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Regulations in services sectors and their impact on downstream industries: The OECD 2013 Regimpact Indicator

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REGULATIONS IN SERVICES SECTORS AND THEIR IMPACT ON DOWNSTREAM INDUSTRIES: THE OECD 2013 REGIMPACT INDICATOR

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By Balázs Égert and Isabelle Wanner

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Abstract/ Résumé

Regulations in services sectors and their impact on downstream industries: the OECD 2013 REGIMPACT indicator

This document presents the new 2013 set of the OECD Regulatory Impact (REGIMPACT) indicator. It measures the impact of regulatory barriers to competition in non-manufacturing sectors on all industries, through intermediate inputs. The paper describes how the indicator is calculated and discusses a number of challenges and trade-offs when constructing the indicator. They relate to the composition of the indicator, how the slow-moving or time-invariant retail and professional services regulation data are integrated with the annual energy, transport and communication regulation (ETCR) indicator and what sector weights are used for the calculation of the REGIMPACT indicator. The document then compares the 2003, 2008 and 2013 vintages of the REGIMPACT indicator and the alternative (narrow and wide) definitions of the 2013 indicator. Finally, the paper uses sectoral data to illustrate the extent to which different vintages and alternative indicator definitions can possibly influence sector-level panel regression results for outcome variables such as productivity, investment and labour inputs.

JEL: L50; L91; L92; L93; L94; L95; L96; L98

Key words: indicators, regulation, competition, services

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Réglementation dans les secteurs des services et leur impact sur les industries en aval: la version 2013 de l'indicateur REGIMPACT de l'OCDE

Ce document présente une version révisée en 2013 de l'indicateur REGIMPACT de l'OCDE. Il mesure pour chaque industrie, l'impact des obstacles réglementaires à la concurrence, par le biais des intrants intermédiaires dans les secteurs non manufacturiers. Ce document décrit la méthodologie utilisée pour calculer cet indicateur et examine un certain nombre de défis et de compromis liés à sa construction. Ils se rapportent à la composition de l'indicateur, notamment l'intégration de séries avec peu de variation temporelle telles que l'indice de réglementation dans le commerce de détail ou les services professionnels avec les indicateurs annuels de réglementation dans les secteurs de l'énergie, du transport et des télécommunications (ETCR) ainsi qu'aux pondérations sectorielles utilisées pour le calcul de l'indicateur REGIMPACT. Le document compare ensuite les versions 2003, 2008 et 2013 de cet indicateur et les définitions alternatives (étroites et larges) de l'indicateur REGIMPACT. Enfin, le document utilise des données sectorielles pour illustrer dans quelle mesure les différentes versions et définitions peuvent éventuellement influencer les résultats de régression en données de panel au niveau sectoriel pour des variables telles que la productivité, l'investissement et l'emploi.

JEL : L50; L91; L92; L93; L94; L95; L96; L98

Mot clefs: indicateurs, règlementation, concurrence, services

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REGULATIONS IN SERVICES SECTORS AND THEIR IMPACT ON DOWNSTREAM INDUSTRIES: THE OECD 2013 REGIMPACT INDICATOR

Balázs Égert and Isabelle Wanner[1]

1. Introduction

1. This document presents the new 2013 set of Regulatory Impact (REGIMPACT) indicator, updating the last vintage published in 2008. The OECD compiles a number of indicators capturing the stance of anti-competitive regulation in the economy. The major indicator, the Product Market Regulation (PMR) indicator is by five year intervals and is available for the years 1998, 2003, 2008 and 2013. Another indicator, derived from PMR is the Energy, Transport and Communication Regulation (ETCR) indicator, which is also updated every 5 years but compiled at an annual frequency. The ETCR indicator covers seven network industries (electricity, gas, telecom, post and air, rail and road transports). The REGIMPACT indicator uses the ETCR indicator (and low-frequency indicators such as regulation in retail and professional services) to assess the indirect effect of regulation in other sectors of the economy.

2. The REGIMPACT indicator shows how important regulation in the sectors covered by ETCR and PMR is for other sectors in the economy. Sectors are affected differently by the same regulation because they use products of the regulated sectors (intermediate inputs) to a different extent. This makes the REGIMPACT indicator attractive for empirical analysis. Plugging in the ETCR indicators directly in sector-level panel regressions would impose the same impact of a given regulation on all sectors analysed. By contrast, the REGIMPACT indicator allows a differentiated impact depending on the extent to which the output of the regulated sectors is used as intermediate input in other sectors. As a matter of fact, it was widely used in academic and policy research papers analysing sector-level data.[2]

3. This document describes how the indicator is calculated and discusses a number of challenges and trade-offs when constructing the indicator. They relate to the composition of the indicator, how the slow-moving or time-invariant retail and professional services regulation data are integrated with the annual ETCR indicator and what sector weights are used for the calculation of the indicator. This document argues that different variants of the REGIMPACT indicator serve different purposes. The narrow definition based on the annual ETCR indicator is best suited for analysing sectoral data over longer time periods. The wider definition including retail trade and professional services is more appropriate for analysis aimed at exploiting cross-country and cross-sector variation in the data.

4. The document compares the 2003, 2008 and 2013 vintages of the REGIMPACT indicator and the alternative (narrow and wide) definitions of the 2013 indicator. The stylised facts presented in the paper suggest that the different vintages of the REGIMPACT indicator can exhibit different dynamics for the very same country. Simple bivariate sector-level panel regressions in which a number of outcome variables

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1. Both authors are members of the OECD's Economics Department. The paper benefited from useful comments and suggestions by Alain de Serres, Peter Gal, Jens Arnold, Oliver Röhn, and Caroline Abettan for technical and editorial assistance. OECD Working Papers should not be reported as representing the official views of the OECD or of its member countries. The opinions expressed and arguments employed are those of the authors.

2. Examples are Amable et al. (2007), Arnold et al. (2008), BenYahmed and Dougherty (2013), Bourlès et al. (2013), Braila et al. (2000). Cette et al. (2013, 2014), Copenhagen Economics (2013), European Commission (2007), IMF(2015) and McMorrow et al. (2009).

including productivity, capital/investment and labour inputs are regressed on the REGIMPACT indicators, show that the different vintages and definitions yield broadly similar results.

5. The structure of the document is the following. Section 2 describes the general principle of the indicator. Section 3 discusses challenges for the construction of the indicator. Section 4 presents some stylised facts of the old and new vintages. Finally, Section 5 reports and discusses the estimation results obtained for the different vintages and definitions of the REGIMPACT indicator.

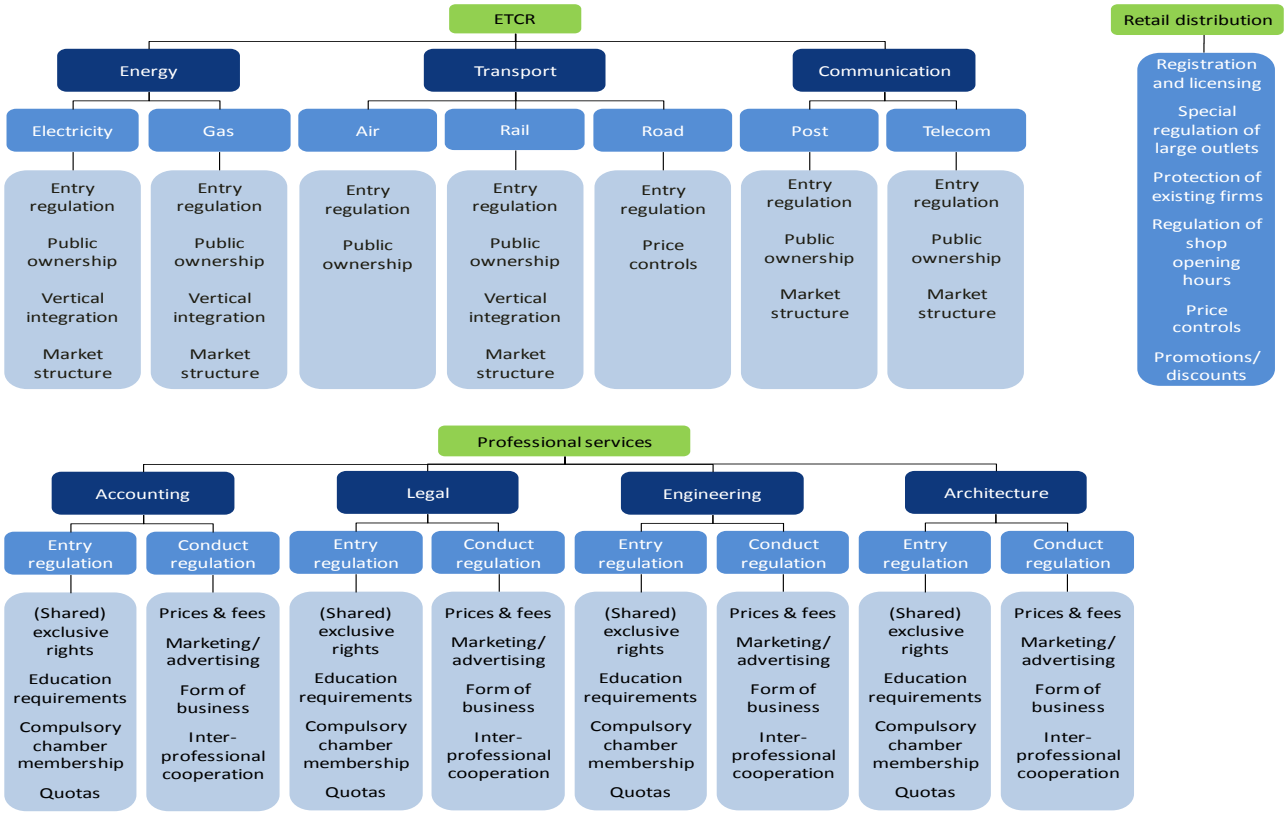
2. The REGIMPACT indicator

6. This section discusses the place of the REGIMPACT indicator in the universe of OECD indicators reflecting anti-competitive product market regulation. It describes how the indicator is calculated and singles out a number of challenges and trade-offs when constructing the indicator.

2.1 The Product Market Regulation indicator

7. The OECD compiles a number of indicators capturing the stance of anti-competitive regulation in the economy. The headline indicator, the Product Market Regulation (PMR) indicator is produced by five year intervals and is available for the years 1998, 2003, 2008 and 2013. The economy-wide PMR indicator covers i) state control, ii) barriers to entrepreneurship, and iii) barriers to trade and investment. The economy-wide PMR indicator is accompanied by a set of sectoral indicators in non-manufacturing industries capturing the stringency of regulation in seven network industries (electricity, gas, telecom, post, and air, rail and road transports), in professional services (legal, accounting, engineering and architecture services) and in retail trade (Koske et al., 2015). The indicator covering the seven network industries is called the Energy, Transport and Communication Regulation (ETCR) indicator. It is available at an annual frequency starting in 1975 for many OECD countries. Regulation indicators for professional services and retail trade are produced every five years (1998, 2003, 2008, 2013). Figure 1 below shows the structure of these indicators.

Figure 1. The structure of the ETCR, professional services and retail distribution indicators



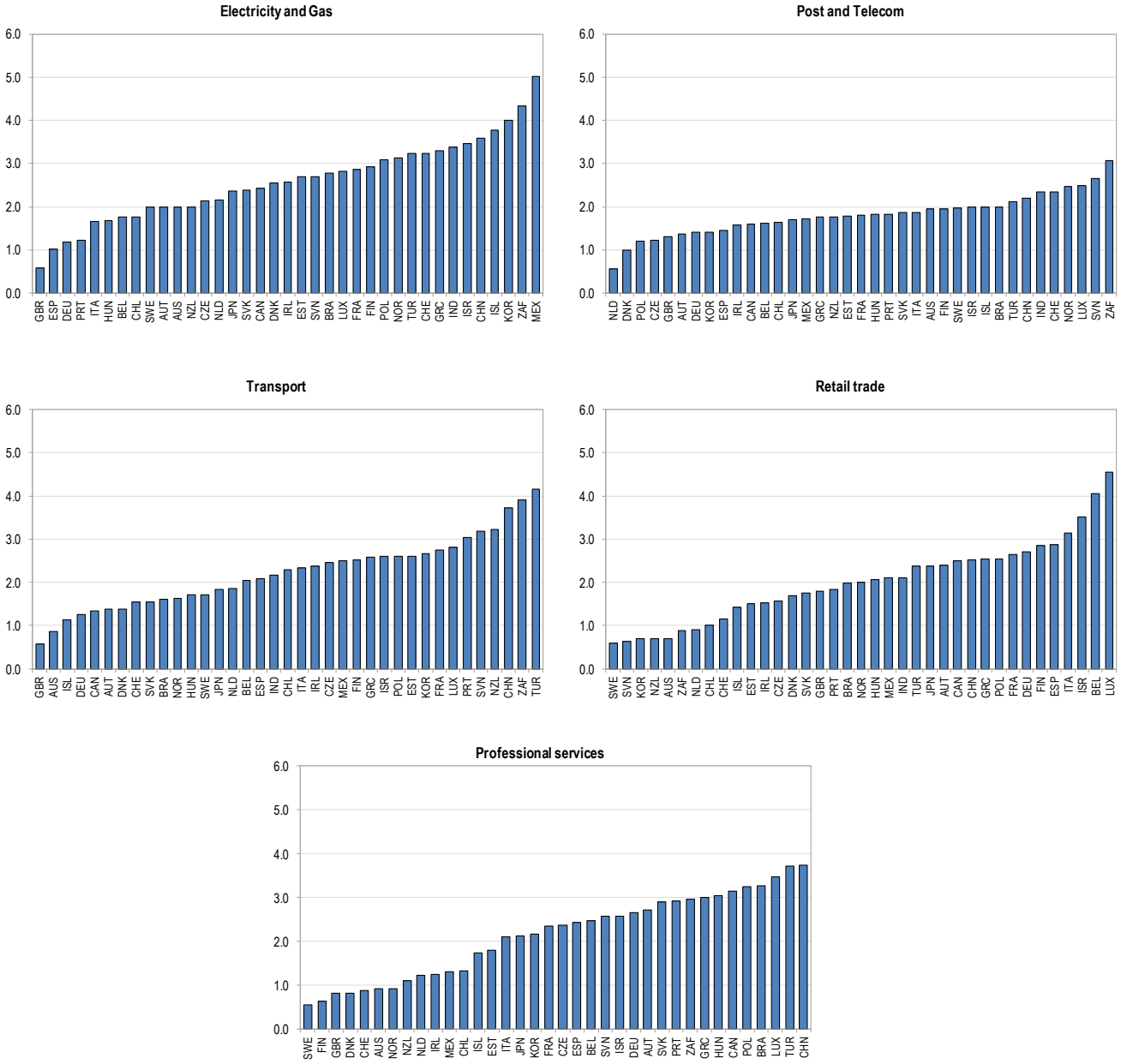
Source: http://www.oecd.org/eco/growth/indicatorsofproductmarketregulationhomepage.htm

