The Impact of Product Market Regulation and Labour Market Institutions on Unemployment and Real Wages: an Instrumental Variables Approach

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Abstract

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Persistently higher unemployment rates compared to the aftermath of the Second World War continue to perplex governments in many developed countries. Unemployment is costly for individuals and the society in general, which is why it is important to understand the factors affecting unemployment. Research investigating the drivers behind unemployment has traditionally focused on the role of income taxes and labour market institutions but during the last decades there has been a growing interest in how product market regulation (PMR) enters the picture.

Theory predicts that regulation affects the level of rents (i.e. the mark-up) in the economy because it determines how easy it is for firms to enter a market. The mark-up therefore defines the extent of competition in a particular industry. High regulation allows the incumbent to appropriate a mark-up over marginal costs as it can set prices higher and restrict output (i.e. employ less people) compared to a situation of perfect competition. Deregulation leads to new players entering the market, which decreases the mark-up and increases competition. The pressure from competition forces the incumbent to decrease the price and produce more, which is why it needs to hire more people. Workers see their real wages increasing as the price level decreases. On the other hand, trade liberalisation may lead to falling aggregate employment if increased competition from foreign low-cost producers forces local pants to shutting down their businesses.

This thesis explores the impact of product market regulation and labour market institutions on unemployment and real wages for 21 OECD countries over 1985–2013 using an instrumental variables approach. The empirical strategy follows closely the one introduced in Griffith, Harrison and Macartney (2007), with considerable differences regarding the sample, data definitions and variable usage. Regulation in the product market is assumed to influence unemployment and real wages through the degree of economic rents so in the first stage the mark-up is explained by PMR indicators as well as labour market and control variables. Then, the second stage shows the impact of competition on unemployment and real hourly labour costs which is a proxy for real wages.

The results suggest that increased competition in the product market leads to an increase in unemployment and a decrease in real wages. These findings are compatible with the minority of previous empirical work. What is more, certain types of regulation exert a direct effect on unemployment and wages: decreasing tariffs and reducing burdens to creating new businesses result in falling unemployment. Hence, deregulation has direct beneficial impacts on employment. In addition, promoting import competition is likely to decrease real wages. The effects of labour market institutions are fairly similar to previous empirical findings.

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Päätöksentekijät monissa kehittyneissä talouksissa miettivät jatkuvasti keinoja vähentää työttömyyttä, joka on sinnikkäästi pysynyt korkeampana verrattuna toisen maailmansodan jälkeiseen korkean talouskasvun aikaan. On tärkeää ymmärtää työttömyyteen vaikuttavia tekijöitä, sillä työttömyys aiheuttaa merkittäviä inhimillisiä sekä yhteiskunnallisia kustannuksia. Työttömyyden syitä analysoiva tutkimus on perinteisesti keskittynyt työn verotuksen ja työmarkkinainstituutioiden vaikutuksiin, mutta viimeisten vuosikymmenien aikana tutkijoiden kiinnostus hyödykemarkkinoiden sääntelyä kohtaan työttömyyden mahdollisena aiheuttajana on kasvanut.

Teorian mukaan sääntely määrittelee markkinoillepääsyn kustannukset, mikä taas heijastuu olemassa olevien yritysten ylisuuriin tuottoihin, joilla tarkoitetaan markkinavoiman mahdollistamia voittoja, joista työvoima- ja pääomakustannukset on katettu. Näiden voittojen taso kertoo siitä, minkälainen kilpailutilanne markkinoilla vallitsee. Erittäin säännellyt markkinat mahdollistavat markkinoilla jo toimivan (monopoli)yrityksen asettaa täydellistä kilpailua korkeampi hinta ja rajoittaa tuotantoa. Toisin sanoen työllisyys on alhaisempi ja tuotot korkeampia kuin täydellisen kilpailun maailmassa. Sääntelyn purkamisen seurauksena markkinoille tulee uusia yrityksiä, mikä pakottaa markkinoilla alun perin olleen monopolin laskemaan hintaansa ja lisäämään tuotantoa, jotta se voisi pysyä markkinoilla. Näin ollen tuotot ja hinnat alenevat sekä työllisyys kasvaa, jotta tuotantoa voidaan lisätä. Reaalipalkat nousevat alhaisempien hintojen myötä. Toisaalta, jos ulkomaisilla toimijoilla on matalammat tuotantokustannukset kuin paikallisilla yrityksillä, kaupan vapauttaminen saattaa johtaa työttömyyden kasvuun, kun paikalliset yritykset joutuvat sulkemaan tehtaitaan kiristyneen kilpailupaineen vuoksi.

