and information and communication had average annual productivity growth rates of respectively 4%, 4% and 5%. These were the highest average growth rates among all the industries, except agriculture, forestry and fishing (8%) and electricity supply⁵ (5%). The latter two industries make up only 2% of employment and 6% of value-added in 2014. In comparison, manufacturing,

wholesale and the retail trade and information and communication account for respectively 16%, 24% and 6% of the employees (see Figure 8.A1.1) and 19%, 18% and 9% of value-added (see Figure 8.A1.2).

The contribution to growth in real value-added per employee also includes reallocation effects, as discussed in the second section. Reallocation effects are due to employees switching between continuing firms with different productivity levels, as measured by $s_{it}^Q - s_{it}^L$. Switching in this sense does not necessarily refer to individual workers changing jobs, but changes in employment shares of firms. When employees “move” in this sense, there may be a productivity effect even if each firm’s productivity level remains unchanged. For example, if employees move from a firm i with low initial productivity level (say $s_{it}^Q < s_{it}^L$) to a firm j in the same industry with high initial productivity level ($s_{it}^Q > s_{it}^L$), the contribution to aggregate productivity will be positive. Reallocations may occur both within industries and across industries. In general, the total within-industry reallocation effect is determined by the covariance between $(s_{it}^Q - s_{it}^L)$ and $\Delta L_{it} / L_{i,t-1}$. The between-industry reallocation effect is determined by the covariance between $(\alpha_{j|C(t)}^Q - \alpha_{j|C(t)}^L)$ and $\sum_{i \in J \cap C(t)} \Delta L_{it} / \sum_{i \in J \cap C(t)} L_{i,t-1}$. The total between-industry reallocation effect is positive if industries (j), with high (low) initial productivity, $\alpha_{j|C(t)}^Q - \alpha_{j|C(t)}^L$, experience high (low) relative labour input growth (see Equation (4) and the following discussion).

Figure 8.2. **Decomposition of productivity growth into five sources: within- and between-industry reallocation; entry- and exit-effects; and non-reallocation**



Source: Authors' calculations.

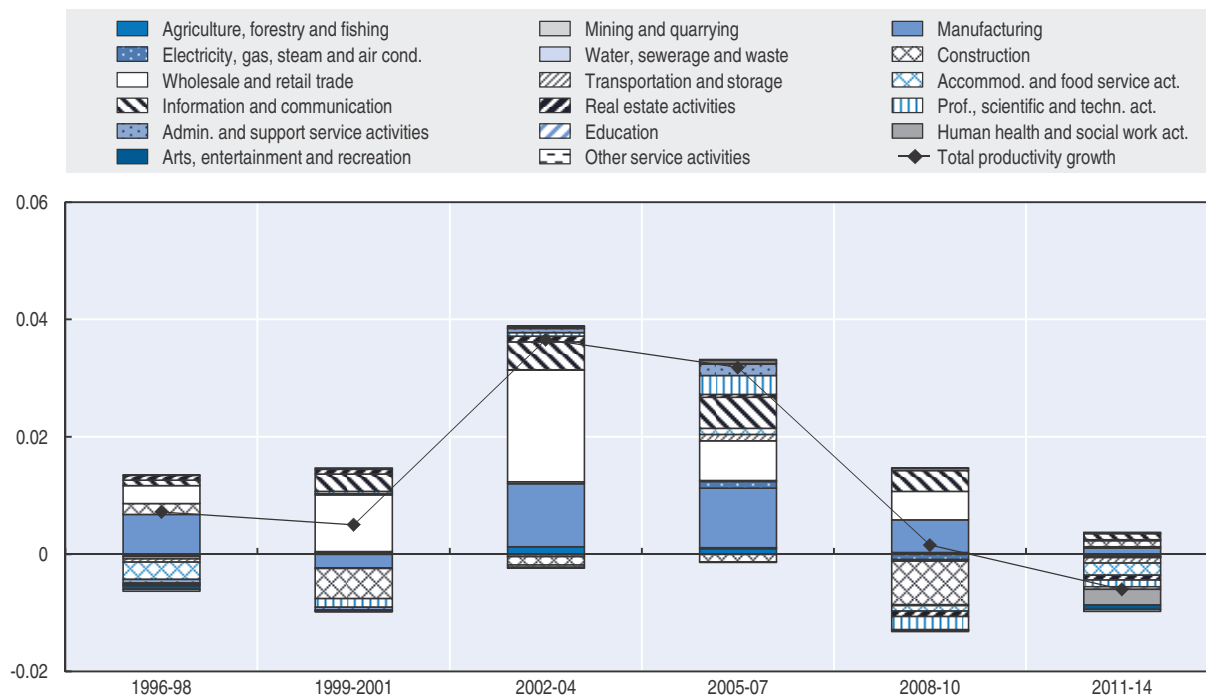
Figure 8.2 depicts the results of the decomposition of productivity growth into five sources: reallocation between firms in the same industries (intra-industry reallocation), reallocation between firms in different industries (inter-industry reallocation), entry-effect, exit-effect and non-reallocation; i.e. within-firm productivity growth. Note that there are two types of reallocation effects. The two effects correspond to the two terms

inside the squared bracket in Equation (4) (which are summed over the industries, J). In general, within-industry reallocation is much more important than between-industry reallocation. With regard to the relative importance of the different sources of productivity growth, the picture is mixed. During 1996-2010, between-firm reallocation dominated but during 2002-07 within-firm productivity growth (non-reallocation) was the main source of aggregate productivity growth in mainland Norway.

Regarding the impact of firm turnover, Figure 8.2 shows that the contribution from (genuine) entry to productivity growth is substantial and negative during 2002-07. This may seem counter intuitive as the conventional wisdom is that firm turnover contributes to “creative destruction” whereby inefficient, old firms are replaced by new and more efficient firms. While Figure 8.2 confirms part of this story: the productivity level of the exiting firms in an industry is lower than the aggregate productivity level of the industry, it raises questions about the reason for the large negative contribution to productivity growth from firm entry during 2002-07. This issue will be addressed in more detail below.

Figure 8.3 depicts the decomposition of the non-reallocation effects by industry. The main drivers of non-reallocation effects are the same as for total productivity growth; manufacturing, wholesale and retail trade, and information and communication. The notable negative contribution from construction in two time-intervals, 1999-2001 and 2008-10, are most likely due to the collapse of the dot-com bubble and the financial crisis, respectively, with a marked negative impact on profitability (and value-added) in this strongly pro-cyclical industry.

Figure 8.3. **The contribution from non-reallocation to productivity growth, by industry**

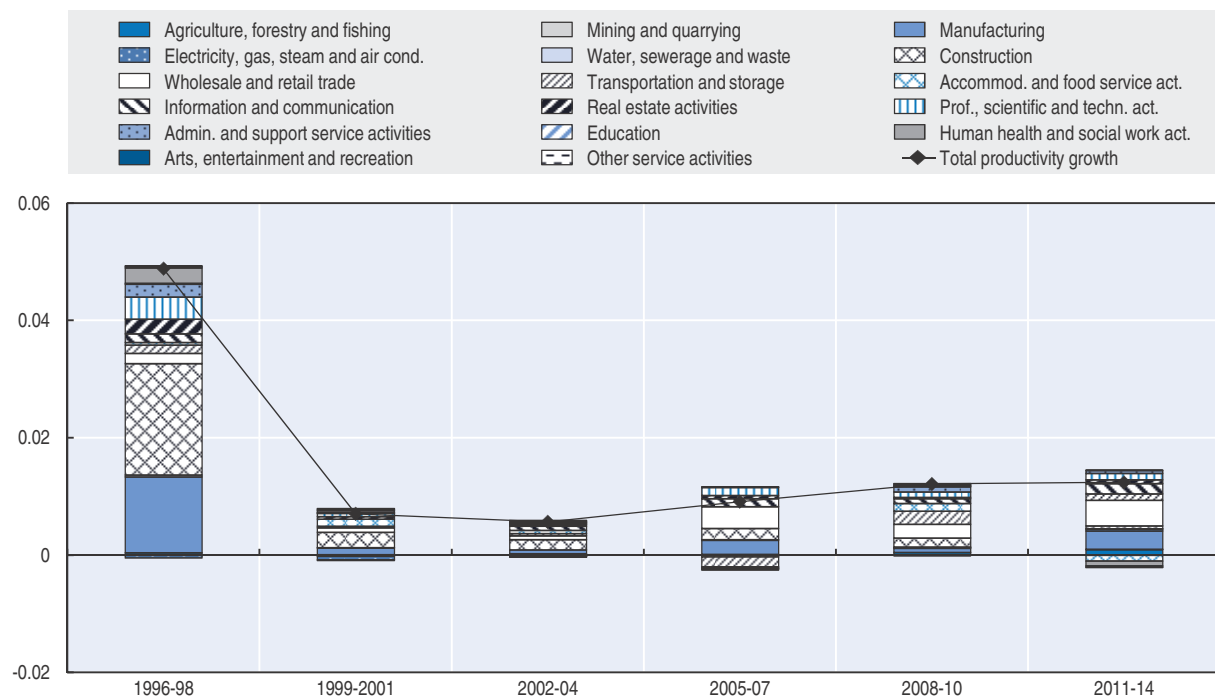


Note: Transportation and storage does not include transport via pipeline, passenger ocean transport and freight ocean transport.
Source: Authors' calculations.

Figure 8.4 depicts a decomposition of the (total) between-firm reallocation effects by industry. It shows that manufacturing and construction were the main contributors to the extraordinarily strong reallocation effects during 1996-98. To examine this further,

Figure 8.A1.1 (in Annex 8.A1) first shows that manufacturing – and to a lesser degree construction – went through a stark reduction in employment share during this period. At the same time, both industries increased their productivity level dramatically, as seen from Figure 8.A1.2. An explanation of the productivity-enhancing reallocation effect for these two industries during 1996-98 is the following: the industries' reduced employment shares did not come to pass as a proportional decrease in labour input across all firms. Instead, the most productive firms (within each industry) increased their relative employment within the industry. The least productive firms were probably not even able to pay the increased wage costs (real wages increased by 6% annually during this period) and closed down (see also Figure 8.5 below).

