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WAGE DIFFERENTIALS, ENTRY
AND THE JOB GENERATION
PROCESS IN GERMANY

by

Tito Boeri

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Based on information from the employment records of individual establishments in western Germany (Federal Republic of Germany before the German unification) between 1977-1988, it is possible to shed some light on the characteristics and determinants of the job generation process. Data for this study were drawn from the Employment Statistics register of the Federal Office of Labour (Bundesanstalt für Arbeit) and cover almost 80 per cent of total employment.

The central finding of the paper is that trend employment growth is, to a large extent, accommodated by plant openings rather than by the expansion of already existing units. While new establishments are subject to high failure rates, the growth of survivors almost completely offsets job losses due to plant closures. Furthermore, statistical analyses of entries and exits provide some support for the hypothesis that reduced wage differentials within any sector negatively affect the pace of entry of new establishments.

These results could be relevant for the current debate on the determinants of the poor employment performance of Germany in the 1980s. In particular, they raise the possibility that reduced wage differentials, associated with labour market policies and collectivistic wage agreements in the 1980s, played an important role in lowering the job generation potential of western Germany.

* * * * * * *


La principale conclusion de cette étude montre que la tendance de la croissance de l’emploi dépend en grand partie de l’ouverture de nouvelles entreprises plutôt que de l’agrandissement des usines existantes. Bien que les nouveaux établissements soient sujets à des taux de faillite élevés, la croissance de ceux qui restent compense presque entièrement les pertes d’emplois dues aux fermetures d’usines. De plus, l’analyse statistique des entrées et sorties vient étayer l’hypothèse que des réductions dans les différentiels de salaires de n’importe quel secteur affectent négativement le rythme des entrées dans les nouveaux établissements.

Ces résultats peuvent s’avérer importants dans le débat actuel sur les causes de la faible performance de l’Allemagne en ce qui a trait à l’emploi dans les années 1980. En particulier, ils permettent de penser que le fléchissement des différentiels de salaires, conjugué aux politiques du marché du travail et aux ententes salariales collectives des années 1980, a joué un rôle important dans la diminution du potentiel de création d’emplois de l’Allemagne occidentale.
WAGE DIFFERENTIALS, ENTRY AND THE JOB GENERATION PROCESS IN GERMANY

Several explanations have been provided for the modest employment performance of Germany in the 1980s. By and large, the hypothesis which has received greater attention from both a theoretical and an empirical stand-point is that labour markets in Germany have been affected by some kind of real wage rigidity. According to this view, the limited responsiveness of wages to rising unemployment explains not only the high employment losses experienced in the adjustment to adverse supply shocks, but also the persistence of large unemployment rates in periods of strong output expansion [Bruno and Sachs, 1985]. Especially the growth of employment in services would have been negatively affected by wage rigidity, with consequent slow job creation in tertiary sectors compared to US standards [Burda and Sachs, 1987].

Empirical work has lent little, if any, support to this hypothesis. The presence of real wage rigidity in Germany has been tested against cross-country data, mainly based on the estimation of reduced form aggregate unemployment equations. Although these tests are far from conclusive', rejection of the hypothesis is corroborated by evidence that the degree of wage response in Germany is not low relative to US standards [Bell, 1986 and 1987]. Furthermore, developments of the literature on wage staggering have somewhat undermined the legitimacy of the real wage rigidity hypothesis by showing that increasing price flexibility may have also perverse effects on output and employment growth [De Long and Summers, 1986].

Other explanations of the German unemployment problem have pointed to the costs associated to structural change in output and employment. In particular, some tests have been made of Lilien’s hypothesis on the existence of a positive relation between inter-industry shifts of workers and unemployment, whose rationale is the presence of lags and adjustment costs in the reallocation of jobs across sectors [Lilien, 1982; Davis, 1987]. This is another case where empirical evidence from Germany has not been indulgent with respect to speculative research [Gross, 1988]. Furthermore, Lilien’s hypothesis is today subject to substantial controversy as the relation between structural shifts and unemployment has been shown to possibly arise from a reverse order of causality [Abraham and Katz, 1986]. Finally, tests of this hypothesis would require using micro-level data, which have been largely neglected in analyses of the German unemployment problem.

Surprisingly enough, specific institutional features of the functioning of labour markets in Germany have been incorporated in the analysis only in the most recent years. The effects of changes occurred in the 1970s in labour market regulations and industrial relations have been investigated and the focus has been on the reduction of inter-industry wage differentials induced by new collectivistic wage agreements [Grundlach, 1986; Soltwedel and Trapp, 1988; Soltwedel, 1988]. The hypothesis put forth by this literature is that greater labour market interventionism associated to policies promoting a greater equality of outcomes have induced both unions and employers to delegate responsibility for full employment to the government, while pursuing wage policies incompatible with the reduction of unemployment.