Tutkielmassa kartoitetaan instrumenttimuuttujamenetelmällä, kuinka hyödykemarkkinoiden sääntely ja työmarkkinainstituutiot vaikuttavat työttömyyteen sekä reaalipalkkoihin käyttäen 21 OECD-maan aineistoa ajalta 1985–2013. Griffith, Harrison ja Macartney (2007) on tutkielmassa sovelletun empiirisen strategian lähde, mutta selkeitä eroja kyseiseen artikkeliin nähden liittyy aineiston laajuuden lisäksi muuttujien muodostukseen ja lukumäärään. Hyödykemarkkinoiden sääntelyn oletetaan vaikuttavan työttömyyteen ja reaalipalkkoihin epäsuorasti ylisuurten voittojen kautta, joten ensimmäisessä vaiheessa näitä voittoja (ts. kilpailua) selitetään sääntelymuuttujilla sekä työmarkkina- ja kontrollimuuttujilla. Toisessa vaiheessa tarkastellaan kilpailun vaikutusta työttömyyteen ja reaalipalkkoihin.

Tutkielman tulokset osoittavat, että kilpailun lisääntyminen hyödykemarkkinoilla lisää työttömyyttä ja alentaa reaalipalkkoja, mikä on suurimpaan osaan aikaisempaan tutkimustietoon verrattuna päinvastainen lopputulos. Lisäksi tutkielmassa havaitaan, että tietyt sääntelyn muodot vaikuttavat suoraan työttömyyteen ja reaalipalkkoihin: Tuontitullien alentaminen ja yrityksen perustamisen helpottaminen vähentävät työttömyyttä, eli sääntelyn purkamisella on suoria myönteisiä työllisyysvaikutuksia. Tämän lisäksi havaitaan, että reaalipalkat näyttäisivät laskevan, kun tuontikilpailua edistetään.

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1. Introduction

1.1. Background and reasoning

Unemployment is a phenomenon constantly preoccupying policymakers and experts, let alone those who suffer from it in their everyday lives. In the aftermath of the Second World War many industrialised countries experienced decades of low unemployment rates and a growing national economy. However, from the 1960s many of the developed countries started to confront (persistently) higher unemployment rates.

Unemployment means a hard time for the individuals who fall under it: loss of main source of income and social network of the workplace for a start. When the unemployment spell lasts longer the individual might face a decreasing human capital and motivation to search for an employment. On top of the humanly costs unemployment has repercussions also on the total economy. Rising unemployment translates into public sector receiving less income taxes and social security contributions from workers but in the same time public expenses rise in the form of increased unemployment benefit payments and supporting services offered to the unemployed. Furthermore, consumption by the unemployed decreases and this in turn affects firms which see the demand for their goods decrease. Consequently, low domestic demand does not give the incentive for firms to invest unless export demand increases. The aggregate economy may be in slack for many years until the situation improves through e.g. recovering global demand.

Theory and empirical evidence have traditionally emphasised the importance of taxes and labour market institutions, such as unemployment benefits and employment protection legislation, in explaining unemployment in different countries over time. As many OECD countries started to deregulate various industrial sectors in the 1980s, during the last two decades there has been a growing interest in exploring how regulation in the product market influences employment outcomes and wages.