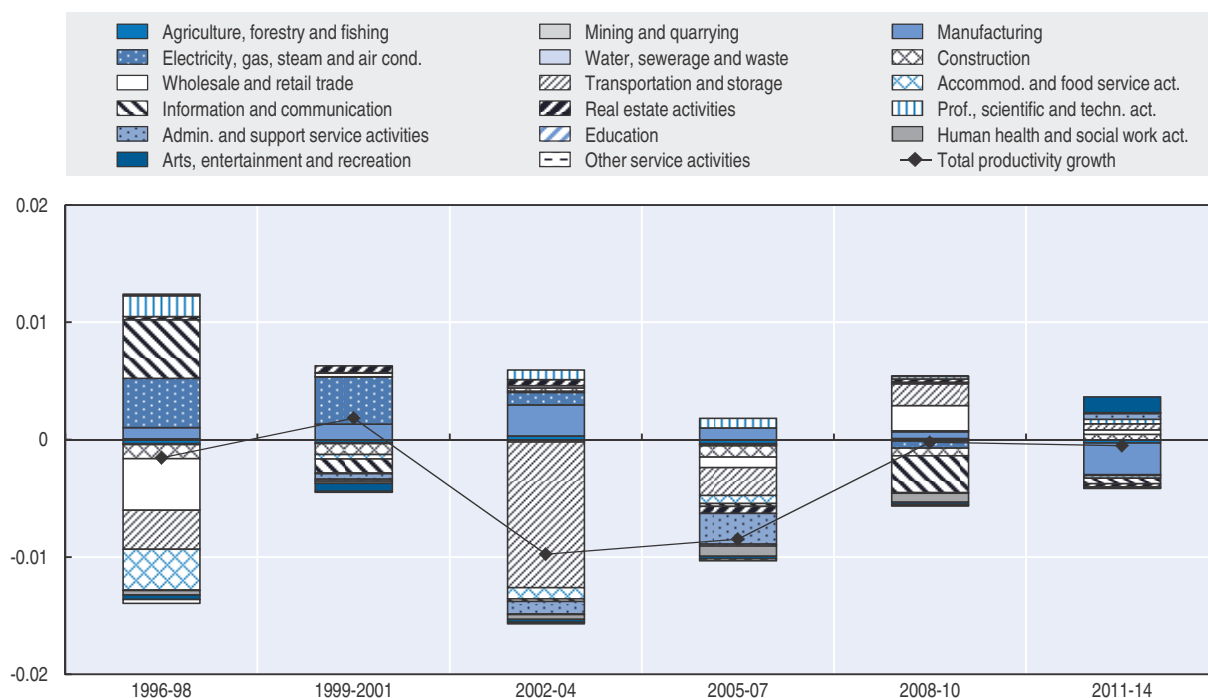
Figure 8.4. **The contribution from between-firm reallocation to productivity growth, by industry**



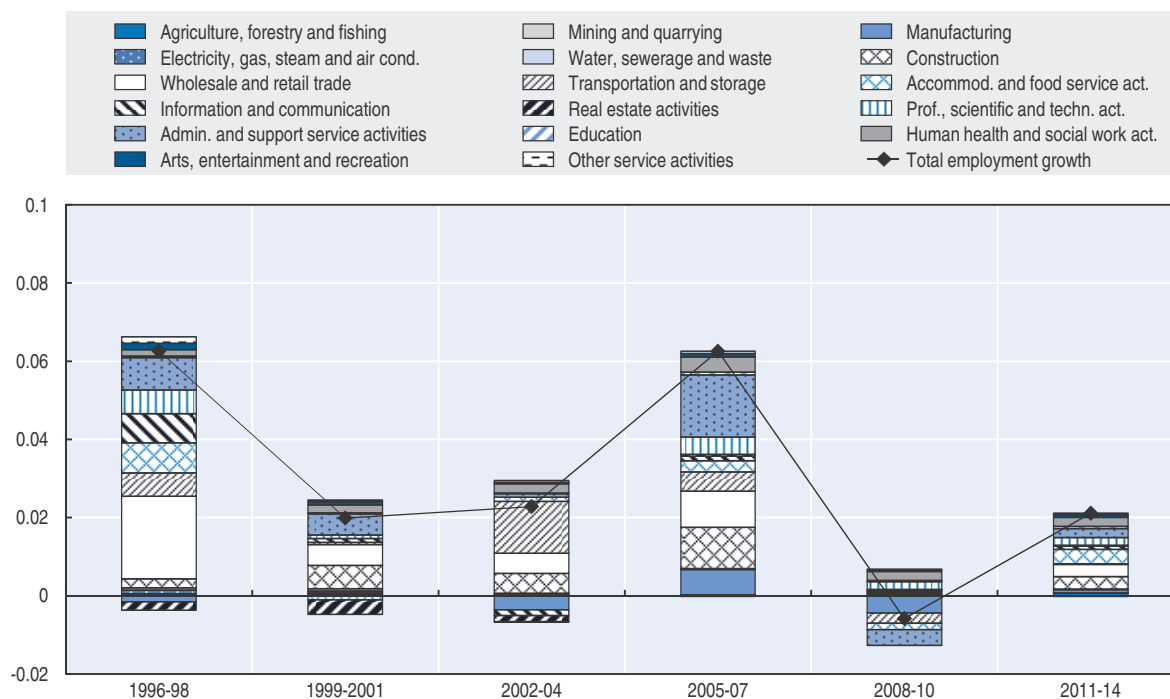
Note: Transportation and storage does not include transport via pipeline, passenger ocean transport and freight ocean transport.
Source: Authors' calculations.

The contributions to firm turnover (entry/exit dynamics) from the different industries are depicted in Figure 8.5. The net contribution from firm turnover is small, except over the period 2002-07, when it was about -1 percentage point annually. During 2002-04, the negative net contribution stems mostly from transportation and storage and during 2005-07 also from administrative and support services. Figure 8.6 shows that during 2002-07, these two industries also contributed most positively to aggregate employment growth.

Comparing Figure 8.5 to the decomposition of the total firm turnover effect into a separate entry- and exit-effect in Figure 8.2 indicates that net entry of employees into new firms in transportation and storage and administrative and support services reduced aggregate productivity growth during 2002-07. This hypothesis is confirmed when one looks at the industry-decomposition of the entry-effect in Figure 8.A1.3 (in Annex 8.A1). On the other hand, productivity growth in existing firms (see Figure 8.3) or reallocation effects (see Figure 8.4), did not affect productivity growth adversely in these industries.

Figure 8.5. **The contribution from entry/exit dynamics to productivity growth, by industry**

Note: Transportation and storage does not include transport via pipeline, passenger ocean transport and freight ocean transport.
Source: Authors' calculations.

Figure 8.6. **Decomposition of employment flows, by industry**

Note: Transportation and storage does not include transport via pipeline, passenger ocean transport and freight ocean transport.
Source: Authors' calculations.

During 2005-07, administrative and support service activities contributed most of all industries to aggregate employment growth (almost 2 percentage points). The industry also increased its share of employees from 6% to 9% over the period 2004-07, whereas its share of value-added increased from 4% to 6%. This implies a considerable increase in employment share in an industry with a low initial productivity level (see Figure 8.A1.2). When one looks closer at the data, one learns that this development occurred mainly because of labour hire companies, which to a large extent employ labour immigrants either from other Scandinavian countries or the new EU member states after the 2004 expansion. Many of these employees actually work in construction, accommodation and food services, the retail trade and other service industries, but are employed in labour supply firms within the industry administrative and support services.⁶

Taken together, this analysis' evidence shows that the strong employment growth in labour-intensive service industries during the last ten years – partly driven by labour immigration – is associated with lower productivity growth in the Norwegian mainland economy through the channel of entry dynamics. However, this effect is restricted to a few service industries in the period 2002-07, reducing productivity growth by one percentage point annually. This temporary effect by no means explains the strong downward trend in productivity growth in mainland Norway during 2005-14.

The contribution of small versus large and exporting versus non-exporting firms to productivity and employment growth

Figure 8.A1.4 (in Annex 8.A1) shows that large continuing firms (>50 employees) are the main contributors to productivity growth. However, when it comes to employment growth (see Figure 8.A1.5), large firms contribute little, and in some periods even negatively. New jobs seem to be created mainly by entering firms and SMEs. Figures 8.A1.6 and 8.A1.7 show the corresponding decompositions with regard to exporting and non-exporting firms. Exporting firms are the dominating contributors to productivity growth in all periods, with non-exporting firms contributing with a gradually decreasing amount (see Figure 8.A1.6). However, with regard to job creation, non-exporting firms are more important than exporting firms (see Figure 8.A1.7). This pattern is, of course, related to the role of manufacturing in the economy, as the largest exporters are found there.

Conclusions

This chapter has explored a new decomposition of labour productivity growth that extends a standard method to incorporate the effects of firm-level dynamics. The analyses have quantified three main sources of productivity growth: within-firm productivity growth, between-firm reallocation effects and entry/exit dynamics. Those of Norwegian firm-level data covering all incorporated firms in the Norwegian mainland economy from 1996-2014 revealed a strong downward trend in labour productivity during the last decade: they found that growth in real value-added per employee during 2005-14 was 1.3% annually, compared to 3.2% during 1996-2004. Moreover, they found that the strong employment growth in labour-intensive service industries in the period 2002-07, partly driven by labour immigration, mainly affected productivity growth through net entry of employees into some service industries. This process temporarily reduced productivity growth in mainland Norway by one percentage point annually, but by no means explains the strong downward trend in productivity growth during the last decade. This chapter's results suggest that the

productivity slowdown is related to the diminishing role of manufacturing, wholesale and retail trade and information and communication as drivers of productivity growth in the mainland economy.

Notes

1. See Official Norwegian Reports NOU (2015) and NOU (2016).
2. The within-industry weights, S_{it}^Q , are not affected by deflating, since the same deflator applies to all firms in the same industry.
3. The non-mainland industries, which are excluded, comprise extraction of crude petroleum and natural gas; support activities for petroleum and natural gas extraction; transport via pipeline; passenger ocean transport and freight ocean transport. These industries account for, on average, 20 % of annual GDP in the period analysed.
4. Firms that enter and exit within the same interval are excluded from the analysis.
5. This industry consists to a large degree of publicly owned enterprises.
6. See www.ssb.no/en/varehandel-og-tjenesteyting/statistikker/ftot/aar/2016-05-30 for an article (in English) about labour supply services. Labour recruitment and provision of personnel (NACE 78) is a part of administrative and support service activities. Supply of personnel within construction had the largest turnover, covering almost 23% of the industry's total turnover in Norway in 2014.