1. Due to the presence of daunting measurement problems, and the lack of tests of structural parameters, econometric results should be viewed with some caution.
In our view, the empirical implications of such moral hazard explanation of the German unemployment problem have been only partly developed, mainly due to the lack of an underlying theory of wage differentials. In the absence of that, the literature on collectivistic wage agreements reduces to a sort of insiders-outsiders story, whose main implication is that real wage rigidity should bear the brunt of blame. Needless to say, this does not seem to add much to conclusions from earlier studies.

The hypothesis put forth in this paper is that wage differentials reflect a fundamental technological asymmetry between incumbents and entrants and that a certain degree of dispersion of wages is required to make entry in the fringe profitable. This may indirectly contribute to the debate on the determinants of the German unemployment problem. In fact, if our hypothesis is correct, then the reduction of wage differentials in Germany associated to recent collectivistic agreements would have been detrimental to employment growth by reducing the pace of entry of firms, hence the creation of new job opportunities.

It is important to make two qualifications at the outset. First, what really matters in this context is not the stickiness of wages, but the degree of dispersion of wages per se. Second, barriers to entry are not necessarily associated to inter-industry wage differentials, e.g., the dispersion of wages between services and manufacturing traditionally considered by the literature [Bell, 1986], but to wage differentials within any given industry.

We will proceed in three steps. We will first show that entry plays a crucial role in the growth of employment in the long run. Then we will argue that evidence on entry and exit rates points to the presence of relevant differences between incumbents and entrants and that such differences can contribute to explaining observed wage differentials between small and large units within the same industry. Finally, based on data on entry and exit rates of establishments in Germany, we will test the hypothesis that reduced intra-industry wage differentials negatively affect the pace of entry.

The plan is as follows. We initially describe the data used in the study. Next, we assess the role of entry in the growth of employment in Germany and we discuss how reduced intra-industry wage differentials might adversely affect the turnover of plants and firms. Finally, we present some estimates of entry and exit equations in Germany.

1. The Data Set

The data for our study are drawn from the Employment Statistics register of the Federal Office of Labour (Bundesanstalt für Arbeit, BA for short), and collected via the Social Insurance procedure introduced in 1973 that compels employers to report every year all changes occurred in the number of workers who are subject to a health or unemployment insurance or who are participating to a pension scheme. There are legal sanctions for misreporting.

As shown by comparisons with Microcensus data, the register covers all dependent employment (no self-employed) in the private sector, i.e., almost 80 per cent of total employment in Germany. Individual plants are assigned separate identification numbers
even when they belong to the same firm; this makes it possible to trace individual histories of establishments. Available data tabulate the number of employees of any plant at 30th June every year. Establishments born over any given year period are classified according to their employment levels at the end of the period.

Plants openings and closures can be identified by comparing the number of employees of each individual plant at different points in time. In other words, entrants (exiting units) are establishments which had no (some) registered workers at t, but some (no) employees at t+1. Ownership changes do not affect establishments identifiers. Hence, BA data provide a measure of actual plant openings and closures rather than of entry and exit via acquisition and divestiture.

BA data have three major advantages with respect to other longitudinal data used in the analysis of the growth of business units. First, there is little, if any, undersampling of small and young establishments. Establishments, in fact, do not have to meet any special requirement in order to be registered. To give an example, unlike in the U.S. Establishment and Enterprise Microdata file (USEEM) data used by Birch (1981), Armington and Odle (1982) and Howland (1988), not only firms that purchase or sell credit are registered. Second, the data base refers to almost the entire population of German establishments. This allows for, inter alia, consistency checks and data cleaning, unlike data based on small samples of business units. Third, BA data make it possible to analyse simultaneously the growth of incumbents and entry and exit behaviour, unlike many closed system longitudinal surveys. A typical example of surveys systematically excluding births and deaths is the longitudinal sample recently constructed by Leonard (1988), based on US firms responses to federal EEO-1 firms.

A major drawback of BA data is their limited coverage of important characteristics of business units. Available data provide information only on the number of insured workers of establishments, on the average wage of employees and on their distribution by educational status (workers with and without vocational training or with university degree). Hence, no information is provided on sales volumes, profits, etc.. Furthermore, there is no information on labour, as opposed to job, turnover. This is because only changes in the number of employees of any establishments are registered. Put another way, our data provide, at best, a lower bound for actual labour turnover, as defined in the studies by Lilien (1980), Hall (1982), Akerlof, Rose and Yellen (1988) and others. All this makes BA data extremely valuable in analyses of labour demand.

2. Entry and Employment Growth

The role of entry and exit processes in the job generation process can be assessed either by looking at the sharing of employment growth between incumbents and entrants and by analysing the dynamic behaviour of different cohorts of establishments. The two approaches are complementary insofar as the first provides information on the contribution given by new plants to aggregate employment growth, whereas the second permits us to assess the stability over time of job gains associated to entry.