2.2 Second-round effects of regulation

8. Product market regulation in any given sector can have second-round effects in other sectors as well. Anti-competitive regulation in non-manufacturing sectors will increase prices and/or lower quality in the regulated sectors. It will affect prices and/or quality in other sectors as well to the extent that the outputs of the regulated non-manufacturing sectors are used as intermediate inputs in other sectors. Higher input prices will raise the costs of entry for new firms and influence the costs structure of existing firms, the allocation of resources within and across firms and hence the productivity of firms (Conway and Nicoletti, 2006).

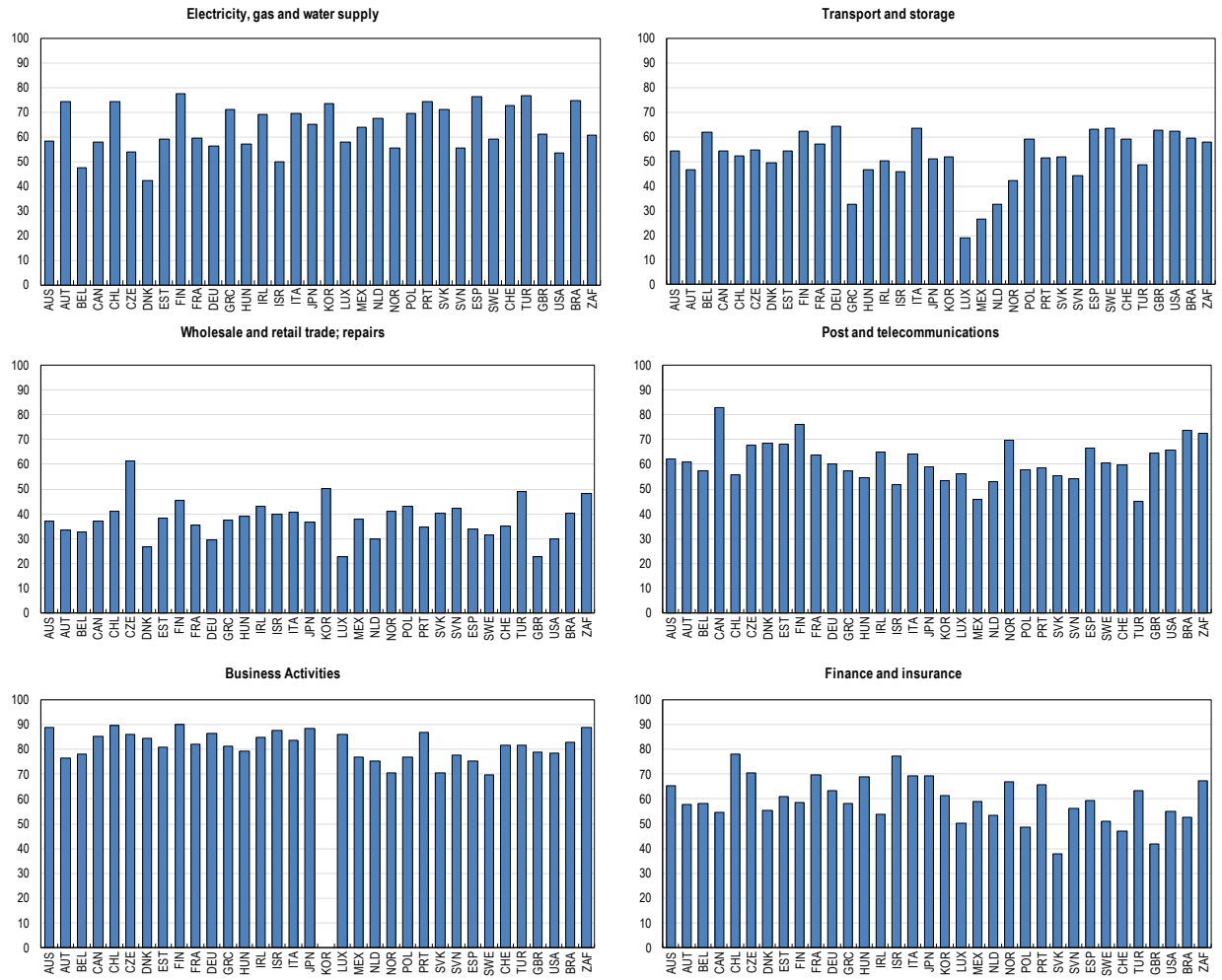
9. The overall impact of this so-called 'knock-on' effect depends on i.) the tightness of regulation in the non-manufacturing sectors, and ii.) the extent to which the output of these sectors are used as intermediate input in other sectors. Regulation in non-manufacturing sectors can diverge to a large extent across countries (Figure 2). It also shows that regulation can be constraining in countries. For instance, the regulation of the electricity and gas sector was very stringent in Korea and Mexico in 2013. The same applies to Turkey and New Zealand for the transport sector and to Luxembourg and Belgium for retail trade. Professional services are tightly regulated in Luxembourg and Turkey. While post and telecommunication is less regulated in most countries, regulation in this sector prohibits competition much more in Slovenia, Norway and Luxembourg than in the most deregulated countries including the Netherlands and Denmark. More generally, non-OECD emerging-market economies including China, India and South Africa have stringent regulations.

Figure 2. Regulation in non-manufacturing sectors, 2013



10. Intermediate output, derived from harmonised input-output tables in the mid-2000s, accounts for about 60% for most sectors (Figure 3). Two exceptions are retail trade and professional services. Only about 40% of gross output in retail trade is used as intermediate input in other sectors of the economy. By contrast, this share reaches 90% in professional services. The overall high share of intermediate outputs indicates the potential importance of 'knock-on' effects. This is shown in the next section.

Figure 3. Share of intermediate demand of non-manufacturing sectors in gross output, mid-2000s



2.3 The REGIMPACT indicator

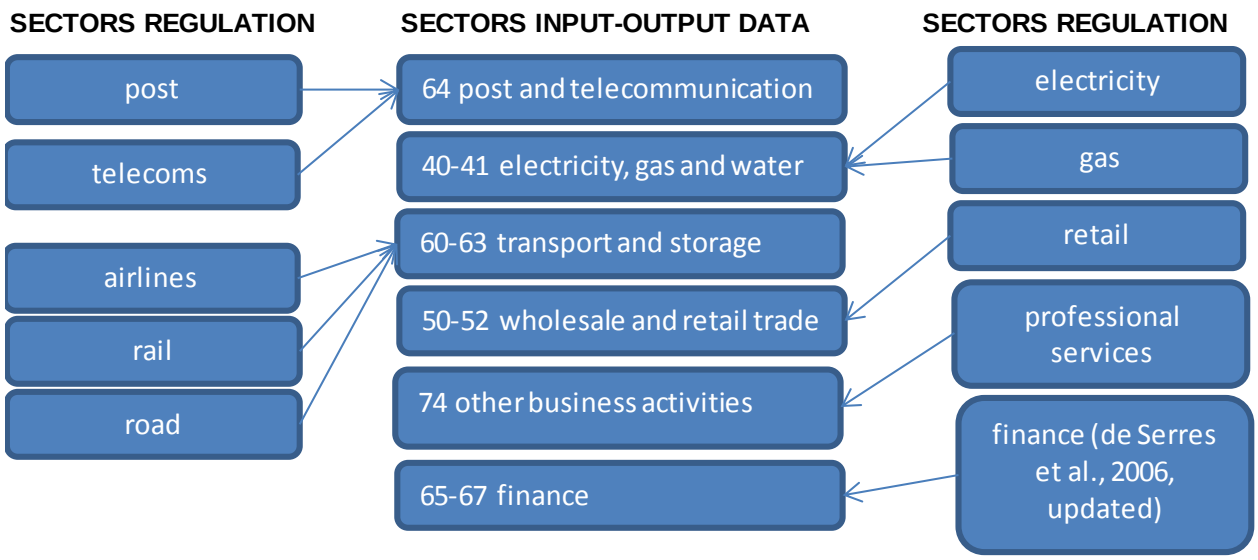
11. The REGIMPACT indicator is calculated using the degree of regulation in the non-manufacturing sectors (REGNMI) and the total input-output coefficients (w), denoting total intermediate inputs of sector k from the non-manufacturing sector j:[3]

$$REGIMPACT_{k,t} = \sum_{j=1}^{n} REGNMI_{j,t} * w_{j,k}$$

where k denotes sectors and j denotes non-manufacturing sectors. Input-output data for OECD countries exist at the 2-digit sectoral level. They therefore do not perfectly match the sectoral disaggregation of the regulation indicators. Figure 4 shows how the regulation indicators are mapped into the 2-digit sectoral disaggregation. The REGIMPACT indicator is calculated for 37 sectors (including non-manufacturing sectors) for OECD countries for the period starting in 1975.

3. See Conway and Nicoletti (2006) for a detailed discussion on how the weights are precisely calculated.

Figure 4. Sectoral correspondence between the regulation indicators and the input-output data



Note: a simple average of sectors regulation is used to match sectors input-output data

Source: based on Conway and Nicoletti (2006).

3. Challenges for the calculation of the REGIMPACT indicator

3.1 Past vintages of the REGIMPACT indicator

12. The first vintage of the REGIMPACT indicator covered the period of 1975 to 2003 and 21 OECD countries (Conway and Nicoletti, 2006). The second vintage of the indicator goes from 1975 to 2007 for 29 OECD countries.[4] This paper discusses the third vintage, which starts in 1975 and ends in 2013 and which extends the country coverage to 32 OECD and 2 non-OECD countries.[5] The data coverage can be extended because of the ever increasing country coverage of the ETCR indicator and because more recent input-output tables cover a higher number of countries (Table 1).

13. The first (2003) and second (2008) vintages of the REGIMPACT indicator are using i) constant input-output weights from the late 1990s and early 2000s respectively, and ii) are a combination of three regulation indicators: i.) the ETCR indicator, ii.) regulation in retail trade and professional services, and iii.) regulation in the banking sector. The ETCR indicator has annual observations, whereas the retail sector refers to only one year (2003 for the 2003 vintage and 2008 for the 2008 vintage)[6] and for 2003 for banking. Some of these choices warrant discussion.

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4. The 21 countries covered by the 2003 vintage are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and the United States. The 2008 vintage covers 8 more countries: the Czech Republic, Hungary, Korea, Luxembourg, Mexico, Poland, Slovak Republic and Turkey.

5. For the United States, the 2013 PMR/ETCR indicators were not available for this update. Input-output data are not available for Iceland. The non-OECD countries are Brazil and South Africa.

6. The indicator for retail trade and professional services is assumed to be constant. The value of 1998 (or the first available year) is used for the 2003 and 2008 vintages.

Table 1. Comparing different vintages of the REGIMPACT indicator

	Coverage	Definition
2003 vintage	21 countries, 1975-2003	Wide definition including - ETCR, annual observations
2008 vintage	29 countries, 1975-2007	- retail and professional services and banking regulation in 2003
2013 vintage	34 countries (32 OECD + Brazil and South Africa) 1975-2013	Narrow definition, including ETCR only Wide definition, exploiting information from 1998, 2003, 2008 and 2013 for retail and professional services, excluding banking regulation

3.2. Input-output weights

- Constant input-output weights are used for the construction of the indicator. For the 2003 vintage, only one set of weights was available. Currently, three sets are available (late 1990s, early 2000s and mid-2000s). Combining the three sets would imply that input-output weights would need to be set constant prior to the late 1990s: they would not move for the first half of the sample period but would then start moving in the second half of it. Furthermore, the precise year to which weights could be assigned, are not known (only that they are from the late 1990s for instance). It is therefore reasonable to stick to constant weights for the whole period of 1975 to 2013. The advantage of such a choice is that changes in the indicator will reflect only changes in policies but not in the input-output weights.