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ANNEX 8.A1

*Proofs and supplementary figures***Proof of the decomposition of Equation (4)**

From (1), (2) and (3), it follows that:

$$\begin{aligned}
 \psi_t &= s_{X(t)}^Q \frac{\left(\sum_{i \in E(t)} Q_{it} - \sum_{i \in X(t)} Q_{i,t-1} \right)}{\sum_{i \in X(t)} Q_{i,t-1}} - s_{X(t)}^L \frac{\left(\sum_{i \in E(t)} L_{it} - \sum_{i \in X(t)} L_{i,t-1} \right)}{\sum_{i \in X(t)} L_{i,t-1}} \\
 &= \sum_j \left[- \left(s_{X(t)}^Q \alpha_{j|X(t)}^Q - s_{X(t)}^L \alpha_{j|X(t)}^L \right) + s_{X(t)}^Q \alpha_{j|X(t)}^Q \frac{\sum_{i \in E(t) \cap j} Q_{it}}{\sum_{i \in X(t) \cap j} Q_{i,t-1}} - s_{X(t)}^L \alpha_{j|X(t)}^L \frac{\sum_{i \in E(t) \cap j} L_{it}}{\sum_{i \in X(t) \cap j} L_{i,t-1}} \right] \\
 &= \sum_j \left[- \left(s_{X(t)}^Q \alpha_{j|X(t)}^Q - s_{X(t)}^L \alpha_{j|X(t)}^L \right) + \frac{\sum_{i \in E(t) \cap j} Q_{it}}{Q_{t-1}} - \frac{\sum_{i \in E(t) \cap j} L_{it}}{L_{t-1}} \right] \\
 &\equiv \sum_j \psi_{jt}.
 \end{aligned}$$

Assuming $\left(s_{C(t)}^Q - s_{C(t)}^L \right) \left(\sum_{i \in C(t)} \Delta L_{it} / \sum_{i \in C(t)} L_{i,t-1} \right) = 0$ (which holds in practice to a high degree of accuracy):

$$\begin{aligned}
 \frac{\Delta Q_t}{Q_{t-1}} - \frac{\Delta L_t}{L_{t-1}} &= s_{C(t)}^Q \left(\frac{\sum_{i \in C(t)} \Delta Q_{it}}{\sum_{i \in C(t)} Q_{i,t-1}} - \frac{\sum_{i \in C(t)} \Delta L_{it}}{\sum_{i \in C(t)} L_{i,t-1}} \right) + \sum_j \psi_{jt} \\
 &= s_{C(t)}^Q \left(\sum_j \alpha_{j|C(t)}^Q \frac{\sum_{i \in C(t) \cap j} \Delta Q_{it}}{\sum_{i \in C(t) \cap j} Q_{i,t-1}} - \sum_j \alpha_{j|C(t)}^L \frac{\sum_{i \in C(t) \cap j} \Delta L_{it}}{\sum_{i \in C(t) \cap j} L_{i,t-1}} \right) + \sum_j \psi_{jt},
 \end{aligned}$$

where

$$\alpha_{j|C(t)}^Q = \frac{\sum_{i \in j \cap C(t)} Q_{i,t-1}}{\sum_{i \in C(t)} Q_{i,t-1}}, \quad \alpha_{j|C(t)}^L = \frac{\sum_{i \in j \cap C(t)} L_{i,t-1}}{\sum_{i \in C(t)} L_{i,t-1}}.$$

The focus is now on the contribution from continuing firms to $\frac{\Delta Q_t}{Q_{t-1}} - \frac{\Delta L_t}{L_{t-1}}$. For all $i \in C(t)$:

$$\begin{aligned}
 &\frac{\sum_{i \in C(t)} \Delta Q_{it}}{\sum_{i \in C(t)} Q_{i,t-1}} - \frac{\sum_{i \in C(t)} \Delta L_{it}}{\sum_{i \in C(t)} L_{i,t-1}} \\
 &= \sum_j \alpha_{j|C(t)}^Q \frac{\sum_{i \in j \cap C(t)} \Delta Q_{it}}{\sum_{i \in j \cap C(t)} Q_{i,t-1}} - \sum_j \alpha_{j|C(t)}^L \frac{\sum_{i \in j \cap C(t)} \Delta L_{it}}{\sum_{i \in j \cap C(t)} L_{i,t-1}} \\
 &= \sum_{i \in C(t)} \alpha_{it}^Q \left(\frac{\Delta Q_{it}}{Q_{i,t-1}} - \frac{\Delta L_{it}}{L_{i,t-1}} \right) + \sum_{i \in C(t)} \left(\alpha_{it}^Q - \alpha_{it}^L \right) \frac{\Delta L_{it}}{L_{i,t-1}},
 \end{aligned}$$

where

$$\alpha_{it}^Q = \frac{Q_{i,t-1}}{\sum_{i \in C(t)} Q_{i,t-1}} = \alpha_{j(i)|C(t)}^Q s_{it}^Q$$

$$\alpha_{it}^L = \frac{L_{i,t-1}}{\sum_{i \in C(t)} L_{i,t-1}} = \alpha_{J(i)C(t)}^L s_{it}^L,$$

With $J(i)$ being the industry of i and:

$$s_{it}^Q = \frac{Q_{i,t-1}}{\sum_{k \in J(i) \cap C(t)} Q_{k,t-1}}, \quad \alpha_{J(i)C(t)}^Q = \frac{\sum_{k \in J(i) \cap C(t)} Q_{k,t-1}}{\sum_{k \in C(t)} Q_{k,t-1}}$$

$$s_{it}^L = \frac{L_{i,t-1}}{\sum_{k \in J(i) \cap C(t)} L_{k,t-1}}, \quad \alpha_{J(i)C(t)}^L = \frac{\sum_{k \in J(i) \cap C(t)} L_{k,t-1}}{\sum_{k \in C(t)} L_{k,t-1}}.$$

First, the term $\sum_{i \in C(t)} (\alpha_{it}^Q - \alpha_{it}^L) \frac{\Delta L_{it}}{L_{i,t-1}}$ is investigated:

$$\begin{aligned} \sum_{i \in C(t)} \alpha_{it}^L \frac{\Delta L_{it}}{L_{i,t-1}} &= \sum_{i \in C(t)} \alpha_{J(i)C(t)}^L s_{it}^L \frac{\Delta L_{it}}{L_{i,t-1}} = \sum_J \alpha_{JC(t)}^L \sum_{i \in J \cap C(t)} s_{it}^L \frac{\Delta L_{it}}{L_{i,t-1}} \\ &= \sum_J \alpha_{JC(t)}^L \frac{\sum_{i \in J \cap C(t)} \Delta L_{it}}{\sum_{i \in J \cap C(t)} L_{i,t-1}}. \end{aligned}$$

Next:

$$\begin{aligned} &\sum_{i \in C(t)} \alpha_{it}^Q \frac{\Delta L_{it}}{L_{i,t-1}} \\ &= \sum_J \alpha_{JC(t)}^Q \sum_{i \in J \cap C(t)} s_{it}^Q \frac{\Delta L_{it}}{L_{i,t-1}} \\ &= \sum_J \alpha_{JC(t)}^Q \frac{\sum_{i \in J \cap C(t)} \Delta L_{it}}{\sum_{i \in J \cap C(t)} L_{i,t-1}} + \sum_J \alpha_{JC(t)}^Q \sum_{i \in J \cap C(t)} s_{it}^Q \frac{\Delta L_{it}}{L_{i,t-1}} - \sum_J \alpha_{JC(t)}^Q \sum_{i \in J \cap C(t)} s_{it}^L \frac{\Delta L_{it}}{L_{i,t-1}} \\ &= \sum_J \alpha_{JC(t)}^Q \frac{\sum_{i \in J \cap C(t)} \Delta L_{it}}{\sum_{i \in J \cap C(t)} L_{i,t-1}} + \sum_J \alpha_{JC(t)}^Q \sum_{i \in J \cap C(t)} (s_{it}^Q - s_{it}^L) \frac{\Delta L_{it}}{L_{i,t-1}}. \end{aligned}$$

Hence:

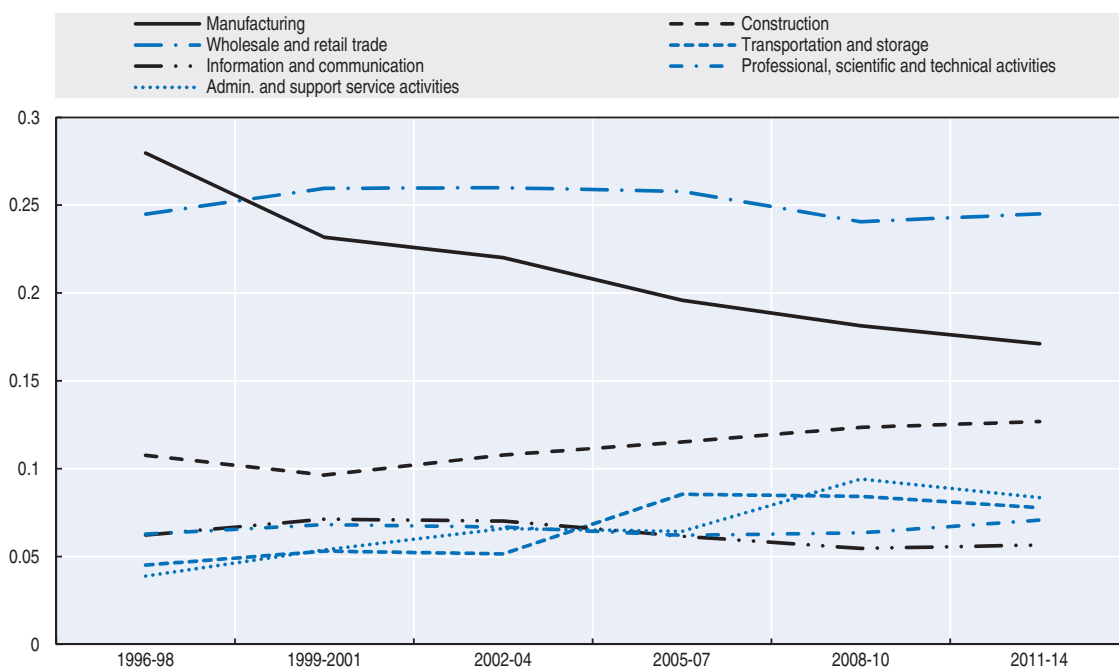
$$\begin{aligned} &\sum_{i \in C(t)} (\alpha_{it}^Q - \alpha_{it}^L) \frac{\Delta L_{it}}{L_{i,t-1}} \\ &= \sum_J \alpha_{JC(t)}^Q \frac{\sum_{i \in J \cap C(t)} \Delta L_{it}}{\sum_{i \in J \cap C(t)} L_{i,t-1}} + \sum_J \alpha_{JC(t)}^Q \sum_{i \in J \cap C(t)} (s_{it}^Q - s_{it}^L) \frac{\Delta L_{it}}{L_{i,t-1}} - \sum_J \alpha_{JC(t)}^L \frac{\sum_{i \in J \cap C(t)} \Delta L_{it}}{\sum_{i \in J \cap C(t)} L_{i,t-1}} \\ &= \sum_J (\alpha_{JC(t)}^Q - \alpha_{JC(t)}^L) \frac{\sum_{i \in J \cap C(t)} \Delta L_{it}}{\sum_{i \in J \cap C(t)} L_{i,t-1}} + \sum_J \alpha_{JC(t)}^Q \sum_{i \in J \cap C(t)} (s_{it}^Q - s_{it}^L) \frac{\Delta L_{it}}{L_{i,t-1}}. \end{aligned}$$

Finally:

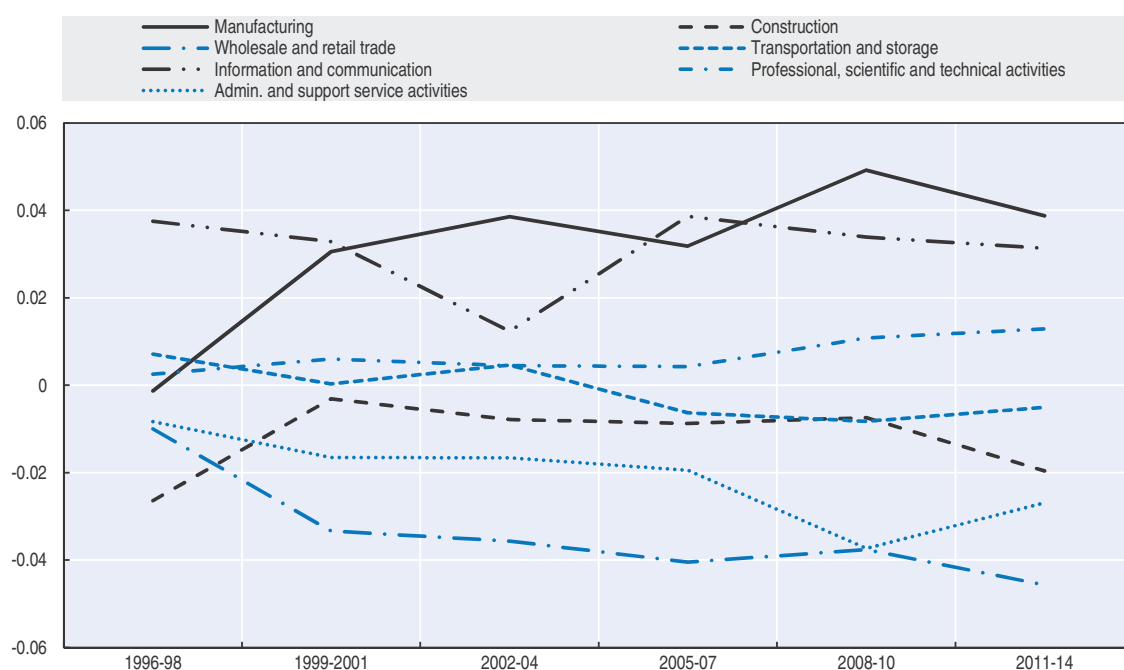
$$\begin{aligned} &\frac{\sum_{i \in C(t)} \Delta Q_{it}}{\sum_{i \in C(t)} Q_{i,t-1}} - \frac{\sum_{i \in C(t)} \Delta L_{it}}{\sum_{i \in C(t)} L_{i,t-1}} \\ &= \sum_{i \in C(t)} \alpha_{it}^Q \left(\frac{\Delta Q_{it}}{Q_{i,t-1}} - \frac{\Delta L_{it}}{L_{i,t-1}} \right) + \sum_J (\alpha_{JC(t)}^Q - \alpha_{JC(t)}^L) \frac{\sum_{i \in J \cap C(t)} \Delta L_{it}}{\sum_{i \in J \cap C(t)} L_{i,t-1}} \\ &\quad + \sum_J \alpha_{JC(t)}^Q \sum_{i \in J \cap C(t)} (s_{it}^Q - s_{it}^L) \frac{\Delta L_{it}}{L_{i,t-1}}, \end{aligned}$$

and

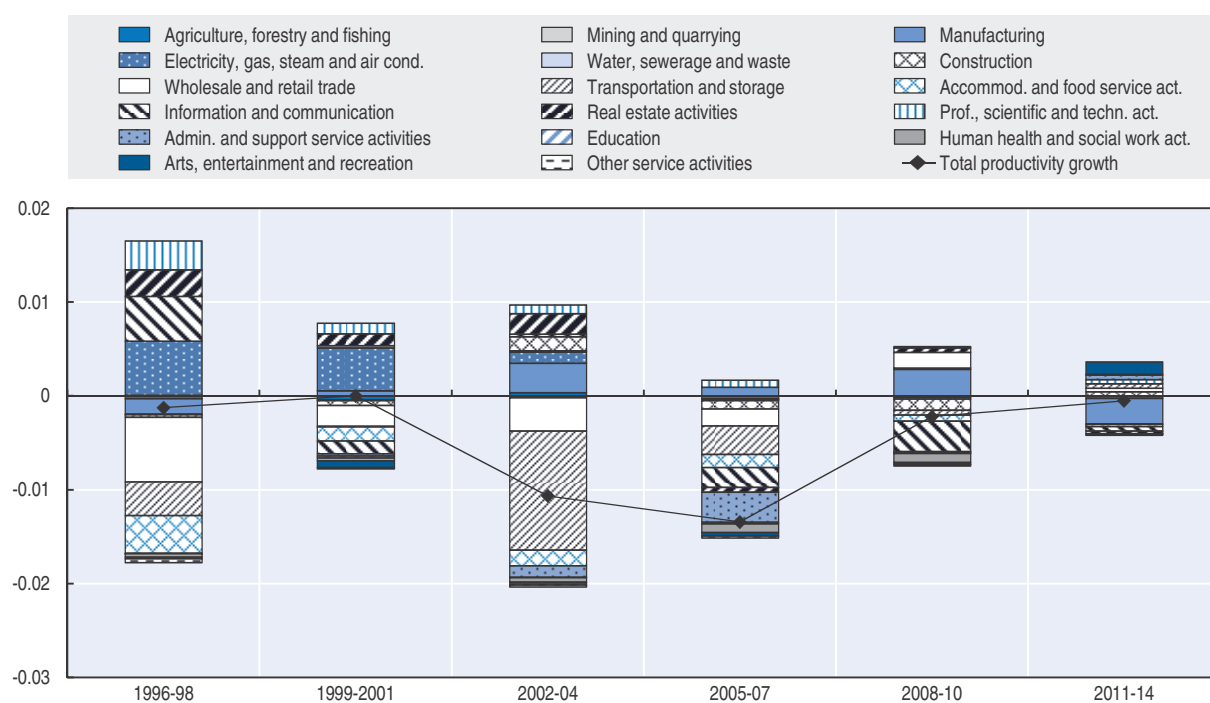
$$\begin{aligned}
& \frac{\Delta Q_{it}}{Q_{i,t-1}} - \frac{\Delta L_{it}}{L_{i,t-1}} \\
&= s_{C(t)}^Q \left(\frac{\sum_{i \in C(t)} \Delta Q_{it}}{\sum_{i \in C(t)} Q_{i,t-1}} - \frac{\sum_{i \in C(t)} \Delta L_{it}}{\sum_{i \in C(t)} L_{i,t-1}} \right) + \sum_J \psi_{Jt} \\
&= \sum_J s_{C(t)}^Q \alpha_{J|C(t)}^Q \sum_{i \in J \cap C(t)} s_{it}^Q \left(\frac{\Delta Q_{it}}{Q_{i,t-1}} - \frac{\Delta L_{it}}{L_{i,t-1}} \right) \\
&+ \sum_J \left[s_{C(t)}^Q \left(\alpha_{J|C(t)}^Q - \alpha_{J|C(t)}^L \right) \frac{\sum_{i \in J \cap C(t)} \Delta L_{it}}{\sum_{i \in J \cap C(t)} L_{i,t-1}} + \sum_{i \in J \cap C(t)} s_{C(t)}^Q \alpha_{J|C(t)}^Q \left(s_{it}^Q - s_{it}^L \right) \frac{\Delta L_{it}}{L_{i,t-1}} \right] \\
&+ \sum_J \psi_{Jt}.
\end{aligned}$$

Figure 8.A1.1. **Employment shares of selected industries**

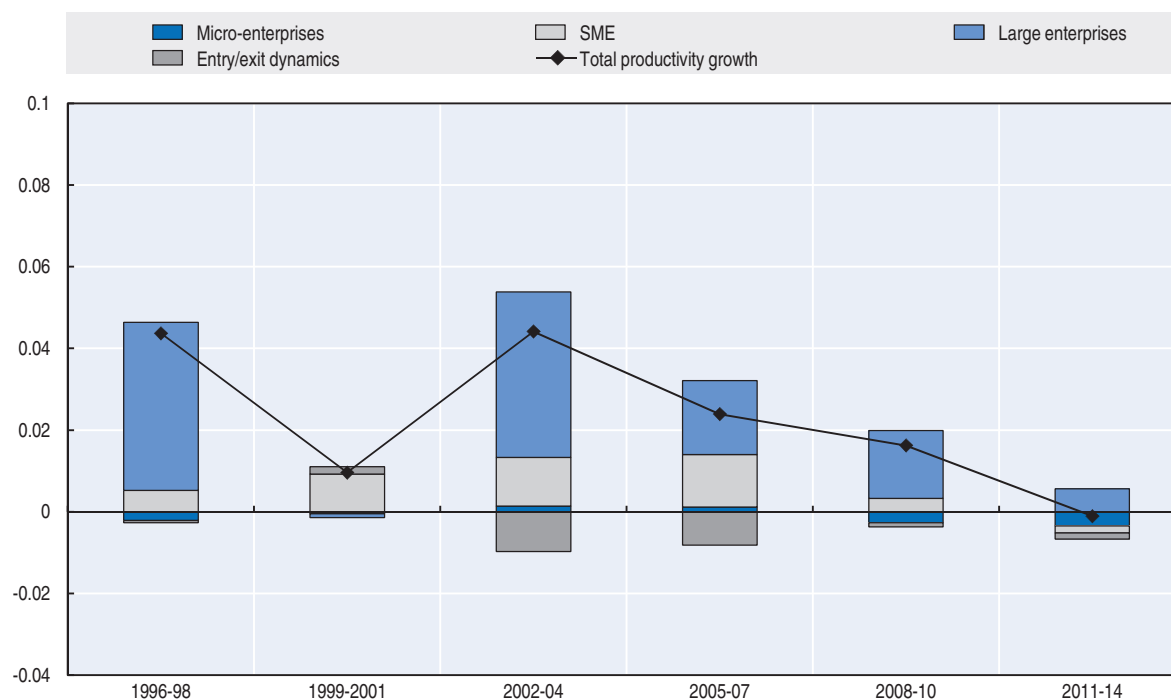
Source: Authors' calculations.

Figure 8.A1.2. **Output shares minus input shares of selected industries**

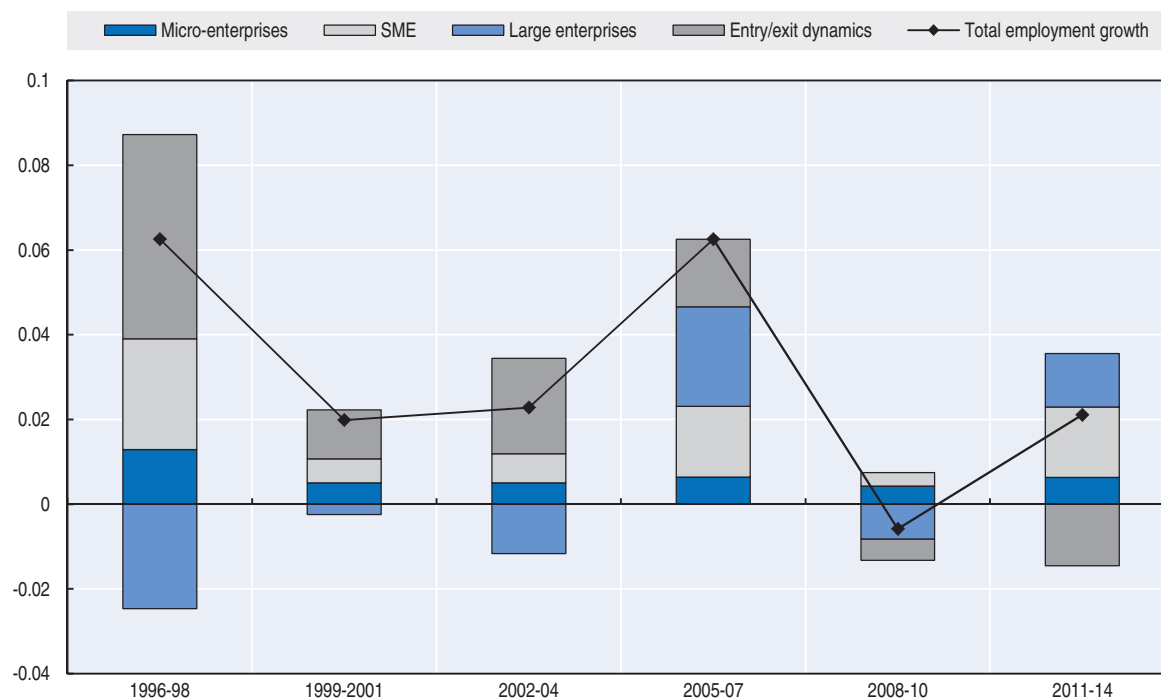
Source: Authors' calculations.