2. The Register is used to reconstruct the local dispersion of working places according to the Census of employers (Arbeitstitenzählung).
3. However, it should be stressed that there is some evidence that labour turnover is to a large extent demand driven. See Davis and Haltiwanger, 1989.
Table 1 shows the different components of employment growth in Germany in the years for which data were available. The time-period considered is characterized by both expansionary (1977-80 and 1984-86) and contractionary (1980-84) fluctuations in aggregate employment with peaks and troughs of the cycle reached respectively in 1978-79 and 1981-82. Such fluctuations are mainly related to the behaviour of the continuing segment, whereas net changes in employment induced by entry and exit processes are always positive, though relatively small. Hence, employment contractions reflect conditions where the continuing segment more than offsets net job gains associated to the turnover of establishments.

Table 1
Components of Employment Growth
(Germany 1977-88, percentage change over previous year)

<table>
<thead>
<tr>
<th>CONTINUING ESTABLISHMENTS</th>
<th>77-78</th>
<th>78-79</th>
<th>79-80</th>
<th>80-81</th>
<th>81-82</th>
<th>82-83</th>
<th>83-84</th>
<th>84-85</th>
<th>85-86</th>
<th>86-87</th>
<th>87-88</th>
<th>Ave</th>
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</thead>
<tbody>
<tr>
<td>Expansions</td>
<td>6.4</td>
<td>6.9</td>
<td>6.4</td>
<td>5.3</td>
<td>5.2</td>
<td>4.8</td>
<td>5.6</td>
<td>7.0</td>
<td>6.9</td>
<td>6.4</td>
<td>5.8</td>
<td>6.1</td>
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<tr>
<td>Contractions</td>
<td>6.0</td>
<td>5.3</td>
<td>5.2</td>
<td>6.7</td>
<td>7.4</td>
<td>6.8</td>
<td>6.6</td>
<td>5.7</td>
<td>5.4</td>
<td>5.3</td>
<td>5.3</td>
<td>6.0</td>
</tr>
<tr>
<td>Net change</td>
<td>0.4</td>
<td>1.6</td>
<td>1.2</td>
<td>-1.4</td>
<td>-2.2</td>
<td>-2.0</td>
<td>-1.0</td>
<td>1.3</td>
<td>1.5</td>
<td>1.1</td>
<td>0.5</td>
<td>0.1</td>
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</table>

<table>
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<th>NEW AND CLOSING ESTABLISHMENTS</th>
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<th>78-79</th>
<th>79-80</th>
<th>80-81</th>
<th>81-82</th>
<th>82-83</th>
<th>83-84</th>
<th>84-85</th>
<th>85-86</th>
<th>86-87</th>
<th>87-88</th>
<th>Ave</th>
</tr>
</thead>
<tbody>
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<td>Entry</td>
<td>2.2</td>
<td>2.1</td>
<td>2.1</td>
<td>2.2</td>
<td>2.1</td>
<td>2.0</td>
<td>2.3</td>
<td>2.2</td>
<td>2.3</td>
<td>2.4</td>
<td>2.4</td>
<td>2.2</td>
</tr>
<tr>
<td>Exit</td>
<td>1.5</td>
<td>1.4</td>
<td>1.4</td>
<td>1.5</td>
<td>1.9</td>
<td>1.8</td>
<td>1.8</td>
<td>1.9</td>
<td>2.0</td>
<td>2.0</td>
<td>1.7</td>
<td>1.7</td>
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<tr>
<td>Net Change</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.2</td>
<td>0.2</td>
<td>0.5</td>
<td>0.3</td>
<td>0.3</td>
<td>0.4</td>
<td>0.7</td>
<td>0.5</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ALL ESTABLISHMENTS</th>
<th>77-78</th>
<th>78-79</th>
<th>79-80</th>
<th>80-81</th>
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<th>82-83</th>
<th>83-84</th>
<th>84-85</th>
<th>85-86</th>
<th>86-87</th>
<th>87-88</th>
<th>Ave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job gains</td>
<td>8.6</td>
<td>9.0</td>
<td>8.5</td>
<td>7.5</td>
<td>7.3</td>
<td>6.8</td>
<td>7.9</td>
<td>9.2</td>
<td>9.2</td>
<td>8.8</td>
<td>8.2</td>
<td>8.3</td>
</tr>
<tr>
<td>Job losses</td>
<td>7.5</td>
<td>6.7</td>
<td>6.6</td>
<td>8.2</td>
<td>9.3</td>
<td>8.6</td>
<td>8.4</td>
<td>7.6</td>
<td>7.4</td>
<td>7.3</td>
<td>7.0</td>
<td>7.7</td>
</tr>
<tr>
<td>Net change</td>
<td>1.1</td>
<td>2.3</td>
<td>1.9</td>
<td>-0.7</td>
<td>-2.0</td>
<td>-1.8</td>
<td>-0.5</td>
<td>1.6</td>
<td>1.8</td>
<td>1.5</td>
<td>1.2</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Averaging out cyclical fluctuations, i.e., taking the mean of yearly rates (last column), the net contribution to employment growth of incumbents is almost negligible, whereas it is significant for entering and exiting units. In absolute figures, establishments surviving at least a one year have over the decade created about 300,000 new jobs, whereas

4. Instead of annualising the change over the ten years period. If employment changes were recorded over long time spans, we would have clearly much larger entry and exit rates and smaller contraction and expansion rates. See on this Baldwin and Gorecki (1988).
about 750,000 additional posts are due to net entry of business units. Overall, trend employment growth is mainly accommodated by the startup of new plants as opposed to the growth of incumbents5.