- For each country, country-specific weights are used. This is a fair choice for narrative policy analysis. However, in empirical estimations, country-specific weights may give rise to endogeneity: higher weights may be due to more competition-friendly regulation. For this specific reason, a version of the REGIMPACT indicator will be also published for which exogenous weights are used. Following the Rajan and Zingales (1998) identification strategy, weights obtained for the USA will be used for the other countries. Using US weights allow a better comparison of the level of the indicator across countries. Nevertheless, the weights do not change over time. As a result, they do not affect the dynamics of the indicators. It should be also noted that the weighting scheme would not matter if the empirical analysis relied on panel regressions including country fixed effects as these take out the cross country variation in the data, including the level differences due to the different weights (which are constant over time).

- The REGIMPACT indicator is normalised for all sectors and countries.[7] This implies that the REGIMPACT indicators can be fully compared across countries but the different vintages using different weights cannot be compared.

7. (X'-Xmin)/(Xmax-Xmin) with X = different measures of REGIMPACT, normalisation across all sectors and all countries.

3.3. The composition of the REGIMPACT indicator

14. The 2003 and 2008 vintages used a broad definition of the REGIMPACT indicator. The indicator was calculated using the annual ETCR indicator and the first observation (1998 or 2003) for retail and professional services and the 2003 observation for the banking sector. The 2003 and 2008 vintages of the REGIMPACT indicator included regulation in 10 sectors:

- The seven network industries (ETCR indicator)
- Professional services (legal, accounting, engineering and architecture services)
- Retail trade
- Banking

15. The broad definition has some important shortcomings. It combines data of different frequency. The ETCR indicator is available at an annual frequency. Regulation for professional services and retail trade and regulation in the banking sector refer to a single year. Hence, combining these indicators imply combining series exhibiting different variation over time. The evolution of the overall indicator will be largely dominated by the ETCR indicator. Regulations in the other sectors will influence the level of the sector-specific REGIMPACT indicators.

16. For the 2013 vintage, for retail trade and professional services, we have observations for 1998, 2003, 2008 and 2013. For banking regulation, we have data for 2003 and an update for around 2010.

17. For the new 2013 vintage, two versions of the REGIMPACT indicator are considered.

- ***A narrow indicator, covering only the network sectors trough the annual ETCR indicator.*** In addition to banking regulation, this indicator excludes retail trade and professional services. This indicator excludes the low-frequency observations from retail trade and professional services (and also banking regulation). The narrow indicator is well suited for empirical analysis if one would like to also analyse time variation of the data.

- ***A broad-based indicator***, following the approach used for the 2003 and 2008 vintages.

  <u>It includes the ETCR indicator and regulation on retail trade and professional services</u>. However, instead of using only observations for a specific year for retail and professional services, all available data points are made use of: 1998, 2003, 2008 and 2013. The data points are not connected via linear interpolation but are rather held unchanged until the next observation. Neither solution is satisfying. Imposing a stepwise change implies that change occurs only for the new observation. This may miss changes in regulation in between. Interpolation is, in our view, even worse. Obviously, as also shown by the annual ETCR indicator, policy changes do not happen continuously but rather in a staggered manner. Data on regulation in retail, professional and banking services start around 2000. They are assumed to be unchanged between 1975 and the late 1990s. This is a rather strong assumption. Therefore, using the wider definition is less recommended for looking at changes over time but more to exploit the cross-country and cross-sector variation in the data.

  <u>It excludes banking regulation</u>. Banking sector regulation is not used for the calculation of the REGIMPACT indicator for two reasons. First, its use would mean a mixing of three different frequencies. We currently have the 2003 observations and an update from around 2010 of

banking sector regulation. This differs from the annual frequency of the ETCR indicator and the four observations available for retail trade and professional services. Second, there exists a trade-off between competition and financial stability in the banking sector. More competition may result in higher risk taking, which could lead to financial crises (OECD, 2010 and Vives, 2010). It is therefore not obvious whether banking sector regulation should be included in the REGIMPACT indicator.

3.4. The four variants of the 2013 REGIMPACT indicator

18. The combination of the two different definitions (narrow vs. wide) and the two weighting schemes yield a total number of four alternative REGIMPACT indicators. These definitions are included into the database and are summarised in Table 2 below.

Table 2. The four measures of the REGIMPACT indicator of the 2013 vintage

Country-specific weights for intermediate outputs	US weights for intermediate outputs
1. Narrow definition, country weights ETCR only	3. Narrow definition, US weights ETCR only
2. Wide definition, country weights ETCR Retail and profession services for ’98, ’03, ’08, ’13 with stepwise changes	4. Wide definition, US weights ETCR Retail and profession services for ’98, ’03, ’08, ’13 with stepwise changes

4. Some stylised facts: comparing the levels of and changes in the different REGIMPACT indicators

19. This section compares different vintages of the REGIMPACT indicator (2003, 2008 and 2013) and the different definitions of the indicator (broad-based indicator and the narrow indicator including only the ETCR indicator) for three aggregated sectors: i) manufacturing; ii) market services and, iii) public services. The seven network industries and retail trade (proxying professional services) are not included in these three main categories. The main aggregates are calculated as the simple average of the sectors included. Table A1 in the appendix provides the list of three-digit sectors, which are included in the three aggregated sectors.

20. Figures 5 to 7 show a comparison of two sets of REGIMPACT indicators: they compare the narrow definition of the indicator (including ETCR only) using the 2008 and 2013 definitions for the three aggregate sectors, respectively.

21. The 2013 vintage of the narrow REGIMPACT (including ETCR only) indicator exhibits some difference compared with the 2008 vintage. For manufacturing and market services, the new REGIMPACT indicator tends to be slightly higher for 2007[8]. This holds true for public services.[9] Importantly, the

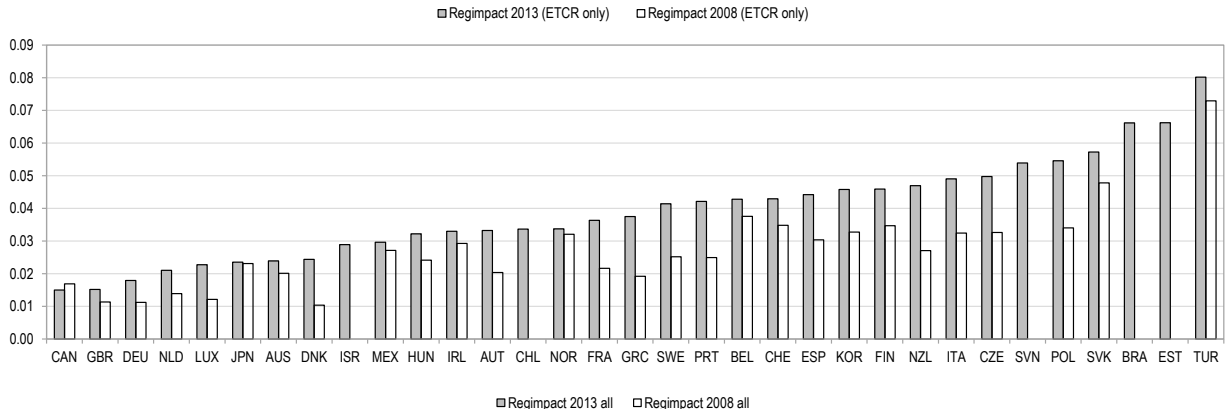
8. This is the latest year for which the original 2008 vintage of the REGIMPACT indicator is available.

ordering of the countries can change to a large extent especially in the middle of the distribution. These differences may be due to two main factors. First, methodological changes took place in the calculation of the ETCR indicator. The major methodological changes include different coding of answers, the addition of extra segments and the removal or addition of specific questions (see Table A2 in the Appendix for these methodological changes). Also, data revisions occurred to the ETCR indicator. Second, different weights are used for the calculation of the REGIMPACT indicator: weights are from the early 2000s for the 2008 vintage and from the mid-2000s for the 2013 vintage.[10]

22. Looking at the levels of the indicator suggests that the 'knock-on' effects differ across the three main aggregate sectors. It is the highest for market services, followed by the impact on manufacturing. The incidence of anti-competitive regulation in the network industries is the smallest in public services. The cross-country variation is considerable: the incidence of regulation is about 8 times higher in the worst performing country (Turkey) compared to the best performing country (United Kingdom) in manufacturing. The difference is about a factor of four in market services (accidentally for the very same two countries).

Figure 5. The narrow REGIMPACT indicator, manufacturing

2008 and 2013 definitions, 2007



9. Manufacturing is defined as food products, beverages and tobacco; textiles, textile products, leather and footwear; wood and products of wood and cork; pulp, paper, paper products, printing and publishing; chemical, rubber, plastics & fuel products; other non-metallic mineral products; basic metals and fabricated metal products; machinery and equipment n.e.c; electrical and optical equipment; transport equipment; and manufacturing n.e.c; recycling. Market services include construction, hotels and restaurants, finance and insurance, real estate activities and renting of M&EQ and other business activities. Public services comprise public administration and defence, compulsory social security, education, health and social work, and other community, social and personal services (Table A1 in the appendix). Obviously, this classification may not fully fit all countries as education and health services are provided by private companies in some countries.

10. Differences may be also driven by another factor: the 2013 ETCR indicator was rebased from 2007 to 2008. This means that the value of the ETCR in the 2008 vintage in 2007 corresponds to the value of the ETCR in the 2013 vintage in 2008.

Figure 6. The narrow REGIMPACT indicator, market services

2008 and 2013 definitions, 2007

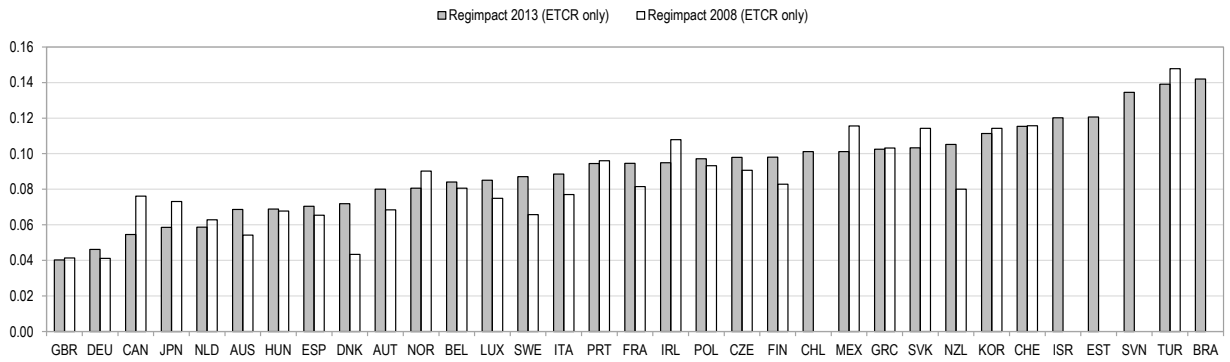
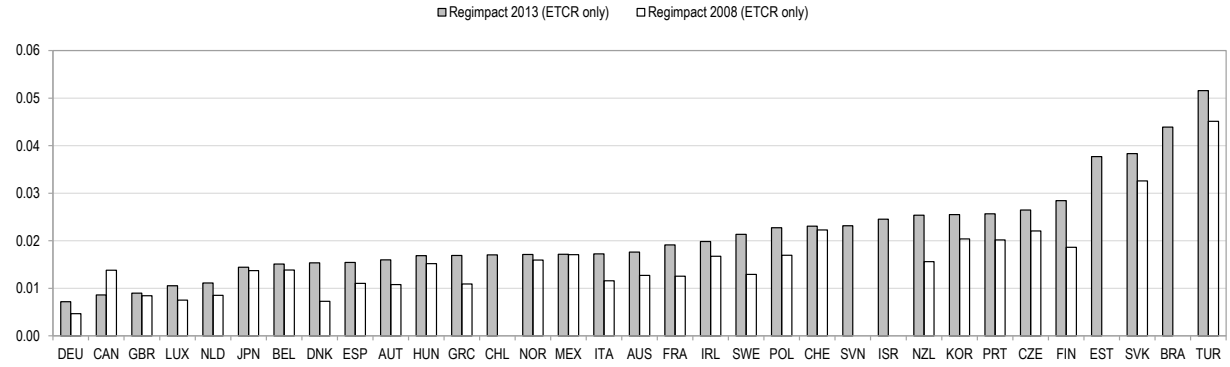


Figure 7. The narrow REGIMPACT indicator, public services

2008 and 2013 definitions, 2007



23. Figures 8 to 10 compare the two versions of the REGIMPACT indicators in 2013 using country specific weights: the broad based indicator and the narrow one (Figure 8 for manufacturing, Figure 9 for market services and Figure 10 for public services). Two major observations can be made.