Figure 8.A1.3. **The contribution of entry-effects to productivity growth, by industry**

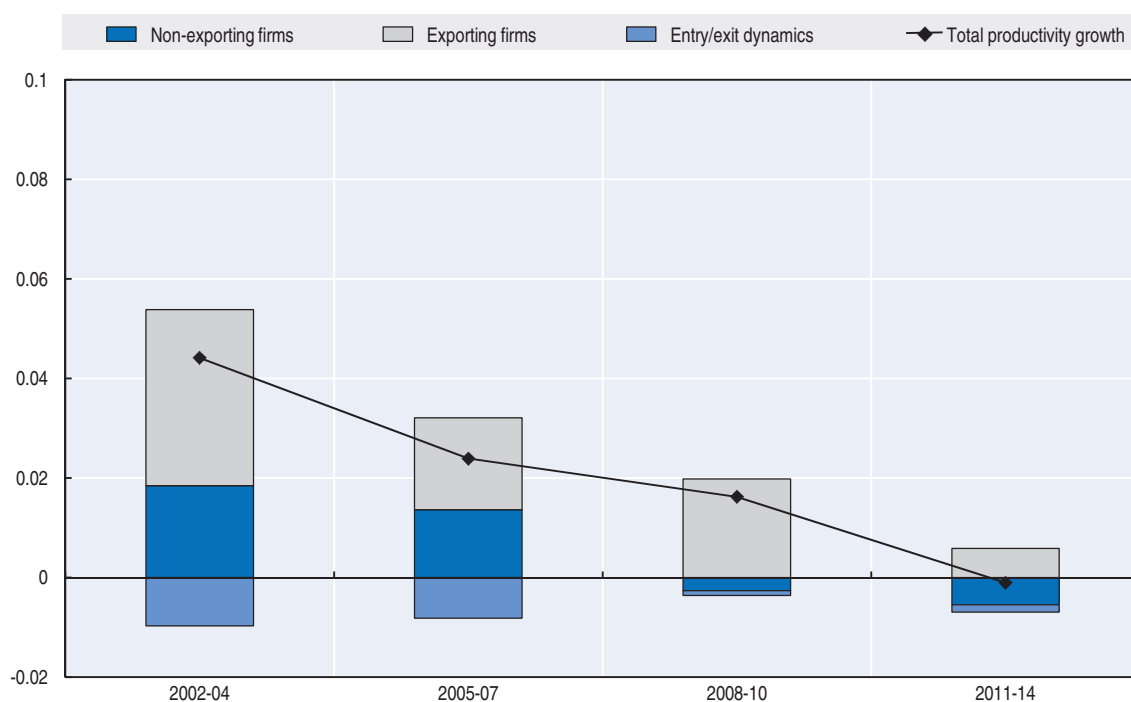
Source: Authors' calculations.

Figure 8.A1.4. **Contribution to productivity growth by firm size**

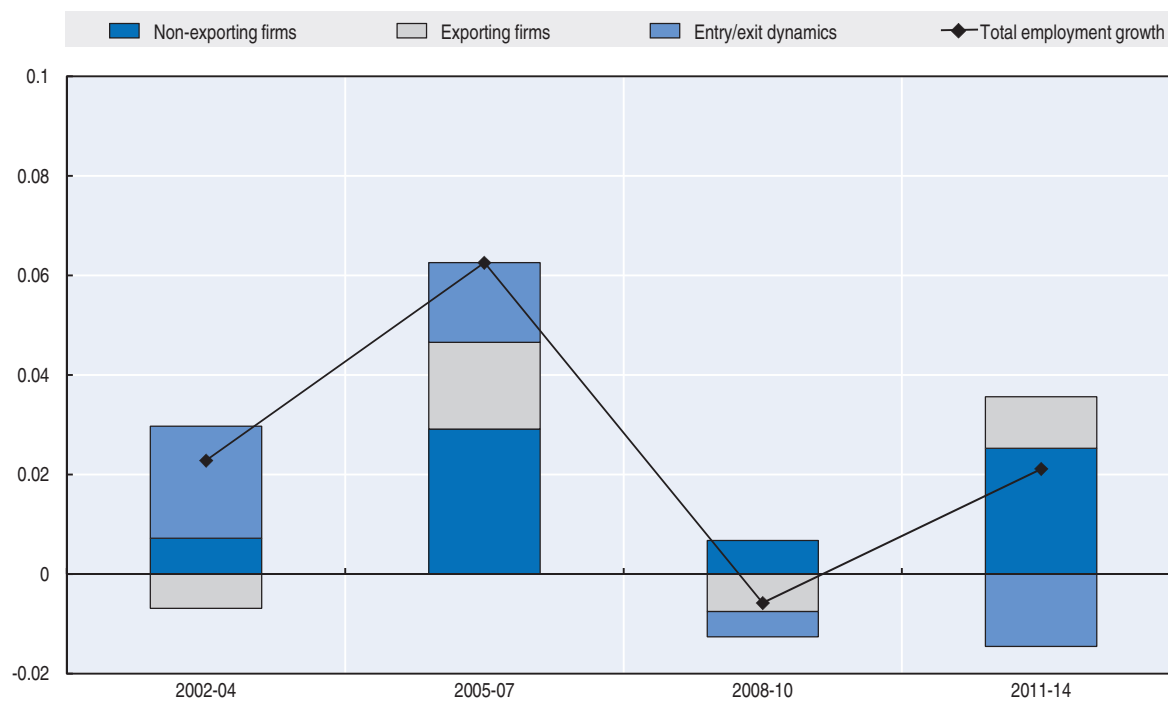
Source: Authors' calculations.

Figure 8.A1.5. **Contribution to employment growth by firm size**

Source: Authors' calculations.

Figure 8.A1.6. **Contribution to productivity growth by exporting status**

Source: Authors' calculations.

Figure 8.A1.7. **Contribution to employment growth by exporting status**

Source: Authors' calculations.

Chapter 9

Employment and productivity dynamics during economic crises in Japan

by

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This chapter examines the effects of economic crises on employment dynamics in Japan, in which during the last two decades, the economy has been going through a long stagnation and suffered a number of economic crises. Focusing on four crises during the period and utilising a comprehensive panel dataset of Japanese listed companies, this chapter considers the effects of these crises on the firm-level within-industry reallocation effects. The results show that the reallocation of labour inputs was productivity-enhancing in Japan and the economic crises reinforced the productivity-enhancing reallocation mechanisms, in both the manufacturing and non-manufacturing sectors. However, the global financial crisis at the end of 2000s did not strengthen these mechanisms. These results are consistent with existing empirical findings in the United States.

Introduction

Job creation has been one of the most important and pressing issues in governments' policy agendas across the OECD. In order to meet this policy interest, a deep understanding of employment dynamics is a critical research issue. Since the early 1990s, Japan has experienced a slowdown in productivity and economic growth and thus job creation. Reallocation of resources across firms is a key mechanism for productivity and economic growth. Reallocation of production factors, such as labour inputs, from a relatively low productive firm to a highly productive firm increases productivity in that sector and at the macro level, which thus impacts on job creation. Understanding such interrelationships between the dynamics of employment and productivity is one of the key objectives of the OECD DynEmp and MultiProd projects.

This raises the issue of the impact of crises. Do economic crises have market cleansing effects? This is a long standing and still ongoing debate (Foster, Grim and Haltiwanger, 2016). According to the cleansing hypothesis, recessions reinforce productivity-enhancing reallocation through their associated low adjustment costs (Davis and Haltiwanger, 1990; Caballero and Hammour, 1994; Mortensen and Pissarides, 1994). There are also alternative hypotheses related to recessions that highlight their potential distortions of reallocation dynamics (Caballero and Hammour, 1996) and "sully" or "scarring" effects (Osotimehin and Pappadà, 2016). Barlevy (2003) argues that the cleansing effect can be reversed also when financial constraints are present.

There are various empirical studies on the relationship between reallocation effects and economic crises. Some studies obtain results consistent with the cleansing hypothesis (Davis and Haltiwanger, 1992, 1999; Davis, Faberman and Haltiwanger, 2006, 2012).

Investigating the link between credit booms, productivity growth, labour reallocations, and financial crises in a sample of over 20 advanced economies and over 40 years, Borio et al. (2015) found that i) credit booms tend to undermine productivity growth by inducing labour reallocations towards lower productivity growth sectors; and ii) the impact of reallocations that occur during a boom, and during economic expansions more generally, is much larger if a crisis follows.

Using establishment-level micro-data for the United States, Foster, Grim, and Haltiwanger (2016) have found that downturns prior to the global financial crisis (GFC) are periods of accelerated reallocation that are even more productivity-enhancing than reallocation in normal times, but during the recent (2007-09) GFC, the intensity of reallocation fell and the reallocation that did occur was less productivity-enhancing than in prior recessions.

Luchese and Pianta (2012) using cross-country data show that during downturns implementing new processes contributes to restructuring and job losses.

The collapse of Japan's bubble economy in the early 1990s was followed by a long economic stagnation and by financial crises. During this period of recession, many Japanese banks continued to lend to otherwise insolvent firms (Caballero, Hoshi and

Kashyap, 2008). Such “zombie lending” is expected to reduce the productivity-enhancing reallocation effects, since resources are stuck in unprofitable and unproductive firms. Kwon, Narita and Narita (2015) investigate the amount of aggregate output growth that was driven by resource reallocation and how much more would have been generated had there been no zombie lending during the 1990s. They found that the contribution to aggregate productivity growth of resource reallocation deteriorated in the 1990s and became negative during the late 1990s, when the Asian financial crisis occurred. Using the industry-level EU KLEMS database, Fukao, Miyagawa and Takizawa (2007) and Fukao et al. (2009) looked at the sources of economic growth for Japan and the Republic of Korea during the period 1975-2005, and they found that the resource reallocation effects of capital input in both Japan and Korea were either negligible or insignificant, while those of labour input (the labour shift from lower wage industries to higher wage industries) were positive and significant. They concluded that a series of productivity-enhancing policies designed to promote the reallocation of capital input seems crucial to resume sustainable growth paths.