Regulation determines the extent of competition in the economy since it controls how easy it is to enter a market. Competition itself involves three different types of efficiency. Firstly, it forces inefficient firms to exit the market, hereby raising the market shares of higher productivity producers. This enables labour and capital to be better allocated, i.e., the allocative efficiency improves. However, this adjustment process may involve adverse employment effects. For example, if domestic firms have higher production costs than their foreign competitors, a more

liberalised trade may engender local plants shutting down their businesses. Secondly, higher competition in the product market gives an incentive for managers and workers to reduce slack and structure the work more efficiently, which enhances the aggregate productive efficiency of existing firms. An often cited example for this is privatisation where business ownership moves partly or completely from the public to the private sector. Yet, privatisation does not automatically mean that competition increases since it depends on whether it creates a genuine pressure of competition and how the remaining regulation and institutional set-up are structured. Thirdly, increased competition may lead to better dynamic efficiency if it encourages firms to innovate. (Griffith & Harrison, 2004, 11–19.)

Therefore, the lack of competition can arise from a too regulated market. If there is no competition, incumbents can freely set prices above market-clearing levels (i.e. they are able to obtain economic rents) and restrict output, which is why they also employ less workers than in a world of perfect competition where they would need to produce according to demand. Deregulation makes it possible for new firms to enter a market and force the incumbent to lower its price and produce more. As the incumbent needs more workforce in order to increase output, employment rises. Hence, deregulation increases competition and employment. Since unemployment is costly both from the individual and community's point of view, it is important to understand all the potential drivers behind it.

1.2. Study goals

The aim of this thesis is to explore empirically how product market regulation and labour market institutions affect unemployment and wages. In order to do this, the study of Griffith, Harrison and Macartney (2007) serves as a benchmark when it comes to the empirical modelling strategy using instrumental variables approach. Using a sample of 14 OECD countries during 1986–2000, they investigate how product market competition impacts unemployment and real wages and how this depends on labour market institutions in a static model with country and year effects. They also provide evidence for interaction effects between product market policies and labour market institutions, such as union density and coverage of collective agreements. Lastly, they test whether coordination in the wage bargaining process influences the effects of competition on unemployment and wages, which is not explored in this thesis.

The approach in Griffith et al. (2007) assumes the theoretical prediction that deregulation in the product market leads to an increase in competition which in turn decreases economic rents in the economy, leading to a fall in unemployment and a rise in real wages. In other words, regulation is assumed to impact unemployment and wages through economic rents and not directly. These rents or excess profits are captured in the mark-up variable which is a measure of value-added over labour and capital costs. In the first stage, the mark-up is instrumented by product market regulation indicators and the second stage regressions show the impact of competition (i.e. the instrumented mark-up) on the unemployment rate and real hourly labour costs which is a proxy for real wages. The article concludes that increased competition results in a decrease in unemployment, more so in countries where labour market institutions increase workers' bargaining power. In addition, they show that increased competition raises real wages but the effect is smaller when workers' bargaining power is high.

When it comes to the theoretical background, Griffith et al. (2007) is based on the model in Chapter 15 of Carlin and Soskice (2006) and it applies elements from Dixit and Stiglitz (1977) and Blanchard and Kiyotaki (1987). The article also uses the predictions of slightly modified theoretical frameworks as formulated in Blanchard and Giavazzi (2003), Spector (2004) and Ebell and Haefke (2004). The model is basically characterised by a closed economy of N sectors with each comprising one firm and one consumer-worker. In this set-up, firms have a monopoly position and trade unions control all the labour force, hence there is a double marginalisation by unions and firms.

Griffith et al. (2007) make use of four time-varying policy indicators as a source of exogenous variation in the product market. These are changes in tariffs and non-tariff barriers, government bureaucracy and the implementation of the EU Single Market Programme. Unlike several other studies, they explore the impacts on traded and non-traded sectors rather than limiting the analysis on network industries. What is more, the writers do not use an aggregate regulatory index for product market regulation because previous empirical evidence suggests that different types of product market reforms may have different effects (see e.g. Griffith & Harrison, 2004).

Annexes 1–3 present estimation Tables 2, 3 and 5 from Griffith et al. (2007) and the same result tables estimated by me in an attempt to construct the variables using exactly same sources as the benchmark study. The purpose of this exercise was to see whether my results substantially differ from the above-mentioned article, before extending the sample size and using a different set and

definition of the variables. It is worth mentioning that my results deliver quite different estimates compared to the benchmark study. One potential reason for this stems from a somewhat different calculation of the mark-up which is a key variable in the empirical strategy.