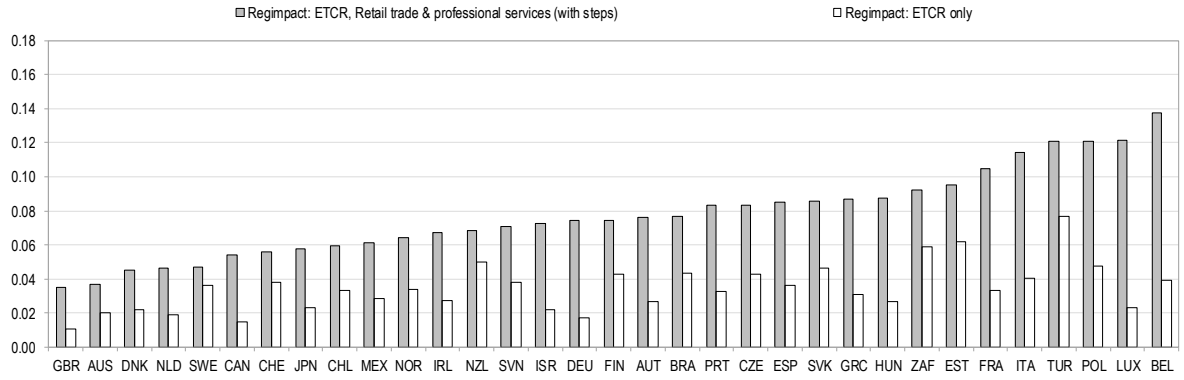
- First, the broad-based REGIMPACT indicator is usually much higher than the indicator using the ETCR indicator only. This shows the importance of retail trade and professional services as intermediate inputs in other sectors. The absolute and relative differences are the highest for market services. This is because the broad indicator is the highest in this aggregate sector. On average, it is second highest in manufacturing. The lowest impact can be observed for public services. The same ranking holds for the narrower definitions of the REGIMPACT indicator.

- Second, using input-output data of the United States to calculate the REGIMPACT indicator of the countries in our sample leaves the observed ranges broadly unchanged for market services. By contrast, it reduces the observed ranges for manufacturing and public services. The relative ordering of the countries remain broadly unchanged but it can change in some cases. For instance, Mexico is well positioned when the REGIMPACT indicator is calculated using country specific weights but it falls to the bottom of the distribution when US weights are employed. The opposite happens to Estonia for manufacturing and public services.

Figure 8. The comparison of the two REGIMPACT indicators, manufacturing

Country-specific and US weights, 2013 definitions, 2013

Panel A: Country specific weights



Panel B: US weights

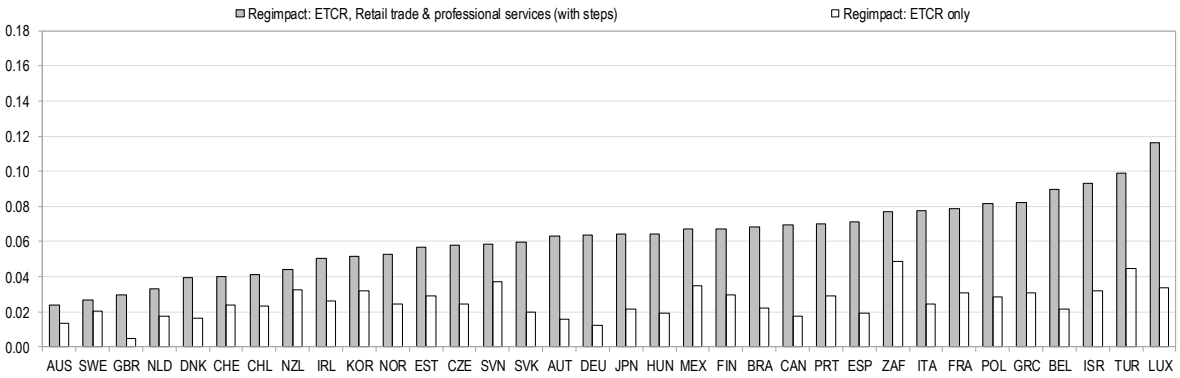
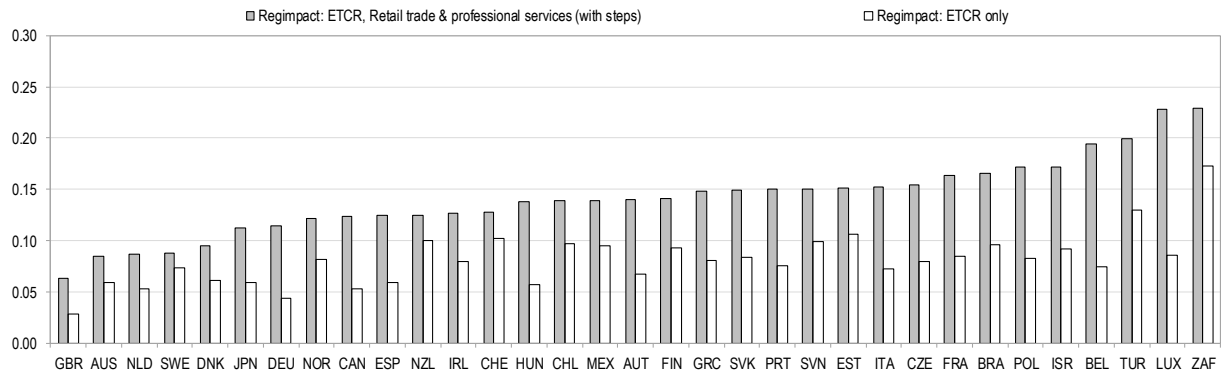


Figure 9. The comparison of the two REGIMPACT indicators, market services

Country-specific and US weights, 2013 definitions, 2013

Panel A: Country specific weights



Panel B: US weights

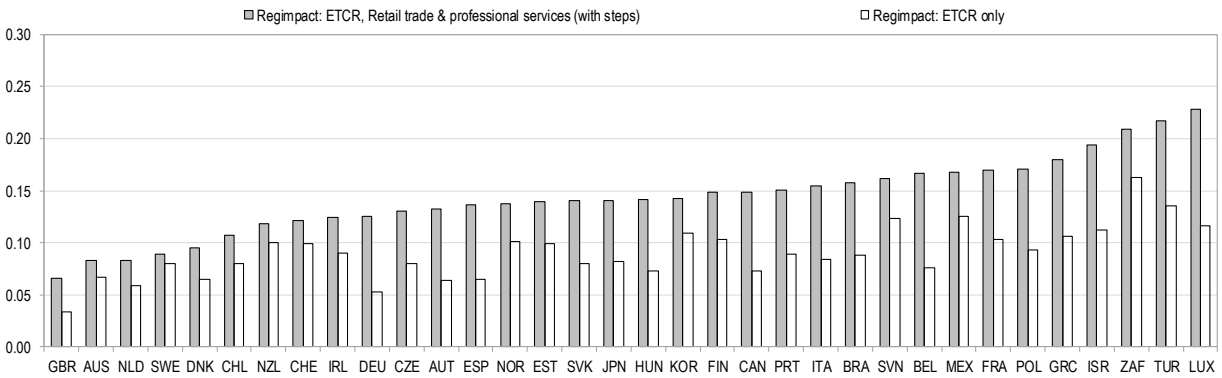
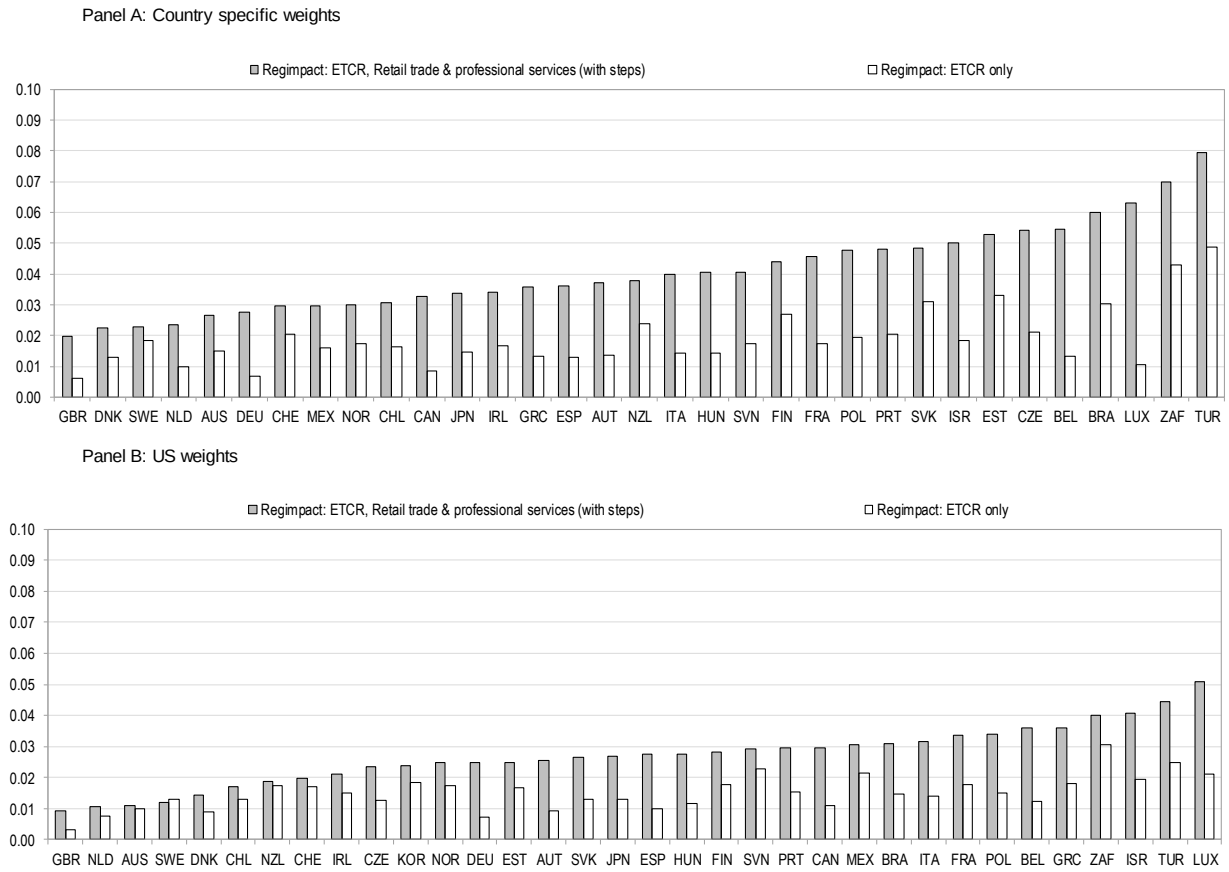


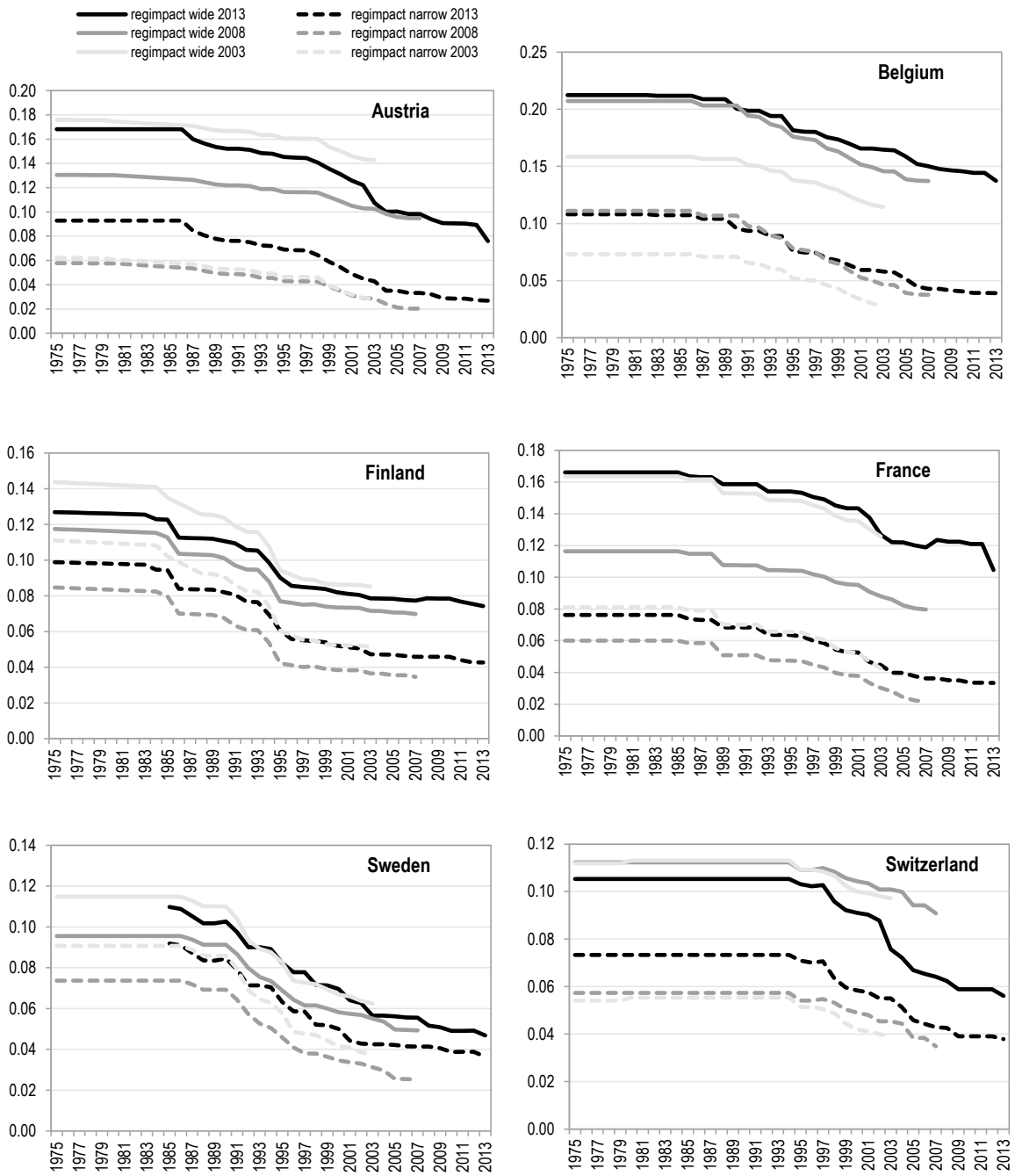
Figure 10. The comparison of the two REGIMPACT indicators, public services