Diagram 1 displays the number of jobs created by different cohorts of establishments as percentage of their employment levels in the year of their startup. This shows that employment in each generation of plants reaches a peak one year after the startup, and then it smoothly declines over time to finally stabilise around 90% of employment at birth. There are two countervailing forces at work in this context. On the one hand, the reduction in the number of active plants belonging to each cohort tends to reduce the amount of workers absorbed by new plants after entry. On the other hand, the increase in the size of survivors tends to increase the total number of employees in each generation of entrants.

Diagram 2

The Post Entry Performance of Entrants

(% of initial employment in each cohort)

5. These results are consistent with evidence from other countries collected by the OECD [OECD, 1987] as well as with previous studies on entry and exit of firms in Canada [Armington, 1986; Baldwin and Gorecki, 1988]. In a recent study of the sources of the US manufacturing employment [Dunne, Roberts and Samuelson, 1989], it is reported that net changes in aggregate manufacturing employment are, each time period, almost exclusively determined by employment changes in continuing plants. Tables displayed in that study indicate also that net employment changes due to plant births and closures are almost always positive, whereas employment changes due to expanding and contracting plants are to a large extent mutually offsetting when added up over cycles.
Diagram 3
The Post Entry Performance of Entrants
(% of number of plants in the initial year)

As shown in Diagram 3, about one fourth of the new establishments withdraw from the market immediately after the startup. In the following years, exit continues, but at a decreasing rate: each year between two and five percent of the initial number of units closes down. Hence, selection is strong between new plants, and only about 40 percent of establishments of each cohort is still operating eight or nine years after birth. The growth of survivors is, however, sufficiently rapid so as to largely compensate the number of jobs destroyed by closing establishments. The average size of survivors is, indeed, increasing over time (Table 2): in about two years time they get, on the average, twice as large than at birth. Overall, those entrants who do not die in early childhood grow sufficiently to almost completely offset the departures: 9 out of 10 posts created at entry are preserved over time.

Further insights on the turnover of establishments can be possibly obtained by going somewhat beyond aggregate figures. Diagram 3 plots entry and exit rates - that is number of, respectively, new and closing plants over the total number of units in the base year - across nine broad industries. Interestingly enough, the sectors with the highest (gross)
Table 2

Average Size of Different Cohorts of Establishments After Entry

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>2.77</td>
<td>4.20</td>
<td>4.84</td>
<td>5.15</td>
<td>5.39</td>
<td>5.56</td>
<td>5.76</td>
<td>6.13</td>
<td>6.47</td>
<td>6.66</td>
</tr>
<tr>
<td>1979</td>
<td>--</td>
<td>2.69</td>
<td>3.86</td>
<td>4.26</td>
<td>4.50</td>
<td>4.63</td>
<td>4.87</td>
<td>5.16</td>
<td>5.48</td>
<td>5.71</td>
</tr>
<tr>
<td>1980</td>
<td>--</td>
<td>--</td>
<td>2.74</td>
<td>3.82</td>
<td>4.23</td>
<td>4.43</td>
<td>4.79</td>
<td>5.10</td>
<td>5.45</td>
<td>5.68</td>
</tr>
<tr>
<td>1981</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>2.91</td>
<td>4.00</td>
<td>4.42</td>
<td>4.78</td>
<td>5.13</td>
<td>5.54</td>
<td>5.84</td>
</tr>
</tbody>
</table>

entry rates are also those with highest (gross) exit rates. The association between the time profile of entry and exit rates in some service sectors (credit and real estate, other personal services, and other productive services) is also rather striking and points to the existence of sizeable displacement effects related to the entry of new establishments.

An overall picture of the job generation process which is suggested by the raw facts so far presented is one where there are sort of intensive and extensive margins facing the growth of employment. Intensive margins are mainly modified by incumbents, whereas extensive margins vary together with changes in the number of active plants. Short term employment fluctuations are characterised by the expansion and contraction of capacity in existing establishments. Trend employment growth is mainly determined by the pace of entry of new business units.

Jobs generated by entry, however, do not simply add to the stock of employment opportunities in an industry. Rather, entrants displace and eventually drive out of business a significant portion of incumbents: there is a lot of churn in the turnover of plants, that is, gross entry rates are many times larger than net entry rates. Furthermore, market shares occupied by entrants at the startup can be preserved over time only via a tough selection process where a few plants of each cohort survive and succeed in expanding capacity. It follows that modifications of extensive margins are associated to significant changes in the allocation of posts within an industry.