Fukao, Kim, and Kwon (2008) analysed the total factor productivity (TFP) growth rate of the Japanese manufacturing sector from 1981-2003 and found that the reallocation of resources from less efficient to more efficient firms was very slow and limited. They emphasised that the “low metabolism” seems to be an important cause for the slowdown in Japan’s TFP growth. Using original Japanese enterprise-level data for the *Financial Statements Statistics of Corporations by Industry for 1982-2007*, Inui et al. (2011) observed TFP trends in both the manufacturing and non-manufacturing industries and found that the acceleration of the TFP growth rate is mainly determined by TFP growth within firms, and that the contribution of resource reallocations across firms to aggregated TFP growth are comparably small, especially in the manufacturing sector. Recently, Hosono and Takizawa (2015) found that there are distortions in the reallocation of production factors in Japanese manufacturing industries and that such distortions have a significant impact on entry and exit as well as on establishment-level productivity growth. They also found that financial constraints play a significant role as factors of distortion.

With these remarks as background and motivation, this chapter addresses empirical questions concerning the potential cleansing effects of the recent economic crises in Japan. First, is reallocation of labour inputs enhancing productivity? Second, is the relationship between productivity and reallocation influenced by economic crises? Third, is the relationship between productivity and reallocation different across crises?

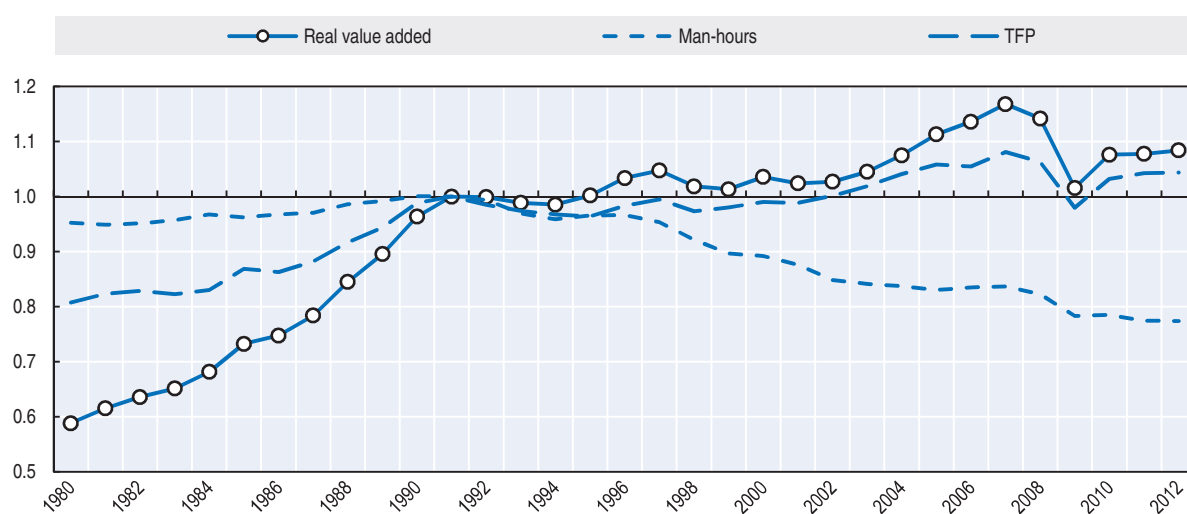
This chapter is organised as follows. The next section overviews the economic crises and their impacts on the labour market in Japan from the 1990s to 2010s. Then, the fourth section examines the interrelationship between employment dynamics and productivity dynamics in Japan during some of the economic crises that have occurred during the last three decades or so (from 1980). The last section concludes the chapter by proposing a future research agenda related to a global perspective on employment dynamics in Japan.

Economic crises in Japan over three decades

This section overviews the several macro events that have potentially affected the employment dynamics during the last three decades in Japan. It focusses particularly on the effects of four economic crises: the burst of the bubble economy in the early 1990s, the Asian financial crisis in the late 1990s, the information technology (IT) bubble burst in the early 2000s, and the GFC at the end of the 2000s.

Figure 9.1 shows the trend of total real value-added to the market economy in Japan in the period 1980 to 2012. Surprisingly, the figure clearly indicates that Japanese real GDP only increased by 8% in the 21 years from 1991-2012, while in the 1980s it had grown by 60%. During the whole period, the Japanese economy had experienced negative real value-added growth five times. First, the burst of the bubble economy occurred in 1992, and the real GDP decreased until 1994. Although from 1995 it recovered, and the economy began to grow again, in 1998 the Asian financial crisis caused damage to the Japanese economy. From 1997-99, the real value-added decreased again. Soon after its recovery in 2000, the IT bubble burst occurred, and the Japanese economy slowed down between 2000 and 2001. The GFC in 2007-09 has had the largest impact, with total real value-added decreasing by more than 10% over the period 2007-09.

Figure 9.1. **Economic crises in Japan (market economy; index: 1991 = 1)**



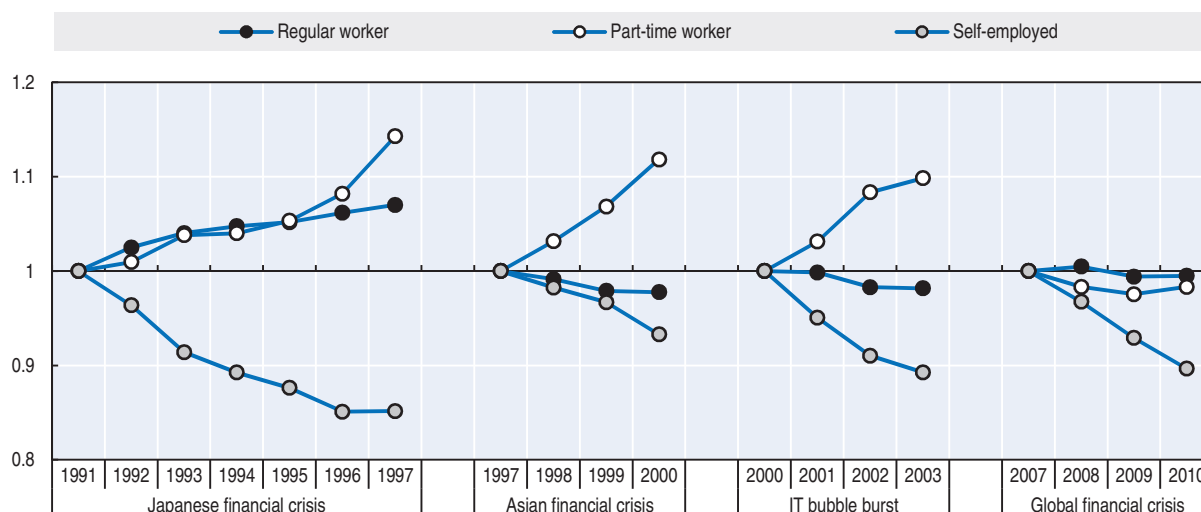
Source: Author's calculation based on Research Institute of Economy, Trade and Industry (2015), *The Japan Industrial Productivity Database 2015* (database), www.rieti.go.jp/en/about/about.html.

After the bubble burst in 1992, the labour demand had been constantly decreasing in Japan. While the labour population did not decrease from 1991-2012, actual labour input (man hours) declined by more than 20%. It seems that the crises accelerate the declining trend of labour demand. During the five periods of crisis (1991-94, 1997-99, 2000-01 and 2007-09), man hours declined more than it did outside of these periods. From the viewpoint of the supply side, the working population also began to decrease from 1997, reflecting the declining birth rate and ageing population.

TFP in Japan has also been stagnant during the last two decades. In contrast to gross domestic product (GDP) and labour demand, however, TFP did not decline during the crisis following the IT bubble burst (2000-01), while during the other three crises TFP declined, along with the economic contraction.

Figure 9.2 presents the effects of crises on labour demand by job status. This shows that labour demand for the self-employed has constantly decreased. During the Japanese financial crisis (1991-94), demand for regular workers and part-time workers increased. While the working hours of part-time workers also increased during the Asian financial crisis and the IT bubble burst, demand for regular workers declined. The GFC, however, affected part-time jobs more than regular workers.

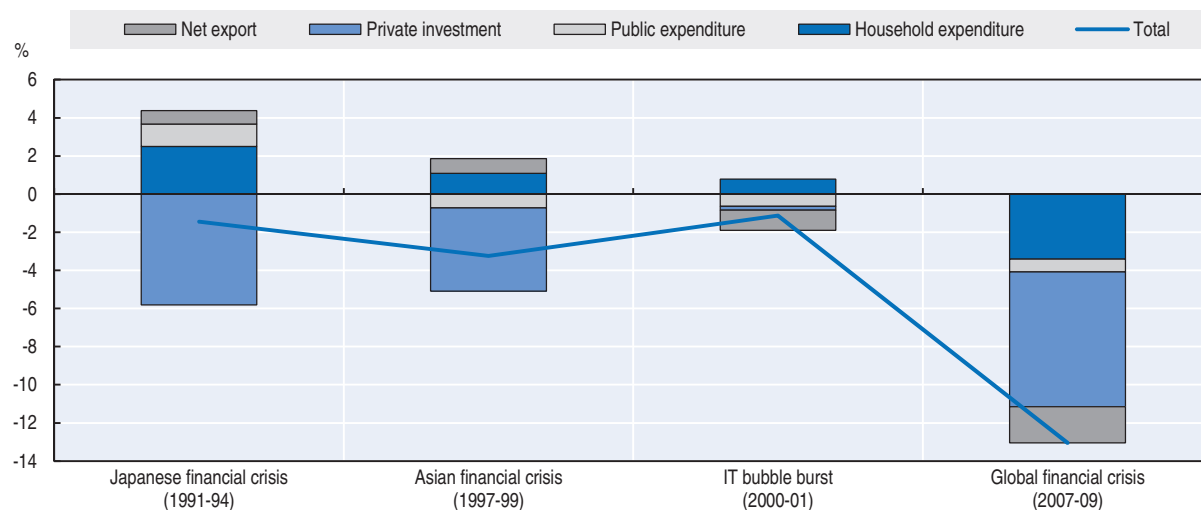
Figure 9.2. Crises and job loss by job status (index: first year of each crisis = 1)



Source: Author's calculation based on the Ministry of Internal Affairs and Communications (2016), "Labour Force Survey: Historical Data", www.stat.go.jp/english/data/roudou/lnindex.htm.

In Figure 9.3, gross-output growth rates during the crises are decomposed into several final demand factors. During the first crisis (Japanese financial crisis), public expenditure increased. The GFC can be characterised by a huge decrease in net exports and household expenditures in addition to the decrease in private investments.