Country-specific and US weights, 2013 definitions, 2013



24. The various REGIMPACT indicators decrease markedly over time (Figure 11). The steady decline starts in the early/mid-1980 for some countries (e.g. Austria or Finland) and only in the mid-1990s for others (e.g. Sweden). Another general observation is that the different vintages can exhibit different dynamics. For instance, the 2003 and 2008 vintages are very similar in Austria and Switzerland but marked differences can be observed compared to the 2013 vintage. For Belgium, the dynamics of all three vintages are visually different for the second part of the sample period. Finally, the narrow indicators (including only ETCR) from the different vintages have a similar dynamic profile. The broad indicator (excluding banking for 2003 and 2008) tend to have visually different slopes.

Figure 11. Changes in the REGIMPACT indicator in manufacturing, 1975-2013, selected OECD countries



Note: **regimpact_wide_2013** = retail trade and professional services with steps, no banking indicator, 2013 ETCR and country weights (definition No. 4 in Table 2), **regimpact_narrow_2013 =** 2013 ETCR only, country weights (definition No. 3 in Table 2), **regimpact_wide_2008** = constant (first available year) retail trade and professional services, banking regulation in 2003, 2008 ETCR and country weights (definition No. 2 in Table 2); **regimpact_narrow_2008** = 2008 ETCR only and country weights; **regimpact_wide_2003** = constant (first available year) retail trade and professional services, 2003 ETCR and country weights; **regimpact_narrow_2003** = 2003 ETCR only and country weights

5. Do different versions and vintages matter for empirical analysis?

25. This section illustrates how the use of different vintages can possibly influence estimation results. It reports the results of panel OLS regression analysis in which various outcome variables such as productivity, capital and labour input at the sectoral level are regressed on the REGIMPACT indicator using various fixed effects. These regressions can be interpreted as a difference-in-difference estimator: it shows how downstream services are affected by regulation in upstream services depending on their use of upstream services as intermediate inputs. The results of this exercise, based on simple bivariate specifications, should not be compared to earlier, more complete empirical analyses of the impact of product market regulation on economic performance at the economy-wide or sector level.

26. This exercise has indeed two main objectives:

1. **Comparing the different vintages of the REGIMPACT indicator**: The three vintages (2003, 2008 and 2013 REGIMPACT indicators) are used to analyse the extent to which the estimation results differ for the different vintages of the REGIMPACT indicator. For each vintage, the narrow definition relying on the ETCR indicator only is used. Differences across vintages can arise due to the revision of the underlying regulatory data and due to differences in the weights obtained from the input-output tables.

2. **Comparing alternative definitions of the 2013 vintage**: Another objective is to test for the sensitivity of the regression results to four alternative definitions of the 2013 vintage. The four indicators are the narrow and the broad definitions, using country-specific and US weights, respectively (Table 2).

27. The dependent variables cover two measures of multi-factor productivity (MFP), two measures of labour productivity, two measures of capital stock, one measure of investment and five measures of employment. Multi-factor productivity is calculated as the natural log of value added minus the log of the net capital stock and the log of labour input. MFP1 uses total employment as labour input. MFP2 uses total hours worked. Labour shares are obtained as the sum of the wage bill over the sum of the value added of specific sectors.[11] The first measure of MFP uses the total number of employed persons as labour input. The second measure uses total hours worked. The two labour productivity measures use total number of employment and total hours worked. The two measures of capital stock are gross and net capital stock. The five measures of employment include the number of employment, the number of employees and the number of self-employed, total hours worked and total hours worked of employees (Table 3). The data on the dependent variables are drawn from the OECD's STAN database.

28. The baseline regressions are estimated for a common sample for all three vintage: 1975 to 2003 and the longest possible sample for all three vintages: 1975 to 2013, using country-year and sector fixed effects and standard errors clustered by sectors. The dependent variables are always log-transformed because of scaling issues. The REGIMPACT indicator could be used either in levels or in log-levels. In the estimations, they are used in both forms. A number of sensitivity checks are performed. First, two other sets of fixed effects are used: country and sector fixed effects only, and country, sector and year fixed effects. The third set includes country-year and sector fixed effects. In addition to clustered standard errors, heteroscedasticity robust standard errors are also employed (Table 3).

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11. This is tantamount to a weighted average. An alternative solution would be to calculate the simple average of sector-specific labour shares across countries.

Table 3. Summary of the specifics of the regression analysis

Dependent variables		Other features	
Productivity		Time periods	1975-2003
Multi-factor productivity 1 (MFP1)	Using total employment		1975-2008
Multi-factor productivity 2 (MFP2)	Using hours worked		1975-2013
Labour productivity 1 (LPROD1)	Value added/total employment	Fixed effects	country and sector
Labour productivity 2 (LPROD2)	Value added/hours worked		country, sector year
Capital deepening			country-year, sector
Net capital stock (CPNK)		Standard errors	robust s.e.
Gross capital stock (CPGK)			clustered (sectors)
Investment (GFCK)		Log vs. non-log	regimpact in levels
Employment			regimpact in logs
Total employment (EMPN)			
Employees (EMPE)			
Self-employed (SELF)			
Hours worked, employment (HRSN)			
Hours worked, employees (HRSE)			

5.1. Comparing the 2003, 2008 and 2013 vintages of the REGIMPACT indicator

29. The main message emerging from the estimation results based on the baseline specifications is that the three different vintages produce broadly comparable results (Table 4). This is reassuring for the continuity of the series: empirical work using the different vintages would probably not produce diametrically opposite results. For half of the dependent variables, the estimation results are absolutely robust. For the two measures of **labour productivity**, the coefficient estimates of the different vintages of the REGIMPACT indicator are in the same ballpark: they are always statistically significant, have a negative sign and the size of the coefficient is comparable. Regressing the number of **total employment**, **total hours worked**, **gross and net capital stock** and investment on the REGIMPACT indicators always yields statistically non-significant estimates. The bivariate regressions including the **number of employees** (EMPE) as a dependent variable produces mostly significant positive coefficient estimates.

30. Only smaller inconsistencies across vintages arise for the other outcome variables. First, for the two measures of **multi-factor productivity**, the more recent vintages (2008 and 2013) of the REGIMPACT indicators tend to produce less significant estimates, especially for the common period of 1975 to 2003. Second, for **hours worked by employees,** the significance of the coefficient estimates tends to be higher for the later vintages, especially for the common period of 1975 to 2003.

Table 4. Estimation results – comparing the 2003, 2008 and 2013 vintages

REGRESSOR: REGULATORY IMPACT INDICATOR	NARROW_03	NARROW_08	NARROW_13
	1975-2013 for the 2013 vintage 1975-2008 for the 2008 vintage 1975-2003 for the 2003 vintage		
DEPENDENT VARIABLES			
Net capital stock	-0.339	-0.430	-0.206
Gross capital stock	0.029	-0.252	-0.038
Investment	0.315	0.293	0.371
Multi-factor productivity 1	-0.812***	-1.024***	-0.481
Multi-factor productivity 2	-0.841**	-1.315***	-0.708*
Labour productivity 1	-1.395***	-1.581***	-0.954***
Labour productivity 2	-1.588***	-1.866***	-1.341***
Total employment	0.159	0.248	0.254
Employess	0.469**	0.681***	0.569***
Self-employed	-0.927*	-0.741	-0.602
Hours worked (employees)	0.185	0.564*	0.483**
Hours worked (employment)	0.019	0.392	0.354
	1975-2003 for the 2013 and 2008 vintages		
Net capital stock	-0.339	-0.630	-0.395
Gross capital stock	0.029	-0.542	-0.297
Investment	0.315	-0.048	0.051
Multi-factor productivity 1	-0.812***	-0.905**	-0.194
Multi-factor productivity 2	-0.841**	-1.164**	-0.268
Labour productivity 1	-1.395***	-1.735***	-0.954***
Labour productivity 2	-1.588***	-2.016***	-1.372***
Total employment	0.159	0.250	0.232
Employess	0.469**	0.772***	0.607***
Self-employed	-0.927*	-0.824	-0.887
Hours worked (employees)	0.185	0.618	0.579*
Hours worked (employment)	0.019	0.363	0.316

Note: The regressions include country*year and sector fixed effects. Standard errors are clustered for sector. *,** and *** refer to statistical significance at the 10%, 5% and 1% level, respectively. Labour productivity 1 and 2 are calculated using the total number of employment and total hours worked, respectively. The same difference applies to MFP 1 and MFP 2.

5.2. Comparing variants of the REGIMPACT indicator from the 2013 vintage

31. Turning now to a systematic comparison of the four variants of the 2013 REGIMPACT vintage, a similar conclusion can be drawn than for the cross-vintage comparison: the coefficient estimates on the alternative REGIMPACT indicators is comparable for all outcome variables, both in terms of the level of significance, the sign and the magnitude of the estimates (Table 5). One qualification is, however, of order.

Table 5. Estimation results 2013

	COUNTRY WEIGHTS		US WEIGHTS	
	NARROW	WIDE	NARROW	WIDE
REGRESSOR: REGULATORY IMPACT INDICATOR				
DEPENDENT VARIABLES				
Net capital stock	-0.206	-0.191	0.002	0.201
Gross capital stock	-0.038	-0.010	0.061	0.229
Investment	0.371	-0.042	0.434**	0.202
Multi-factor productivity 1	-0.481	-0.599**	-0.774***	-0.739***
Multi-factor productivity 2	-0.708*	-0.961***	-0.821***	-0.900***
Labour productivity 1	-0.954***	-1.019***	-0.814***	-0.557***
Labour productivity 2	-1.341***	-1.516***	-0.905***	-0.803***
Total employment	0.254	0.227	0.091	0.060
Employess	0.569***	0.292	0.284**	0.140
Self-employed	-0.602	-0.420	-1.010**	-0.726**
Hours worked (employees)	0.483**	0.394	0.121	0.119
Hours worked (employment)	0.354	0.459*	0.140	0.191
REGRESSOR: LOG(REGULATORY IMPACT INDICATOR)				
DEPENDENT VARIABLES				
Net capital stock	-0.354*	-0.342*	0.253	0.127
Gross capital stock	-0.057	-0.116	0.293	0.174
Investment	-0.327*	-0.372**	-0.301	-0.205
Multi-factor productivity 1	-0.054	-0.149*	-0.254	-0.262***
Multi-factor productivity 2	-0.079	-0.197**	-0.184	-0.360***
Labour productivity 1	-0.278***	-0.437***	-0.126	-0.026
Labour productivity 2	-0.354***	-0.492***	-0.027	-0.038
Total employment	-0.053	-0.015	0.091	-0.094
Employess	0.041	0.041	0.129	-0.093
Self-employed	-0.240**	-0.189	-0.367	-0.484***
Hours worked (employees)	0.052	0.111	-0.384**	-0.036
Hours worked (employment)	-0.068	0.018	-0.266*	-0.051

Note: as for Table 4.

Coefficient estimates using the narrow REGIMPACT indicator (ETCR only), mostly based on US sectoral weights differ sometimes from the other estimates. Hereafter are the details of these differences:

- **Multi-factor productivity** (MFP1 and MFP2): the narrow regimpact indicator produces statistically non-significant coefficient estimates
- **Labour productivity** (LPROD1 and LPROD2): the coefficients on the log-level US-weighted regimpact indicators are statistically not significant
- **Labour market indicators** (EMPN, EMPE, SELF, HRSN, HRSE): occasionally, the narrow and US-weighted regimpact indicator is statistically significant, whereas the other indicators are not.