6. The correlation coefficient between entry and exit rates across 81 sectors is 0.96 and significant at 99% confidence interval. Such a strong positive cross-sectional correlation between entry and exit rates is consistent with evidence from the US, Canada and several European countries [Shapiro and Khemani, 1987; Dunne and Roberts, 1989; Schwalbach, 1989].
Figure 1

Establishments Entry and Exit Rates in Germany

ENTRY
EXIT

PRIMARY & GROUND MANUF.

INVESTMENT GOODS MANUF.

TRANSPORTATION

CONSUMPTION GOODS MANUF.

CREDIT & REAL ESTATE

CONSTRUCTION

OTHER PERSONAL SERV.

TRADE

OTHER PRODUCTIVE SERV.
3. Entrants, Incumbents and Pay Differentials

There at least two main lessons that can be drawn from the above. The first is that any theory which is capable of identifying the determinants of entry is also a theory of employment growth in the long run. The second lesson is that understanding entry means characterising the displacement effects associated to the startup of new plants, hence ultimately identifying the most relevant asymmetries between entrants and incumbents.

Unfortunately, the relation between entrants and incumbents has been fairly neglected by the literature on the growth of firms\(^7\). There are only a few models that can mimic displacement effects of the kind of those actually associated to the entry process. Let us briefly summarize how such models characterise the distinction between incumbents and entrants.

Some recent developments of the Bayesian theories of the growth of the firm are based on the assumption that learning by doing is embedded only in new machinery [Jovanovic and Lach, 1989]. As efficiency enhancements due to learning can be appropriated only by new firms installing new machinery, in a competitive environment entry is accompanied by price reductions that expand industry demand and displace incumbents. Hence, net entry is always positive, which is consistent with our previous description of the role of entry in trend employment growth.

A major drawback of these models is that they do not seem to cope with evidence on hazard rates for entrants. If the latter successfully erode market shares of incumbents, then the question arises why should new firms be subject to failure rates equal to as much as 25 per cent.

Another source of asymmetries between entrants and incumbents has been identified in the product space by models of the growth of the firm in heterogeneous product industries [Boeri, 1989]. Entry is in this context associated to the choice of the design for products. Insofar as changing the design of products is costly and time-consuming, entry plays a major role in matching changes in consumers preferences. It follows that product specifications of entrants must be sufficiently different from those of incumbents, that is, new firms must occupy market niches that are poles apart from those of exiting units and from those of the continuing segment as well. Appropriate assumptions on the stochastic process governing the dynamics of consumers' preferences\(^8\) can then generate a large turnover of plants and induce entrants to choose a highly specialised, hence risky, design for their products.

As far as empirical work is concerned, some relevant asymmetries between entrants and incumbents have been pointed out by studies on the relation between small and large firms. As entry occurs mainly in the fringe and entrants are smaller than incumbents\(^9\), such findings indirectly contribute to characterising the distinction between entrants and incumbents.

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7. See Boeri 1990 for a survey of theories of the growth of the firm.
8. In particular, there must be some degree of persistence in the way in which consumers rank available varieties.
9. For instance, in the BA sample the average number of employees in new establishments is always less than 3, whereas the average size of plants that have been active over the 1977-88 period is 23.
An important empirical regularity highlighted by this literature is the existence of a strong positive correlation between establishment or firm size and wages [Antons, 1981; Mellow, 1983; Brown and Medoff, 1984]. Differentials in labour costs are even larger when account is made for differences in fringe benefits (paid leisure, pension plans, different kinds of insurance, etc.) across small and large units. It should be stressed that this holds also when industry differences are controlled for. In other words, differentials in labour costs between small and large units or between entrants and incumbents are significant even within well-defined sectors.

Several explanations have been provided for the existence of such wage differentials. The rationale for having firms of different size paying differently workers has been initially found in models of economies with unions, and namely in the greater bargaining power of workers in large than in small organisations [Weiss, 1966; Johnson, 1975; Parsley, 1980]. A possible objection to such view is that large firms tend also to have large monopsonistic power, which should depress workers' wage payments below levels prevailing in price-taking small units [Rees and Shulz, 1970]. Furthermore, such union-based theories of wage differentials across small and large units are incomplete insofar as they do not cope with actual unions behaviour and namely with the fact that unions strategies generally go much beyond the level of an individual firm. In other words, these theories are incomplete insofar as they do not take into account the existence of collective wage agreements and industry-wide, if not economy-wide, unions strategies.