Figure 9.3. Crises and decomposition of the gross-output growth rate to final demand factors



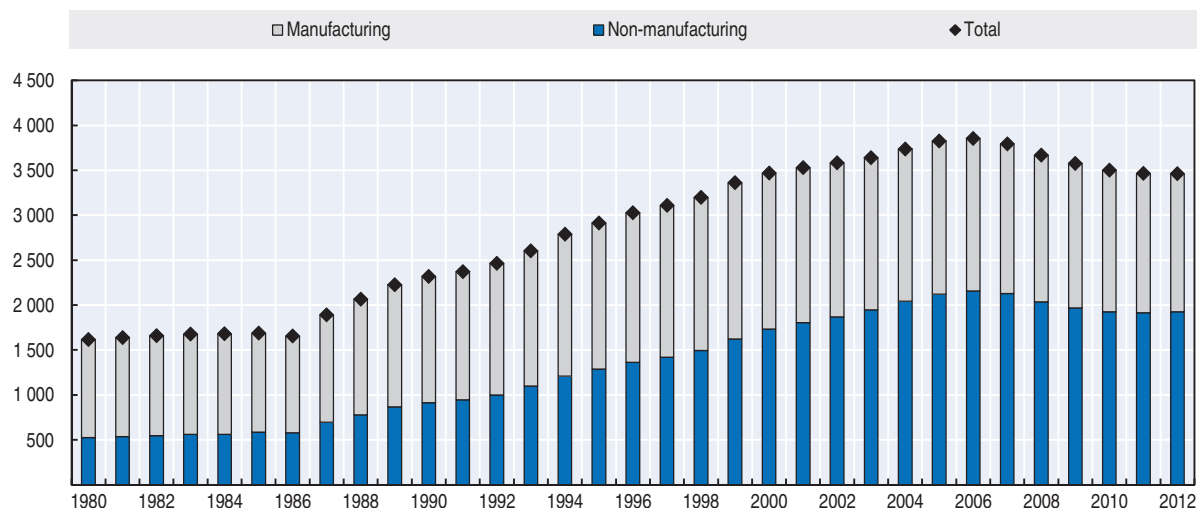
Source: Author's calculation based on Research Institute of Economy, Trade and Industry (2015), *The Japan Industrial Productivity Database 2015* (database), www.rieti.go.jp/en/about/about.html.

Firm-level reallocation and crises

This section relates employment dynamics to productivity for a subset of the population of Japanese firms, in particular it limits its analysis to listed companies in Japan. Utilising the micro dataset of listed firms¹ it investigates whether the macroeconomic crises have enhanced within-industry reallocation effects. Figure 9.4 shows how the number of listed

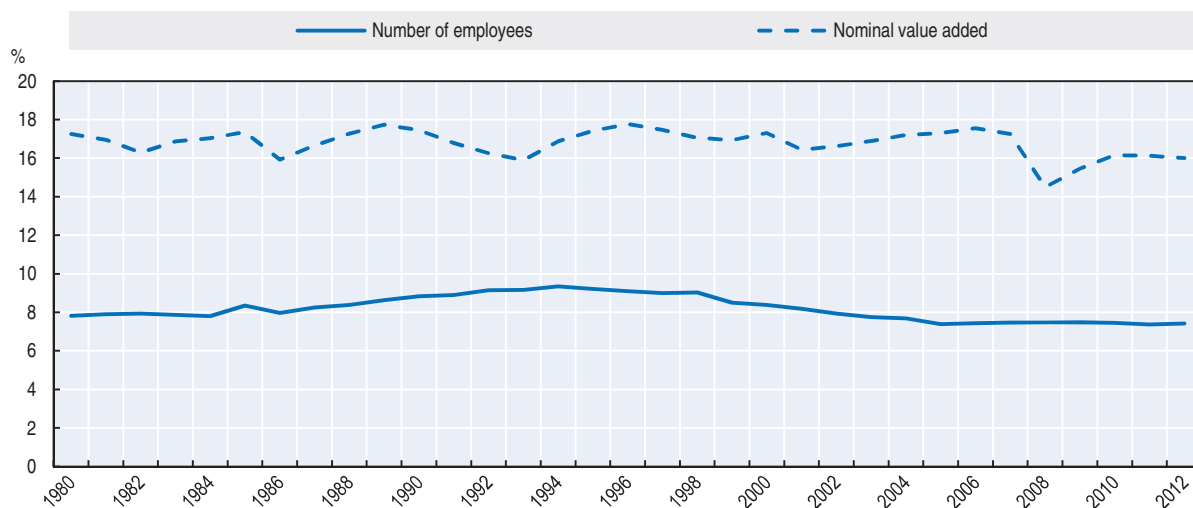
companies, that is, the size of this study's sample, has evolved over time. The number of listed firms increased from 1980 to 2006. There are between 1 600 and 3 856 firms for each year. Figure 9.5 shows the coverage ratio of the listed company sample in the total economy. The listed companies cover almost 7% to 9% of total employees and 15% to 18% of total value-added in Japan.

Figure 9.4. Number of listed companies



Source: Author's calculation based on Research Institute of Capital Formation, Development Bank of Japan (2015), *Corporate Financial Data Bank* (database), www.dbj.jp/ricf/databank/.

Figure 9.5. Share of sample firms in total economy



Source: Author's calculation based on Research Institute of Capital Formation, Development Bank of Japan (2015), *Corporate Financial Data Bank* (database), www.dbj.jp/ricf/databank/ and Research Institute of Economy, Trade and Industry (2015), *The Japan Industrial Productivity Database 2015* (database), www.rieti.go.jp/en/about/about.html.

For the period 1980-2012, there were 4 799 active firms in the sample (Table 9.1). The firms in the sample vary across industries: 2 115 firms were in manufacturing, and 2 706 firms were in non-manufacturing industries (Table 9.2). The share of the number of non-manufacturing² firms increased over time.

Table 9.1. **Number of firms: manufacturing industries**

Industry	1980-2012	80-89	90-99	00-12
Total	4 849	2 308	3 488	4 606
Manufacturing	2 143	1 418	1 812	2 013
Livestock products	28	21	25	28
Seafood products	8	2	8	8
Flour and grain mill products	7	7	7	7
Miscellaneous foods and related products	131	77	109	127
Prepared animal foods and organic fertilisers	7	5	7	7
Beverages	9	9	9	8
Textile products	81	64	76	75
Lumber and wood products	13	7	9	12
Furniture and fixtures	14	9	11	13
Pulp, paper, and coated and glazed paper	30	24	25	23
Paper products	22	13	20	20
Printing, plate making for printing and bookbinding	29	13	26	28
Leather and leather products	4	3	3	4
Rubber products	25	22	24	24
Chemical fertilisers	6	5	5	5
Basic inorganic chemicals	42	35	40	38
Basic organic chemicals	6	5	5	5
Organic chemicals	59	45	53	57
Chemical fibres	7	7	7	7
Miscellaneous chemical products	90	53	76	89
Pharmaceutical products	88	48	56	85
Petroleum products	14	10	10	13
Coal products	2	2	1	1
Glass and its products	16	12	13	13
Cement and its products	39	26	36	31
Pottery	13	12	13	13
Miscellaneous ceramic, stone and clay products	37	29	33	32
Pig iron and crude steel	46	37	36	40
Miscellaneous iron and steel	32	27	31	29
Smelting and refining of non-ferrous metals	22	13	15	21
Non-ferrous metal products	43	34	36	37
Fabricated constructional and architectural metal products	49	30	44	46
Miscellaneous fabricated metal products	71	46	67	68
General industry machinery	79	66	70	75
Special industry machinery	132	92	110	123
Miscellaneous machinery	79	56	68	72
Office and service industry machines	25	16	22	22
Electrical generating, transmission, distribution and industrial apparatus	54	40	50	53
Household electric appliances	42	28	35	38
Electronic data processing machines, digital and analogue computer equipment and accessories	25	9	17	24
Communication equipment	38	32	35	37
Electronic equipment and electric measuring instruments	42	22	34	40
Semiconductor devices and integrated circuits	24	10	16	22
Miscellaneous electrical machinery equipment	132	72	101	128
Motor vehicles	15	13	14	15
Motor vehicle parts and accessories	121	85	112	117
Other transportation equipment	28	24	24	25
Precision machinery and equipment	79	44	63	72
Plastic products	58	28	51	58
Miscellaneous manufacturing industries	80	29	54	78

Source: Author's calculation based on Research Institute of Capital Formation, Development Bank of Japan (2015), *Corporate Financial Data Bank* (database), www.dbj.jp/ricf/databank/.

Table 9.2. **Number of firms: non-manufacturing industries**

Industry	1980-2012	80-89	90-99	00-12
Total	4 849	2 308	3 488	4 606
Non-manufacturing	2 706	890	1 676	2 593
Fisheries	1	1	1	1
Mining	13	7	8	13
Construction	289	169	256	271
Civil engineering	5	5	5	4
Electricity	13	10	10	13
Gas, heat supply	19	13	16	19
Waste disposal	5		1	5
Wholesale	474	193	367	443
Retail	434	152	305	411
Finance	5	2	2	5
Insurance	1			1
Real estate	246	62	90	235
Railway	27	24	27	27
Road transportation	59	28	49	59
Water transportation	46	41	43	36
Air transportation	9	5	6	9
Other transportation and packing	38	20	31	37
Telegraph and telephone	36	2	18	35
Education (private and non-profit)	30	3	21	29
Research (private)	1			1
Medical (private)	9	1	2	9
Hygiene (private and non-profit)	1		1	1
Advertising	45	1	10	44
Rental of office equipment and goods	24	8	19	24
Automobile maintenance services	1		1	1
Other services for businesses	92	8	39	92
Entertainment	37	19	24	36
Broadcasting	21	6	11	21
Information services and internet-based services	476	49	180	470
Publishing	14	5	11	13
Video picture, sound information, character information production and distribution	27	11	14	25
Eating and drinking places	134	26	74	132
Accommodation	18	15	17	15
Laundry, beauty and bath services	9	2	4	9
Other services for individuals	29	1	10	29
Social insurance and social welfare (non-profit)	18	1	3	18

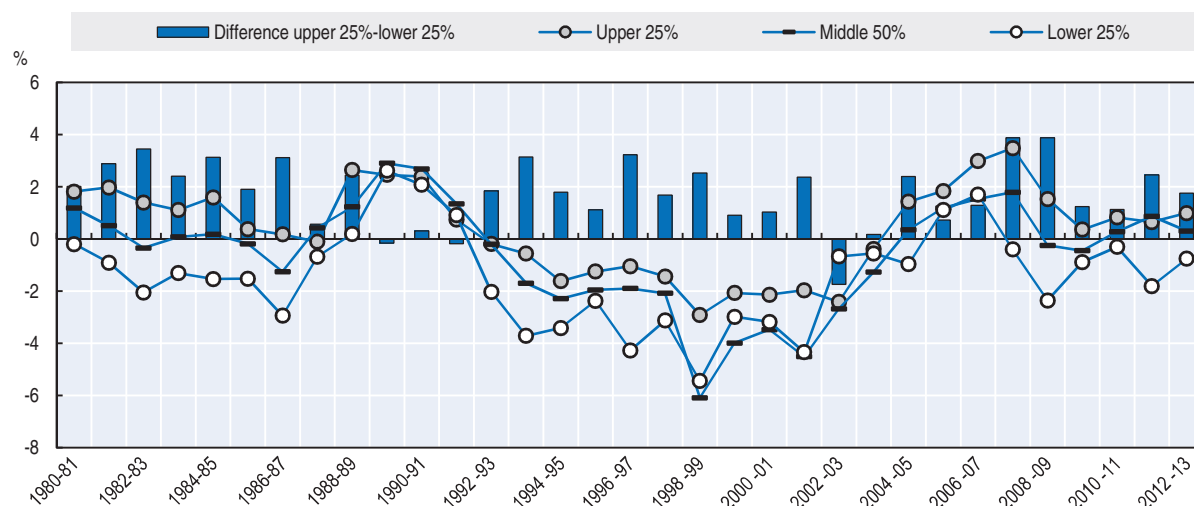
Source: Author's calculation based on Research Institute of Capital Formation, Development Bank of Japan (2015), *Corporate Financial Data Bank* (database), www.dbj.jp/ricf/databank/.