5.3. Economic interpretation of the estimation results

32. Beyond the consistency across different vintages, it is also worthwhile analysing the coefficient estimates in economic terms. The coefficient on the REGIMPACT indicators is strongly negative for the two labour productivity measures. This implies that a rise in the second-round effect of regulation, through intermediate inputs used in other sectors, tends to lower labour productivity on average across sectors. The impact of higher regulation is also found to hamper multifactor productivity. The effect on the capital stock and investment is less straightforward: statistically significant effects can be identified only for some of the REGIMPACT indicators in the baseline specifications. For labour inputs, both in terms of headcount and hours worked, the estimates are, for most of the time, positive but largely non-significant at conventional statistical levels. The only exception is the number of self-employed, which turns out to be negatively affected by more regulation in a few specifications.

5.4. Robustness of the estimation results to alternative model specification

Looking at alternative specifications renders this picture a little more subtle, especially for productivity and the capital stock/investment. The type of fixed effects included in the estimations, the way standard errors are calculated and whether or not the REGIMPACT indicator is taken in logs or in absolute levels can make a significant difference. Table 6 demonstrate these issues on the basis of the 2003 and 2013 vintages of the narrow (only ETCR-based) REGIMPACT indicator.

- **Fixed effects**: for gross capital stock and investment, the strong negative effect, obtained using country and sector fixed effects is wiped out by the introduction of country/sector/year or country-year/sector fixed effects.

- **Standard errors**: using standard errors clustered in sectors reduces statistical significance to a large extent. For instance, the negative coefficient on net capital stock statistically significant at the 1% level becomes either less significant (10%) or statistically non-significant. The same happens to the two measures of MFP and the number of self-employed.

- **Logs vs. non-logs of the REGIMPACT variable**: the coefficient estimates on the 2013 REGIMPACT indicators become more significant for net capital stock, investment and the number of self-employed, if the REGIMPACT indicator is taken in logs and not in straight levels. For the 2003 vintage, the opposite effect can be observed for the self-employed and the MFP measures.

Table 6. Sensitivity checks, 1975-2003

FIXED EFFECTS												
country/sector	YES	YES					YES	YES				
country/sector/year			YES	YES					YES	YES		
country-year/sector					YES	YES					YES	YES
STANDARD ERRORS	robust	clustered	robust	clustered	robust	clustered	robust	clustered	robust	clustered	robust	clustered
REGRESSOR			**NARROW_03**						**LOG_NARROW_03**			
DEPENDENT VARIABLE												
Net capital stock	-1.445***	-1.445***	-0.254***	-0.254	-0.376***	-0.376	-0.401***	-0.401***	-0.262***	-0.262	-0.377***	-0.377*
Gross capital stock	-1.444***	-1.444***	0.059	0.059	-0.025	-0.025	-0.274***	-0.274***	0.138***	0.138	0.138***	0.138
Investment	-1.248***	-1.248***	0.292**	0.292	0.245**	0.245	-0.540***	-0.540***	-0.218***	-0.218	-0.267***	-0.267
Multi-factor productivity 1	-1.165***	-1.165***	-0.768***	-0.768***	-0.800***	-0.800***	-0.163***	-0.163***	-0.069***	-0.069	-0.090***	-0.090
Multi-factor productivity 2	-1.348***	-1.348***	-0.802***	-0.802**	-0.798***	-0.798**	-0.217***	-0.217***	-0.098***	-0.098	-0.119***	-0.119
Labour productivity 1	-2.284***	-2.284***	-1.417***	-1.417***	-1.418***	-1.418***	-0.483***	-0.483***	-0.369***	-0.369***	-0.425***	-0.425***
Labour productivity 2	-2.621***	-2.621***	-1.591***	-1.591***	-1.619***	-1.619***	-0.542***	-0.542***	-0.407***	-0.407***	-0.463***	-0.463***
Total employment	0.139***	0.139	0.136***	0.136	0.149***	0.149	-0.027**	-0.027	-0.054***	-0.054	-0.031	-0.031
Employess	0.337***	0.337**	0.477***	0.477**	0.469***	0.469**	0.004	0.004	0.042*	0.042	0.041	0.041
Self-employed	-1.096***	-1.096**	-0.925***	-0.925*	-0.959***	-0.959*	-0.067***	-0.067	-0.004	-0.004	-0.026	-0.026
Hours worked (employees)	0.272***	0.272	0.180**	0.180	0.168*	0.168	0.102***	0.102**	0.110***	0.110	0.134***	0.134
Hours worked (employment)	-0.004	-0.004	-0.046	-0.046	-0.024	-0.024	-0.034*	-0.034	-0.096***	-0.096	-0.078**	-0.078
REGRESSOR			**NARROW_13**						**LOG_NARROW_13**			
DEPENDENT VARIABLE												
Net capital stock	-1.605***	-1.605***	-0.203***	-0.203	-0.206***	-0.206	-0.410***	-0.410***	-0.290***	-0.290*	-0.354***	-0.354*
Gross capital stock	-1.814***	-1.814***	-0.042	-0.042	-0.038	-0.038	-0.361***	-0.361***	-0.039	-0.039	-0.057*	-0.057
Investment	-1.700***	-1.700***	0.396***	0.396	0.371***	0.371	-0.545***	-0.545***	-0.277***	-0.277*	-0.327***	-0.327*
Multi-factor productivity 1	-1.057***	-1.057***	-0.445***	-0.445*	-0.481***	-0.481	-0.158***	-0.158***	-0.029*	-0.029	-0.054***	-0.054
Multi-factor productivity 2	-1.410***	-1.410***	-0.660***	-0.660*	-0.708***	-0.708*	-0.197***	-0.197***	-0.049***	-0.049	-0.079***	-0.079
Labour productivity 1	-2.216***	-2.216***	-0.892***	-0.892***	-0.954***	-0.954***	-0.407***	-0.407***	-0.220***	-0.220**	-0.278***	-0.278***
Labour productivity 2	-2.743***	-2.743***	-1.346***	-1.346***	-1.341***	-1.341***	-0.475***	-0.475***	-0.311***	-0.311***	-0.354***	-0.354***
Total employment	0.068	0.068	0.247***	0.247	0.254***	0.254	-0.048***	-0.048	-0.044***	-0.044	-0.053***	-0.053
Employess	0.355***	0.355**	0.546***	0.546***	0.569***	0.569***	0.002	0.002	0.043**	0.043	0.041**	0.041
Self-employed	-0.929***	-0.929**	-0.699***	-0.699	-0.602***	-0.602	-0.165***	-0.165***	-0.204***	-0.204**	-0.240***	-0.240**
Hours worked (employees)	0.562***	0.562***	0.472***	0.472**	0.483***	0.483**	0.060***	0.060	0.049**	0.049	0.052**	0.052
Hours worked (employment)	0.370***	0.370*	0.339***	0.339	0.354***	0.354	-0.018	-0.018	-0.074***	-0.074	-0.068***	-0.068

Note: as for Table 4

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APPENDIX

Table A1. Three-digit sectors included in the three main aggregated sectors (manufacturing, market services, public services)

Manufacturing		Market services		Public services	
15-16	Food products, beverages and tobacco	45	Construction	75	Public admin. and defence; compulsory social security
17-19	Textiles, textile products, leather and footwear	55	Hotels and restaurants	80	Education
20	Wood and products of wood and cork	65-67	Finance and insurance	85	Health and social work
21-22	Pulp, paper, paper products, printing and publishing	70	Real estate activities	90-93	Other community, social and personal services
23-25	Chemical, rubber, plastics & fuel products	71-74	Renting of M&EQ and other business activities		
26	Other non-metallic mineral products				
27-28	Basic metals and fabricated metal products				
29	Machinery and equipment n.e.c				
30-33	Electrical and optical equipment				
34-35	Transport equipment				
36-37	Manufacturing n.e.c; recycling				

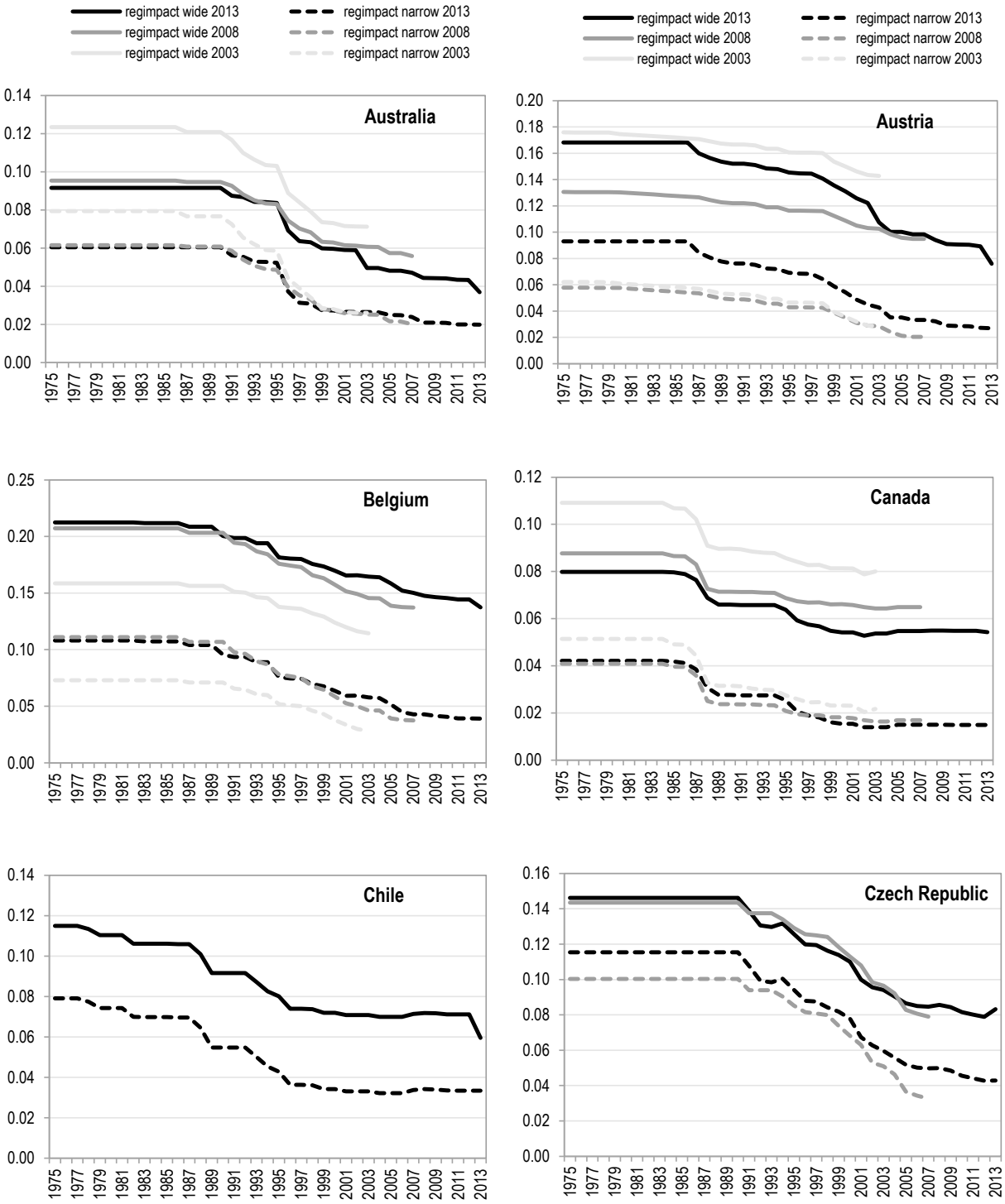
Note: The seven network industries, retail trade and business services are not included in the three main sectoral categories.