Another rationalisation of the existence of wage differentials between small and large units which has been put forth is the existence of some kind of compensating mechanism [Lester, 1967; Masters, 1969; Calvo, 1977; Calvo and Wellisz, 1978; Rosen, 1981; Strand, 1987]. In other words, competitive markets would equalise differences in labour productivity forcing the most efficient and profitable units to pay their workers more than other firms. Still, this does not yet solve the puzzle. If wage differentials reflect compensating payments, then one should provide an explanation for the existence of labour productivity differentials across small and large firms. Needless to say, this is the most difficult task and one which is still far from being accomplished.

To give an example, labour productivity differentials between small and large units have been often attributed to intrinsic characteristics of workers and namely to the fact that small units employ workers with a relatively low skill profile [Oi, 1983]. This is at odds with evidence from the BA sample on the distribution of worker qualifications by size of establishments displayed in table 3. The most startling feature of the table is, indeed, that establishments with less than 10 employees have a larger share to the total of workers with vocational training than large units. It is true that a large number of workers with university degree is employed in the largest establishments, but highly qualified workers are quite unlikely to be involved in production. Hence, production workers in small plants appear to be even more trained than production workers in medium-sized and large units.

In our opinion, any theory of productivity differentials between small and large units should take into account the fact that a significant portion of small units is represented by entrants. This means that the compensating mechanism operating on the wage side is likely to reflect some relevant asymmetry between entrants and incumbents. In other

10. Incidentally, this fact is consistent with the view that entrants are more specialised than incumbents, provided that product specialisation is associated to the hiring of specialised workers.
words, differential wage payments can be thought of as compensations for comparative cost disadvantages of entrants with respect to incumbents which can arise from a variety of factors, such as the presence of internal learning by doing, the fact that entrants produce new goods for which technologies have not yet been standardized, etc.

<table>
<thead>
<tr>
<th>Qualification\Size class</th>
<th>1</th>
<th>2-10</th>
<th>11-100</th>
<th>101-1000</th>
<th>1001-...</th>
<th>TOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>no vocational training</td>
<td>34.2</td>
<td>33.1</td>
<td>34.5</td>
<td>36.0</td>
<td>34.0</td>
<td>39.0</td>
</tr>
<tr>
<td>vocational training</td>
<td>63.2</td>
<td>64.1</td>
<td>62.0</td>
<td>58.6</td>
<td>56.3</td>
<td>57.0</td>
</tr>
<tr>
<td>university</td>
<td>2.6</td>
<td>2.8</td>
<td>3.5</td>
<td>5.4</td>
<td>9.7</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Summarising, there is a strong case for bringing together results from the literature on wage differentials and from the theories coping with the relation between incumbents and entrants. This would contribute not only to explaining some empirical regularities - such as the fact that small units pay lower wages than large establishments - but also to identifying some factors that may reduce the job generation potential of an economy or industry. An important implication of the suggested line of thinking is, indeed, that policy induced reductions in the dispersion of wages across small and large units should negatively effect entry, hence exit, in the fringe. This is the core hypothesis that we are now going to test.

4. The Statistical Framework

The data set described in Section 1 provides information on entry and exit rates by sector and over time. Combining such data with available information on the performance of different industries\(^{11}\), it is possible to test our hypotheses on the relation between wage dispersion and firm turnover.

It is convenient first to specify the statistical framework for estimating entry and exit equations. Entry and exit can be modelled as binary decisions related, respectively, to whether \( \beta E[V(x_i)] - k \geq W \) and \( E[V(x_i)] < W \), where \( x \) is a vector of state variables, \( k \) denotes entry (positioning) costs and the \( W \) the opportunity cost of staying in the industry. By linearly approximating the value function, entry and exit rules define implicitly two critical values -- e.g., \( I^e \) and \( I^d \) -- such that if \( x'\beta \geq I^e \), then entry occurs and if \( x'\gamma \leq I^d \), then exit occurs. We allow these critical values to vary across sectors in order to capture

11. The OECD (ISDB), and the IFO Institut of Munich (Strukturerichterststattung) publish series on demand (GDP, and output gaps), labour costs, gross operating surplus, investments, capital, labour and total factor productivity, vacancies, both across sectors and over time. Furthermore, the German Federal Office of Labour provides data on the structure of industries (variance of the size of establishments, standard deviation of wages, both within and across industries, share of workers with and without vocational training, etc.).
the effects of intra-industry wage differentials on entry and exit. The conditional probability of entry (exit) when \( I \) occurs is assumed to be distributed according to a logistic cumulative density function, i.e.:

\[
Pr\{E|I_i\} = F(x_i'; \beta) = \frac{1}{1 + e^{-x_i'\beta}}
\]

and analogously:

\[
Pr\{D|I_i\} = F(x_i'; \gamma) = \frac{1}{1 + e^{-x_i'\gamma}}
\]

where the subscript \( i \) refers to different industries. The advantage of using a logistic distribution is that the log odds ratio of entering and exiting the industry are, respectively, simply given by:

\[
\ln\left(\frac{\mu^e}{1 - \mu^e}\right) = x_i'\beta + u_i
\]

and:

\[
\ln\left(\frac{\mu^d}{1 - \mu^d}\right) = x_i'\gamma + e_i
\]

where the measures \( \mu^e \) and \( \mu^d \) represent in this context number\(^{12}\) of entrants and number of exiting units normalized over, respectively, the initial and the final population of firms in the industry.