For the empirical part of the thesis (section 5), a large amount of data has been gathered from various statistical sources and the main difference between the empirical analysis presented in this thesis and the one in Griffith et al. (2007) concerns the sample and variables used. Firstly, I have an extended sample of 21 OECD countries for the period of 1985–2013. Secondly, I have calculated the mark-up variable in a slightly different way, concerning mainly the capital cost component of the variable. In regard to the other variables, the biggest differences relate to public sector employment rate, employment protection legislation and coordination. Thirdly, there are two additional variables in my model that are not in Griffith et al. (2007): extension clauses and the home ownership rate. Finally, I show estimation results for two different sets of regulation indicators which are retrieved from the OECD product market regulation (PMR) database and Fraser Institute's economic freedom dataset. Annexes 4 and 5 provide more information on data coverage, variable definitions and summary statistics.

The thesis is structured as follows: section 2 presents the theoretical predictions regarding the impact of regulation and competition on unemployment and wages. In section 3 the earlier empirical evidence is discussed and the focus is on showing the impact of regulation even though the effect of labour market institutions is also presented. Section 4 explains in detail the main variables used for the empirical part and provides descriptive statistics. Section 5 introduces the main part of the thesis where the empirical strategy and estimation results are presented. Section 6 concludes.

2. Theory

This chapter discusses the theory how unemployment and real wages are affected by product market regulation and bargaining between firms and labour unions in a monopolistically competitive market, which is the theoretical framework in Griffith et al. (2007). As mentioned, their approach is based on the theoretical formulations of Carlin and Soskice (2006), applying elements from Dixit and Stiglitz (1977) and Blanchard and Kiyotaki (1987). The study – like most other empirical papers in this research topic – also refers to the work of Blanchard and Giavazzi (2003) and Spector (2004). That is why this chapter not only presents the theoretical background of the benchmark study but also describes the predictions of these two other models.

Besides stressing the role of workers' bargaining power in formulating the impact of regulation on unemployment and wages, other theoretical characterisations have considered the implications using efficiency wages (for instance, Amable & Gatti, 2004) and search and matching in the labour market (e.g. Ebell & Haefke, 2004). In contrast to the other theoretical papers discussed in this chapter, Amable and Gatti (2004) show that increased competition in the product market may raise efficiency wages to the extent that aggregate employment falls.

The framework in Griffith et al. (2007) is that of a closed economy consisting of N sectors, each of which comprises one firm and one consumer-worker who is represented by one union. Labour is the only input used for producing one good and the goods are not perfectly substitutable. The preferences of worker-consumers follow constant elasticity of substitution as well as increasing disutility to work. Blanchard and Kiyotaki (1987) prove that the latter condition is needed in order to obtain a unique equilibrium when there are constant returns to scale in production. Finally, there is a double monopoly situation since there is only one producer per sector and unions control all the labour in their sector. Formally, this gives:

$$log\ E\ =\ A\ log\left[B\left(\frac{1}{1\ +\ \mu}\right)^2\right], \tag{1}$$

where E stands for the equilibrium employment, A is a constant and describes the employment elasticity of the disutility of work, B is a scaling parameter and μ is the mark-up of price over marginal cost. Griffith et al. (2007) show that this level of employment is lower than in a corresponding situation without unions which in turn is lower than the outcome in a world of

perfect competition. In the former case, the component in brackets in equation (1) becomes $B\left(\frac{1}{1+\mu}\right)$ and in the latter setting, the mark-up component – $\left(\frac{1}{1+\mu}\right)$ – disappears. These elaborations imply that a decrease in the mark-up (due to higher competition) leads to an increase in employment and this increase is larger in a double monopoly situation compared to the one with firm monopoly without unions. In other words, the theory predicts that employment gains from increased competition are greater when workers/unions have higher bargaining power. Both in theory and empirical research, this power is most often measured by the proportion of workers who are covered by collective wage bargaining or the union membership rate. These two indicators are also used in the empirical part of this thesis.