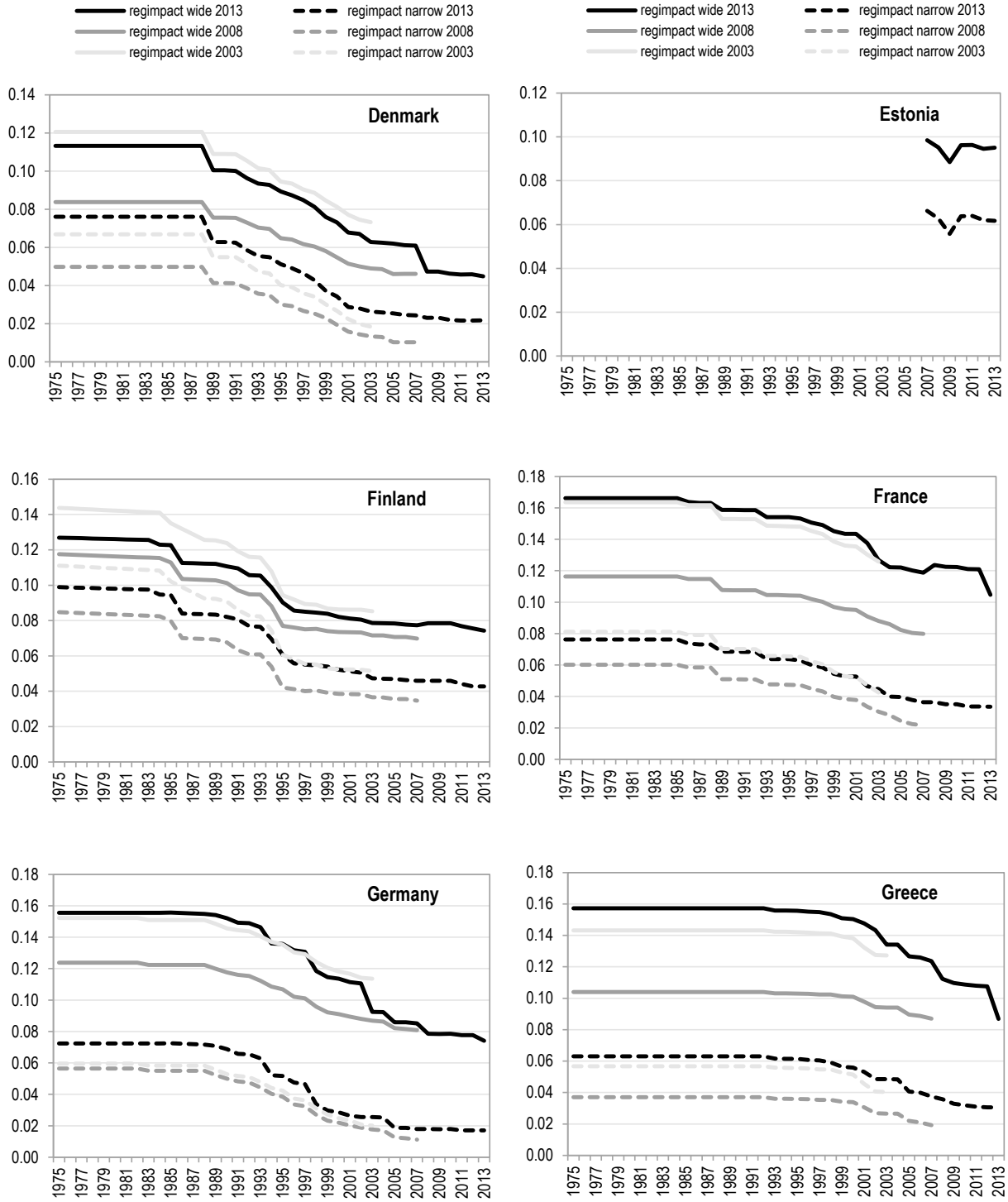
Table A2. An overview of the methodological changes in the 2013 ETCR compared with the 2008 ETCR

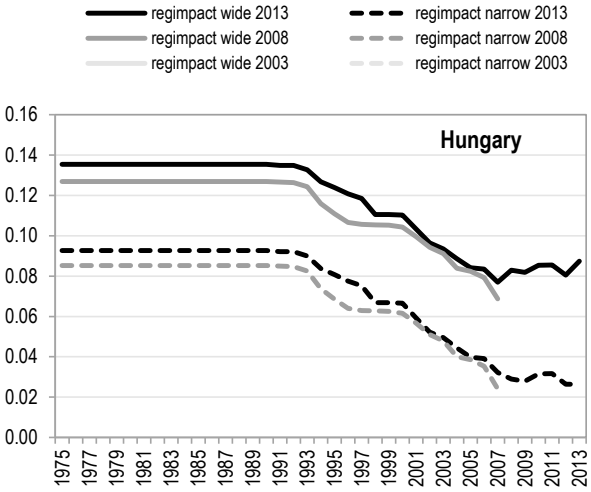
		Major changes	Minor changes
Electricity: 75% of this indicator is affected by methodological changes			
Entry regulation	0.25	--	--
Public ownership	0.25	Percentage of shares owned by the government directly used instead of thresholds to define the ownership structure.	
Vertical integration	0.25	Average over all segment of the electricity sector instead of (not clear) thresholds for defining a degree of vertical separation between transmission/generation and an overall degree.	
Market structure	0.25	New component	
Gas: All components of this indicator are affected by methodological changes (including 75% of major changes).			
Entry regulation	0.25	Questions removed from the computation implying changes in the coding system.	--
Public ownership	0.25	Percentage of shares owned by the government directly used instead of thresholds to define the ownership structure.	--
Vertical integration	0.25	Average over all segments of the gas sector instead of (not clear) thresholds for defining a degree of vertical separation between the segments of the industry.	
Market structure	0.25	--	Slight changes in the coding and weighting systems.
Rail transport: 50% of this indicator is affected by methodological changes (including 25% of major changes).			
Entry regulation	0.25		Slight changes in the coding scheme.
Public ownership	0.25	1. Percentage of shares owned by the government directly used instead of thresholds to define the ownership structure. 2. One segment removed.	Slight changes in the weighting system.
Vertical separation	0.25	--	--
Market structure	0.25		Slight changes in the coding scheme.
Road transport: The structure of this indicator is affected by methodological changes.			
No indicator based on the previous vintage for CHL, EST, ISR, SVN and BRIICS countries.			
Entry regulation & Prices controls		One question removed from 'Entry regulation' and added to 'Price controls'.	Slight changes in the weighting system.
Air transport: 50% of this indicator is affected by methodological minor changes.			
Entry regulation	0.5	--	Slight changes in the coding and weighting systems.
Public ownership	0.5	--	--
Post: The structure and all components of this indicator are affected by methodological changes.			
Entry regulation		New questions added implying changes in the coding system.	--
Public ownership		1. Percentage of shares owned by the government directly used instead of thresholds to define the ownership structure; one segment removed; new weighting system. 2. New set of questions used for 'courrier services'.	--
Market structure		New component	--
Telecom: All components of this indicator are affected by methodological changes.			
Entry regulation		1. New questions on mobile phone regulations. 2. Major changes in the coding system.	Large changes in the weighting system.
Public ownership		Two segments have been added (Fixed-line network & Internet services).	Large changes in the weighting system.
Market structure		1. New questions on the number of firms compete on the same market. 2. Major changes in the coding system	Large changes in the weighting system.

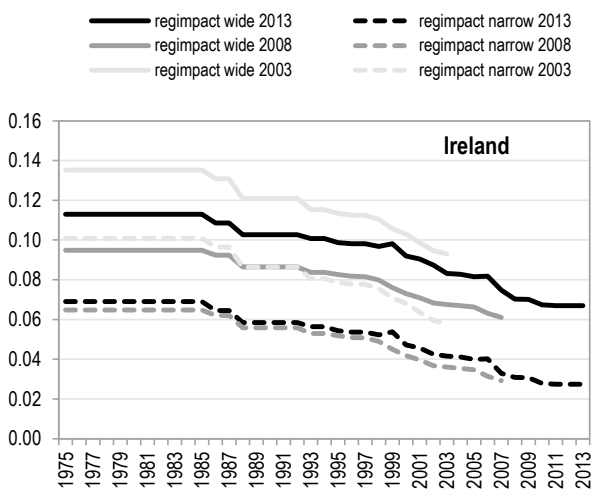
1. Only for questions used in both methodologies.

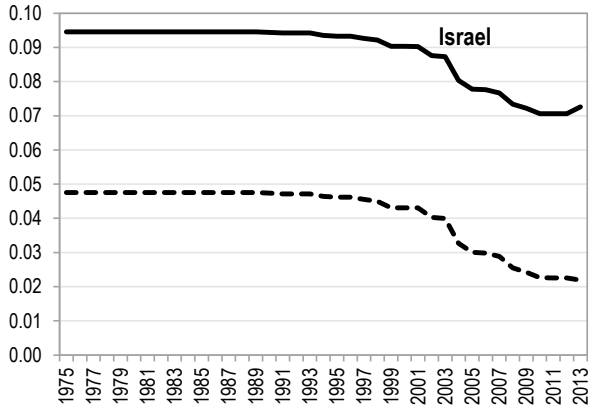
Figure A1. Changes in the REGIMPACT indicator, manufacturing, 1975-2013, OECD countries




regimpact wide 2013
regimpact narrow 2013
regimpact wide 2008
regimpact narrow 2008
regimpact wide 2003
regimpact narrow 2003
Denmark
Estonia
Finland
France
Germany
Greece


regimpact wide 2013
regimpact wide 2008
regimpact wide 2003
regimpact narrow 2013
regimpact narrow 2008
regimpact narrow 2003
Hungary


regimpact wide 2013
regimpact wide 2008
regimpact wide 2003
regimpact narrow 2013
regimpact narrow 2008
regimpact narrow 2003
Ireland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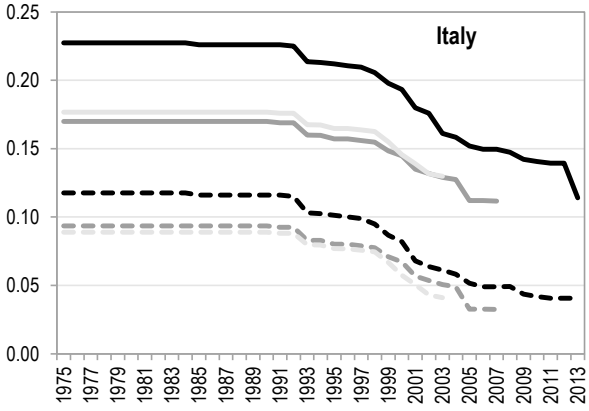
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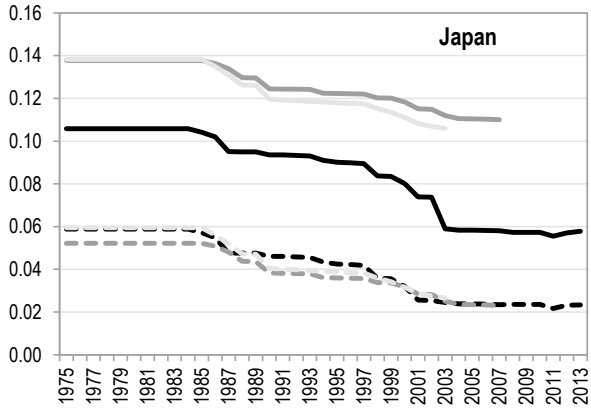
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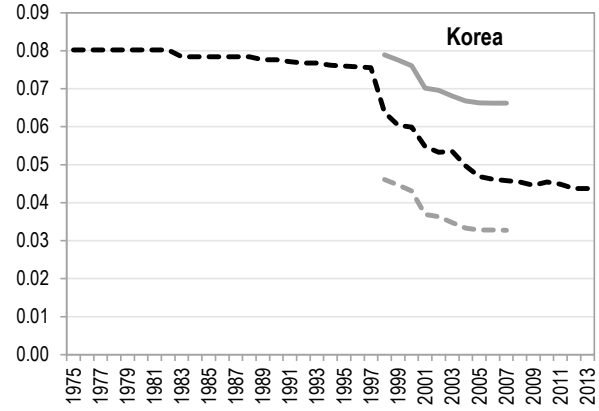
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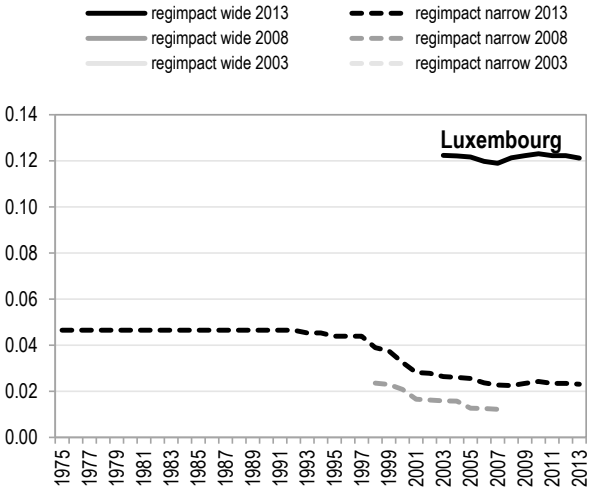
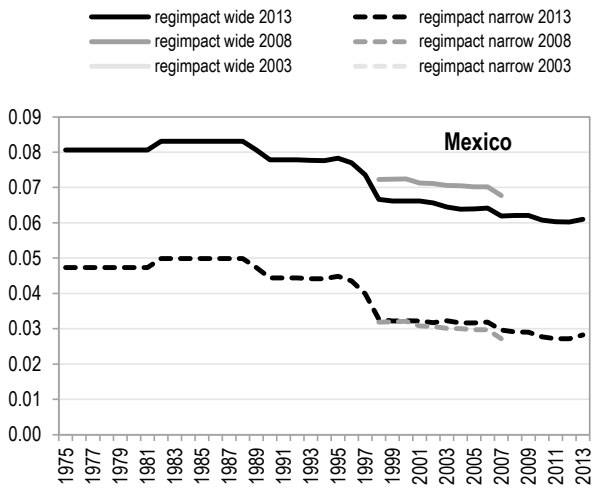
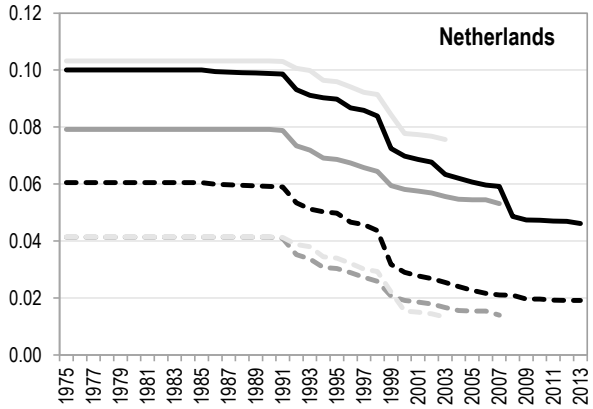