In the entry and exit equations, intra-sectoral wage differentials are measured by the standard deviation of hourly wages across establishments within any given sector. In the light of our previous qualifications, we expect such a variable to enter with a positive sign both equations.

Other variables are included in the set of regressors in order to avoid mis-specification errors. First of all, we consider the degree of market concentration in different industries, which is proxied by the standard deviation of the distribution of establishment size in any sector. This variable should negatively affect entry and exit. Hence, it is included in both equations.

Concerning specifically the entry equation, we need to find some proxy for positioning costs. As shown above, employment in small establishment is characterized by the presence of a relatively large component of specialised workers. Hence, we suspect that entry costs could be inversely related to the availability of specialized workers. We try to capture such effects by using a common index of labour market mis-match, such as the ratio of vacancies over unemployed, whose coefficient we expect to be negative. Inasmuch as specialized equipment is not perfectly fungible, another source of unre-

\(^{12}\) Data on output or profit shares of entrants and exiting units were not available. Previous studies, however, (see, for instance, Dunne and Roberts (1989)) have found that changing the measures of entry and exit does not significantly alter the estimation results.
coverable entry costs is the required capital investment at the startup\textsuperscript{13}, which is con-
sequently included in the set of regressors, lagged one period in order to avoid simultaneity bias. We clearly expect to observe a negative coefficient for this variable. Finally, as in standard econometric models of entry, we include in the set of regressor
a measure of industry profitability, namely the share of operating surplus on GDP, lagged
one period. We expect to observe a negative coefficient for this variable inasmuch as
industries with higher than the average profits are likely to have benefited from higher
than the average entry barriers.

As far as the exit equation is concerned, displacement effects associated to entry can
be captured by including in the set of regressors entry rates, whose sign should be positive.
We also add to regressors available series on long term interest rates, and on operating
surplus weighted by the capital stock. We expect the latter explanatory variable to enter
the exit equation with a negative sign, whereas the former should positively affect exit
rates.

5. Regression Results

Due to the availability of observations on entry and exit rates across 9 broad industries
and for 10 years only, cross-section, and time-series data are combined in order to
improve the degrees of freedom. Intersectoral heterogeneity is captured by two industry
dummies, respectively, for manufacturing, and the group of trade, construction, and
transportation, and several purely cross-sectional variables, i.e., constant over time for
any given sector (mean of the sectoral series over the period). Since the Breusch-Pagan
test\textsuperscript{15} revealed the presence of heteroskedasticity, GLS estimators are used, i.e., observa-
ations are weighted by the standard deviation of the residuals of different groups of
sectors, the latter estimated by running OLS.

The regression results, displayed in Tables 4 and 5, are broadly consistent with a-priori
expectations. In particular, we find support to the hypothesis that the lower the variance
of wages within any industry, the lower are both entry and exit rates.

In the case of the entry equation, the coefficients for the intra-sectoral dispersion of
size\textsuperscript{16} (STDS) and the ratio of vacancies over unemployed (MISM) are, as expected,
significant\textsuperscript{16} and negative. Furthermore, entry rates appear to be negatively affected by
the relative scarcity of qualified workers. The coefficients for the variance of size and
gross entry rates (GRENT) in the exit equations are significant and in line with the
predictions of the model.

13. Ideally, one should weight data on sectoral investments based on the degree of fungibility of capital,
e.g., based on the share of capital that can be rent by the entrant. Unfortunately, we have access only to
series of investment by sector.
14. Residuals were normalized on the mean square error and regressed on each of the independent
variables. The test is a chi-square. The critical value of the test at 1\% level is 0.68. The lowest value
from the test was 3.9.
15. The low t-statistics for the standard deviation of size can be explained by the presence of multi-
collinearity with the standard deviation of wages. Empirical work has found, indeed, a significant positive
correlation between standard deviation of size and wages within any sector [Saunders and Marsden, 1982].
16. The low t-statistics for the STDS coefficient in the entry equation seems to depend on the afore-
mentioned multicollinearity with the standard deviation of wages (STDW).
Table 4
Regression Analysis of Gross Entry
(Germany, 9 industries 1977-87)