Following Fukao et al. (2011), the cross-sectional TFP index for each firm is calculated as the relative value of the industry average TFP in each year. Figure 9.6 compares the employment growth rates between firms that had a relatively high TFP with those that had a lower TFP. In almost the whole period, the average employment growth rate of the firms in the highest quartile for TFP (upper 25%) was higher than that those in the lowest quartile (lower 25%). During the periods of crisis, the difference in the average employment growth rates between highest and lowest quartiles (difference between the upper 25% and the lower 25%) tended to increase.

In order to examine the effects of economic crises on reallocation effects, this analysis relates employment growth rate of firms to their TFP. Table 9.3 shows the results of a

regression analysis in which the dependent variable is the firm-level employment growth rate for the sample companies during 1980-2012. Column [1] of the table shows the basic result with relative employment size and TFP as independent variables. The independent variables in all the models include a set of year-industry dummies, in order to factor out the effects of time varying industry-specific market conditions. The coefficient for relative employment size is negative and statistically significant, and the coefficient for relative TFP is positive and significant. The results indicate that the employment growth rate of large firms tends to be lower than that of smaller firms. The positive coefficient for relative TFP indicates that reallocation is productivity-enhancing in general. For a given firm size, firms with a higher TFP grow faster than those with a lower one.

Figure 9.6. **Employment growth rate by TFP class**



Source: Author's calculation based on Research Institute of Capital Formation, Development Bank of Japan (2015), *Corporate Financial Data Bank* (database), www.dbj.jp/ricf/databank/ and Research Institute of Economy, Trade and Industry (2015), *The Japan Industrial Productivity Database 2015* (database), www.rieti.go.jp/en/about/about.html.

Next, this study examines whether such a market cleansing mechanism becomes stronger during an economic crisis. Column [2] of Table 9.3 includes the interaction terms of industry (gross-output) growth rate with employment size and TFP, in addition to the main effects of these variables.³ The coefficient for the interaction term of TFP and industry growth is significantly negative. This result indicates that an industry downturn reinforces the productivity-enhancing effects of reallocation. In contrast, the coefficient for the interaction term of TFP and GDP growth rate is not significant (column [3]). These results imply that a macro level economic downturn has no negative impact on inter-firm reallocation effects in industries which do not face a demand reduction while a demand shrink in a particular industry reinforces productivity-enhancing reallocation in that industry.

Column [4] examines the effects of economic crises utilising a dummy variable that takes the value of one in each of the four economic crisis periods in Japan, and, is zero otherwise. Here, a positive and statistically significant coefficient for the interaction term of TFP and the crisis dummy can be observed. This result indicates that an economy-wide crisis enhances the reallocation mechanism. Moreover, in column [5], the effects of each crisis are distinguished. Significantly positive coefficients are visible for the interaction terms of TFP and the dummy variables for the three crises (Japanese financial crisis, Asian

financial crisis, and IT bubble burst), while the interaction term with the GFC dummy is not significant. This indicates that the effect of the GFC on the reallocation mechanism differs from earlier crises.

Table 9.3. Reallocation effects and economic crisis

Dependent variable: employment growth rate

	[1]	[2]	[3]	[4]	[5]
Ln. emp. size	-0.004*** [0.000]	-0.004*** [0.000]	-0.004*** [0.000]	-0.004*** [0.001]	-0.004*** [0.001]
Ln. TFP	0.148*** [0.005]	0.149*** [0.005]	0.149*** [0.005]	0.142*** [0.006]	0.144*** [0.006]
Ln. emp. size * industry growth		-0.006 [0.004]	0 [0.005]	-0.004 [0.005]	0 [0.005]
Ln. TFP * industry growth		-0.107** [0.050]	-0.108* [0.062]	-0.059 [0.054]	-0.113** [0.057]
Ln. emp. size * GDP growth			-0.020** [0.010]		
Ln. TFP * GDP growth			0.009 [0.115]		
Ln. emp. size * crisis dummy				0.001 [0.001]	
Ln. TFP * crisis dummy				0.022** [0.009]	
Ln. emp. size * Japanese financial crisis (91-94)					0.003*** [0.001]
Ln. emp. size * Asian financial crisis (97-99)					-0.004*** [0.001]
Ln. emp. size * IT bubble burst (00-01)					-0.004** [0.002]
Ln. emp. size * GFC (07-09)					0.005*** [0.001]
Ln. TFP * Japanese financial crisis (91-94)					0.025* [0.013]
Ln. TFP * Asian financial crisis (97-99)					0.068*** [0.016]
Ln. TFP * IT bubble burst (00-01)					0.044** [0.019]
Ln. TFP * GFC (07-09)					-0.024 [0.015]
Constant	-0.131*** [0.003]	-0.134*** [0.004]	-0.127*** [0.005]	-0.132*** [0.004]	-0.129*** [0.005]
Industry-year dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
No. of observations	79 000	79 000	79 000	79 000	79 000
No. of firms	4 551	4 551	4 551	4 551	4 551
R ²	0.163	0.163	0.163	0.163	0.164

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Highest and lowest 1% outliers are removed.

Source: Author's calculation based on Research Institute of Capital Formation, Development Bank of Japan (2015), *Corporate Financial Data Bank* (database), www.dbj.jp/ricf/databank/ and Research Institute of Economy, Trade and Industry (2015), *The Japan Industrial Productivity Database 2015* (database), www.rieti.go.jp/en/about/about.html.

The effects of the economic crises on the reallocation mechanism may differ across industries. In order to check this possibility, Table 9.4 shows the estimation results of the same regression models as Table 9.3 but with firms in the sample divided into two

subsamples according to industry. The results for manufacturing firms are shown in columns 1 and 2, and the results for non-manufacturing firms are shown in columns 3 and 4. The coefficient for TFP is positive and significant for both samples. This implies that the reallocation mechanism is productivity-enhancing in both manufacturing and non-manufacturing sectors. There are, however, several differences between the results for manufacturing and non-manufacturing sectors.

Table 9.4. Reallocation effects and economic crisis by sector

Dependent variable: employment growth rate

	Manufacturing		Non-manufacturing	
	[1]	[2]	[3]	[4]
Ln. emp. size	-0.003*** [0.000]	-0.003*** [0.001]	-0.005*** [0.001]	-0.005*** [0.001]
Ln. TFP	0.212*** [0.008]	0.196*** [0.009]	0.124*** [0.007]	0.122*** [0.008]
Ln. emp. size * industry growth	0 [0.004]	0.003 [0.005]	-0.024** [0.010]	-0.013 [0.011]
Ln. TFP * industry growth	-0.04 [0.063]	0.014 [0.078]	-0.167** [0.081]	-0.196** [0.092]
Ln. emp. size * Japanese financial crisis (91-94)		0.005*** [0.001]		0.001 [0.002]
Ln. emp. size * Asian financial crisis (97-99)		-0.006*** [0.002]		-0.002 [0.002]
Ln. emp. size * IT bubble burst (00-01)		-0.006*** [0.002]		-0.003 [0.003]
Ln. emp. size * GFC (07-09)		0.004** [0.002]		0.005*** [0.002]
Ln. TFP * Japanese financial crisis (91-94)		0.073*** [0.023]		0.003 [0.015]
Ln. TFP * Asian financial crisis (97-99)		0.155*** [0.027]		0.039** [0.020]
Ln. TFP * IT bubble burst (00-01)		0.094*** [0.031]		0.031 [0.023]
Ln. TFP * GFC (07-09)		-0.029 [0.028]		-0.018 [0.018]
Constant	-0.005 [0.034]	-0.005 [0.034]	0.032 [0.064]	0.031 [0.064]
Industry-year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
No. of observations	45 000	45 000	35 000	35 000
No. of firms	2 079	2 079	2 472	2 472
R ²	0.19	0.192	0.141	0.142

Notes: *** p < 0.01, ** p < 0.05, * p < 0.1. Highest and lowest 1% outliers are removed.

Source: Author's calculation based on Research Institute of Capital Formation, Development Bank of Japan (2015), *Corporate Financial Data Bank* (database), www.dbj.jp/ricf/databank/ and Research Institute of Economy, Trade and Industry (2015), *The Japan Industrial Productivity Database 2015* (database), www.rieti.go.jp/en/about/about.html.

First, the interaction term of TFP and industry gross-output growth rate is insignificant for manufacturing industries but significant and negative for non-manufacturing. Second, the Japanese financial crisis and IT bubble burst reinforced the productivity-enhancing reallocation mechanism only for the manufacturing sector. In contrast, both in manufacturing and non-manufacturing sectors, the Asian financial crisis reinforced the reallocation mechanism, while the GFC had no significant effect on this.

Conclusion

This chapter has examined the effects of economic crises on employment dynamics in Japan. During the last two decades (from 1990), the Japanese economy has been going through a long stagnation and suffered a number of economic crises. Focusing on four crisis periods, in which a negative growth rate of value-added was observed in the total market economy, this study has considered the effects of these on the labour market and on productivity. During the crises, both the labour inputs and TFP decreased sharply. Even in the economic recovery periods following the crises, when TFP increased, the labour inputs did not increase. In particular, this study found that demand for self-employed and regular workers was diminished by the crises, while the demand for part-time workers increased.

Then, utilising a comprehensive panel dataset of Japanese listed companies, it examined firm-level within-industry reallocation effects. During the period from 1980-2012, it found that the reallocation of labour inputs was productivity-enhancing in Japan. The results of regression analyses based on the firm-level panel data show the economic crises as having reinforced the productivity-enhancing reallocation mechanisms, in both the manufacturing and non-manufacturing sectors. However, it found that during the GFC at the end of 2000s, the productivity-enhancing reallocation mechanism was not strengthened. These results are consistent with existing empirical findings in the United States (Foster, Grim, and Haltiwanger, 2016).

The GFC caused a fluctuating global financial market and brought a sharp decline of net exports from the Japanese economy. Since highly productive firms tend to be more internationalised, they might also be more affected by such a downturn in the global economy. The results of this chapter may indicate that the market cleansing effects of an economic crisis in the era of high globalisation largely depend on international market conditions, rather than those of the domestic economy. To further investigate such a mechanism, a comparably rich international dataset is needed that is, for employment and productivity dynamics, linked to global value-chain data.

Notes

1. Research Institute of Capital Formation, Development Bank of Japan (2015) is used for analysis.
2. In non-manufacturing industries, fisheries, mining, construction and financial sectors are included. See Table 9.2 for a concrete list of non-manufacturing industries.
3. Because the industry year dummies are included as the control variables, the main effect of industry growth is not estimated.

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