regimpact wide 2013
regimpact wide 2008
regimpact wide 2003
regimpact narrow 2013
regimpact narrow 2008
regimpact narrow 2003
Luxembourg


regimpact wide 2013
regimpact wide 2008
regimpact wide 2003
regimpact narrow 2013
regimpact narrow 2008
regimpact narrow 2003
Mexico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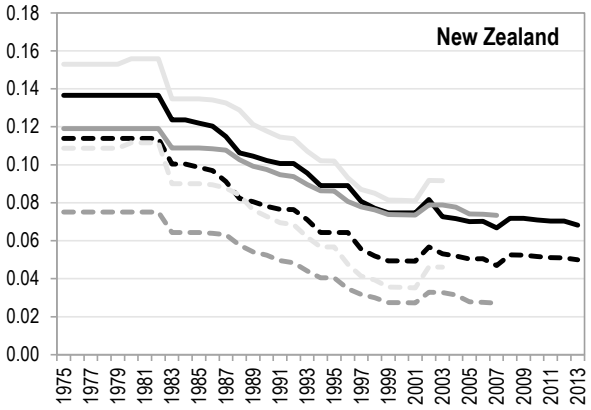
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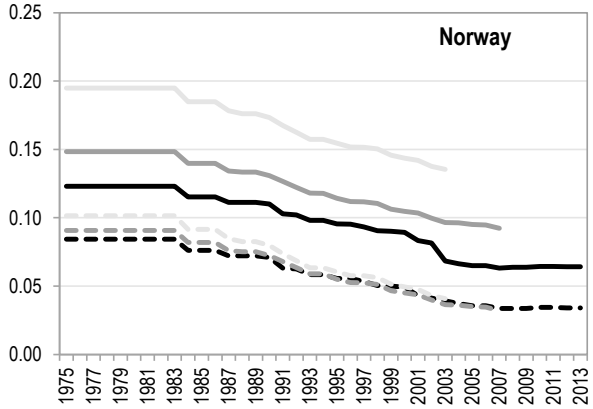
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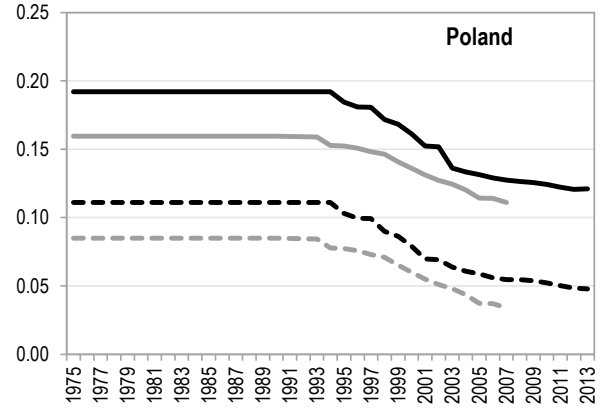
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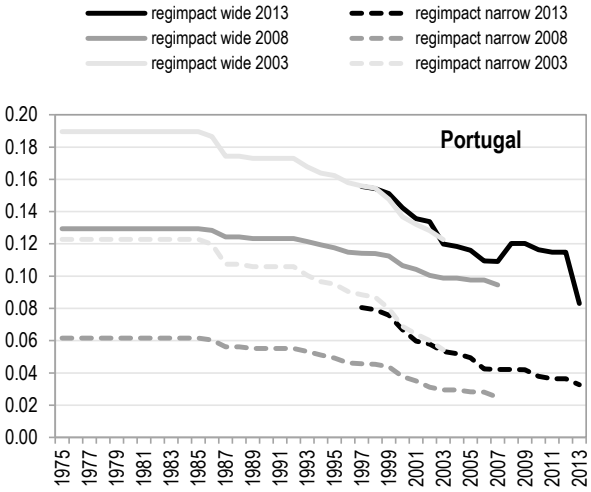
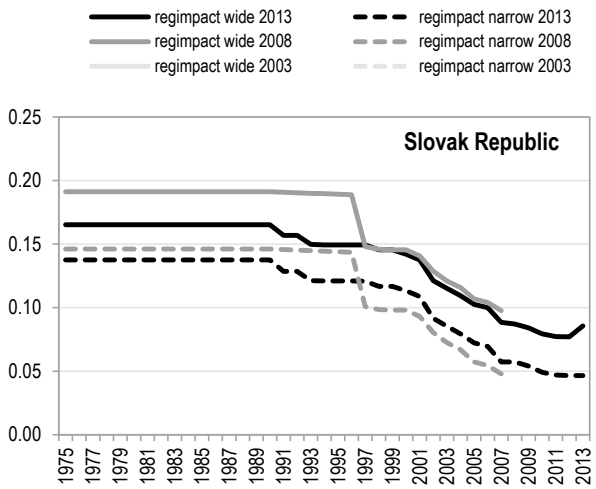

regimpact wide 2013
regimpact wide 2008
regimpact wide 2003
regimpact narrow 2013
regimpact narrow 2008
regimpact narrow 2003
Portugal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regimpact wide 2008
regimpact wide 2003
regimpact narrow 2013
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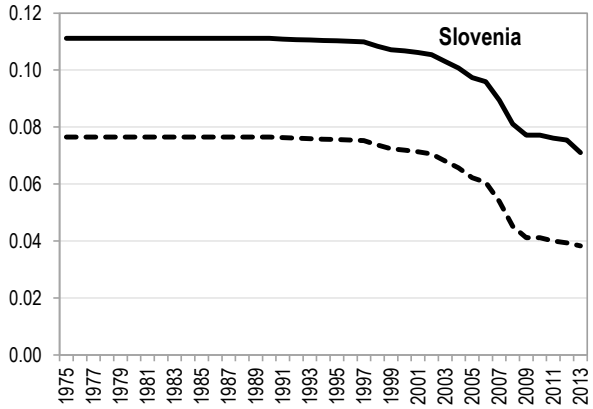
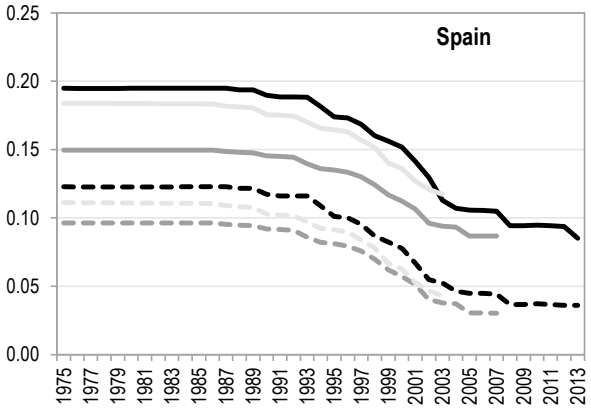
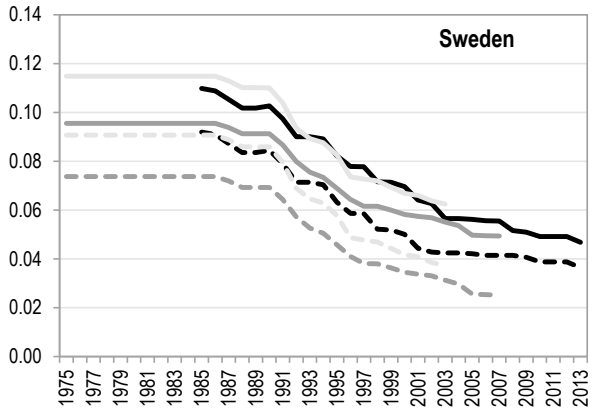
regimpact narrow 2003
Slovak Republic


Slovenia


Spain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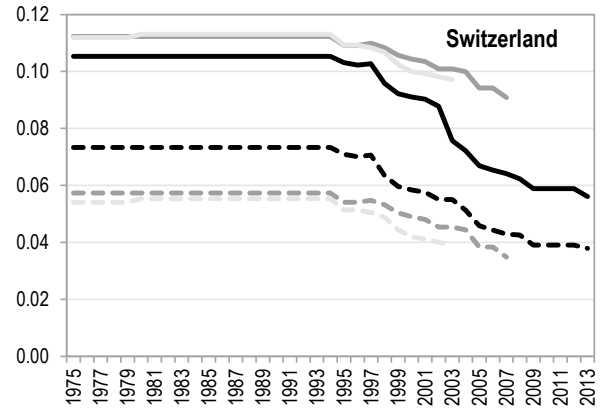
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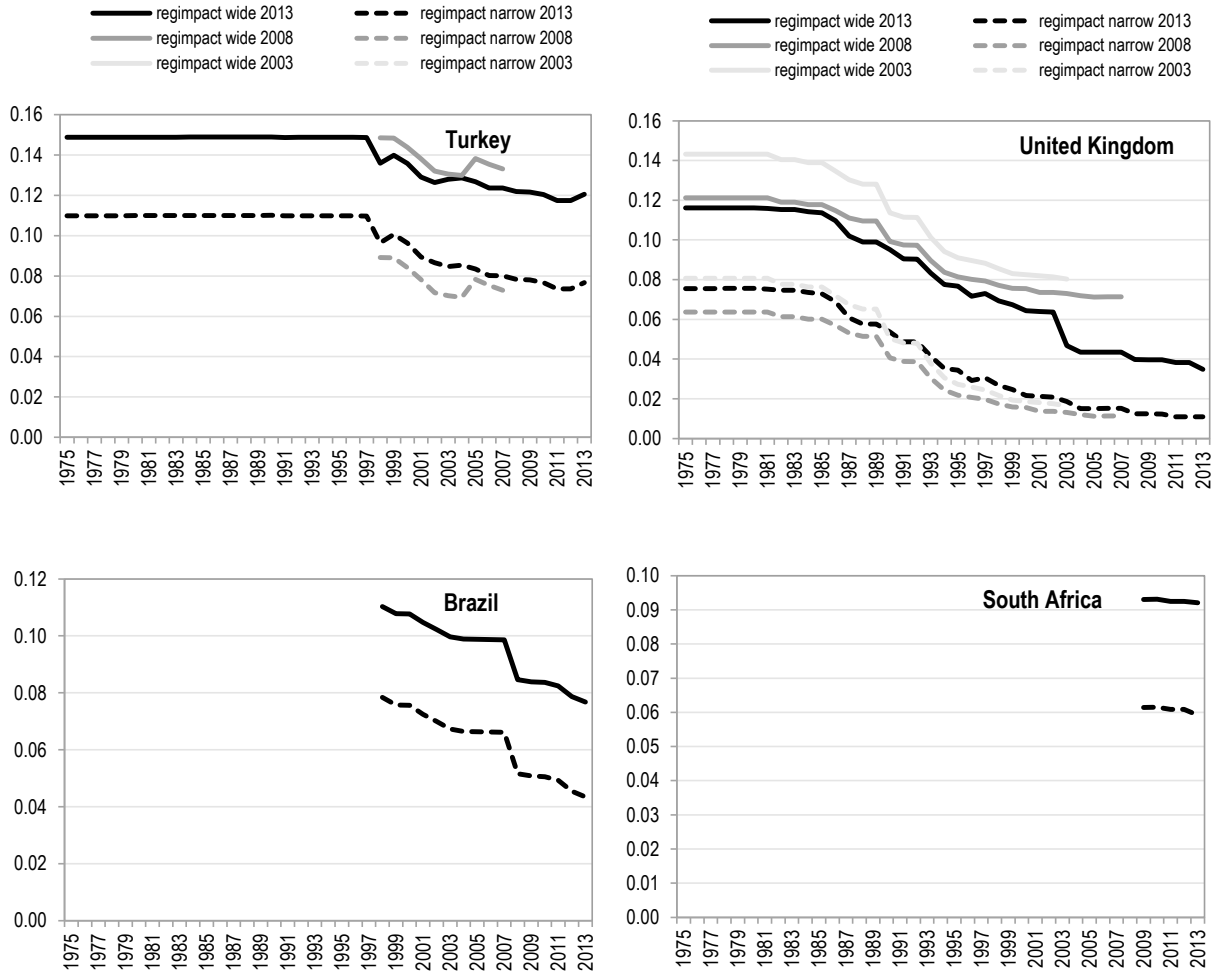

Note: **regimpact_wide_2013** = retail trade and professional services with steps, no banking indicator, 2013 ETCR and country weights (definition No. 4 in Table 2), **regimpact_narrow_2013 =** 2013 ETCR only, country weights (definition No. 3 in Table 2), **regimpact_wide_2008** = constant (first available year) retail trade and professional services, banking regulation in 2003, 2008 ETCR and country weights (definition No. 2 in Table 2); **regimpact_narrow_2008** = 2008 ETCR only and country weights; **regimpact_wide_2003** = constant (first available year) retail trade and professional services, 2003 ETCR and country weights; **regimpact_narrow_2003** = 2003 ETCR only and country weights