<table>
<thead>
<tr>
<th>Var</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNST</td>
<td>-3.195520</td>
<td>0.114217</td>
<td>27.977568</td>
</tr>
<tr>
<td>D1</td>
<td>0.767570</td>
<td>0.088666</td>
<td>-8.656840</td>
</tr>
<tr>
<td>D2</td>
<td>-0.304044</td>
<td>0.044711</td>
<td>-6.800273</td>
</tr>
<tr>
<td>STDS</td>
<td>-0.185261</td>
<td>0.172885</td>
<td>-1.071583</td>
</tr>
<tr>
<td>STDW</td>
<td>0.040782</td>
<td>0.006218</td>
<td>6.558544</td>
</tr>
<tr>
<td>MISM</td>
<td>-1.842965</td>
<td>0.157599</td>
<td>-11.693982</td>
</tr>
<tr>
<td>CAP</td>
<td>1.654330E-006</td>
<td>5.554171E-007</td>
<td>2.978537</td>
</tr>
<tr>
<td>PRSH</td>
<td>1.139983</td>
<td>0.080029</td>
<td>14.244582</td>
</tr>
</tbody>
</table>

Observations: 90
R-squared: 0.992
R-bar-squared: 0.991
F-stat: 125.02

Notes:
D1 = dummy (manuf.)  MISM = vacancies/unemployed
D2 = dummy (serv.)  STDW = coeff. of var. wages
STDS = stdev ln(St)  CAP = gross fixed cap.form.(t-1)
PRSH = operating surplus (share on GDP)

The parameter estimates referred to the other variables included in the regressions are
generally consistent with a priori expectations: the coefficient for capital formation
(CAP) in the entry equation is positive, whereas exit rates appear to be positively affected
by interest rates (INTR) and negatively affected by returns on capital (RETCAP). The
coefficient for profit shares on GDP (PRSH) in the entry equation, however, is unexpec-
tedly positive17. This might be due to the fact that such a variable is likely to capture
not only the presence of entry barriers, but also time-lags between the opening of new
market opportunities and the actual startup of new firms.

The fact that market structure variables (STDS and STDW), enter with the same
direction entry and exit equations might be responsible for the co-movements observed
in empirical work between entry and exit rates. Moreover, sectoral dummies are highly
significant in both equations, which points further to the importance of market structure
effects in the dynamics of firms’ turnover.

Given inevitable measurement errors, these results should be viewed with some
cautions. Nevertheless, they seem to perform well in the light of several alternative
specifications. Interestingly enough, demand variables - such as GDP or the deviation
of GDP from the trend - appeared to have a low explanatory power. This seems to

17. It should be stressed that other studies [Dunne and Roberts, 1989] have observed a positive co-
efficient for measures of price-cost margins in entry equations, at least when entry is measured by the number
of new firms.
Table 5
Regression Analysis of Gross Exit
(Germany, 9 industries 1977-87)

<table>
<thead>
<tr>
<th>Var</th>
<th>Coef</th>
<th>Std. Error</th>
<th>t-Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNST</td>
<td>-2.537659</td>
<td>0.202137</td>
<td>-12.554153</td>
</tr>
<tr>
<td>D1</td>
<td>0.276858</td>
<td>0.089885</td>
<td>3.080124</td>
</tr>
<tr>
<td>D2</td>
<td>0.131586</td>
<td>0.039207</td>
<td>3.356198</td>
</tr>
<tr>
<td>STDS</td>
<td>-1.420492</td>
<td>0.211801</td>
<td>-6.706733</td>
</tr>
<tr>
<td>STDW</td>
<td>0.040638</td>
<td>0.007352</td>
<td>5.527362</td>
</tr>
<tr>
<td>GREN</td>
<td>0.044155</td>
<td>0.011711</td>
<td>3.770404</td>
</tr>
<tr>
<td>INTR</td>
<td>0.017551</td>
<td>0.007775</td>
<td>2.257254</td>
</tr>
<tr>
<td>RETCAP</td>
<td>-0.080560</td>
<td>0.024445</td>
<td>-3.295511</td>
</tr>
</tbody>
</table>

Observations: 90
R-squared : 0.980
Rbar-squared: 0.979
F-stat : 50.763

Notes:
D1 = dummy (manuf.)  STDW = coeff. of var. wages
D2 = dummy (serv.)   GREN = gross entry rate
STDS = stdev. ln(St) INTR = long term interest rates
RETCAP = op. surplus on capital stock

question the empirical relevance of alternative theories of entry, such as those based on
scale economies, technical change and shifts in the optimal size of firms, as well as on
adjustment costs\(^\text{18}\), all implying a close correspondence between entry rates and
movements in output.

Final Remarks

Regression results on the determinants of entry and exit of business units do not falsify
our hypothesis that reduced wage differentials in a sector negatively affect the pace of
entry of new establishments. As we have shown that entry plays a major role in the
growth of employment in the long-run, such result can be assessed in the light of the
current debate on the sources of the poor employment performance of Germany in the
1980s and on the factors that may contribute to improve its job generation potential in
the years to come. In particular, our results seems to indicate that rather than real wage
rigidity it is the reduction in intra-industry wage differentials associated to labour market
policies and collectivistic wage agreements in the 1980s that should bear the brunt of
blame.

18. For a discussion of the empirical implications of these models, see Gort and Klepper, 1982.
REFERENCES