Griffith et al. (2007) emphasise the indecisiveness of theory with regard to the impact of competition on wages. Nevertheless, the model described above predicts that the real wage is only affected by developments in the product market and not at all by workers' bargaining power. Hence, the real wage is determined simply by the following way:

$$w^e = \frac{1}{1+\mu},$$
(2)

where w^e is the equilibrium real wage and μ is the mark-up as in equation (1).[1] The wage equation (2) corresponds to a situation where wage bargaining is conducted by the *right to manage* framework (Nickell & Andrews, 1983) where employers' organisations and unions first negotiate the wages and then individual firms choose the employment levels maximising their profits given the bargained wage level. In this context, firms raise prices as a mark-up over the agreed wage. This means that any increase in wages is set-off by increasing prices (Griffith et al., 2007).

If the model instead assumed that unions and employers bargain over wages and employment at the same time (i.e. *efficient bargaining*, see McDonald & Solow, 1981), the real wage would be a positive function of workers' bargaining power. In this case, workers are able to acquire a part of the available rents, the more the higher is their bargaining power. Consequently, a decrease in the mark-up (an increase in competition) increases the real wage less when workers have higher bargaining power. All in all, equation (2) states that increasing competition raises the real wage.

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[1] For a more detailed formulation of the employment and wage equations in the model, see Chapter 15 of Carlin and Soskice (2006) and Blanchard and Giavazzi (2003).

The discussion over different bargaining regimes additionally predicts that the wage increase is smaller when workers possess a high bargaining power, to the extent that bargaining is not characterised by the *right to manage* situation.

Blanchard and Giavazzi (2003) present a theoretical model without capital that makes a distinction between the short- and long-term effects of increased product market competition. Labour is assumed to exert constant returns. Fundamentally, product market regulation defines the cost of entry in a monopolistically competitive market and thus the extent of competition which determines the size of economic rents available in the economy. Labour market regulation reflects the bargaining power of workers and manages the distribution of rents between workers and firms. The bargaining itself is that of *efficient bargaining*. In the short run, the number of firms and (differentiated) products is fixed, while in the long term they are endogenous. The theoretical formulation defines two elements of product market deregulation which are, on the one hand, reductions in e.g. tariffs and administrative requirements which influence entry costs and, on the other hand, an increase in the substitutability among products. The bargaining power of workers may develop for example with evolutions in the use of extension clauses and rules on the right to strike.

According to the model of Blanchard and Giavazzi (2003), the short-run implications from increased product substitutability are the following: as firms are faced with a more elastic demand they decrease their mark-up, which results in a fall in unemployment and an increase in real wages. However, in the long term these beneficial impacts disappear because entry costs have not changed. Since the mark-up decreases but entry costs are fixed, the number of firms will fall because it does not make sense to enter the market. In the long term, the mark-up moves back to its pre-reform level and so do unemployment and the real wage.

As for the impact of decreased tariffs and administrative burdens, the outcomes are different. There are no short-run impacts from smaller entry costs because the number of firms is given. By contrast, in the long term new firms will enter the market, the elasticity of demand rises and the mark-up decreases. Consequently, the lower mark-up translates into lower unemployment and higher real wages. (Blanchard & Giavazzi, 2003.)

The article also shows that relaxing regulation in the labour market (i.e., reducing the bargaining power of workers) means that in the short run there are no employment effects but workers lose in the form of lower real wages since they are now able to appropriate a smaller part of the rents.

Hence, firms capture a larger share of the profits. In the longer term, new entrants come to the market, striving to reap the benefits of higher profits. Consequently, competition increases and profits fall, which engenders lower unemployment and higher real wages. In effect, the aggregate impact is that wages remain unchanged compared to the situation before labour market deregulation but unemployment is lower.

What happens to the theoretical predictions if unions and employers bargain according to the *right to manage* framework? Blanchard and Giavazzi (2003) argue that in the short-run, unemployment is higher and the real wage lower than under *efficient bargaining*.[2] However, the long-term unemployment rate is lower than under *efficient bargaining* since the number of firms is greater (i.e., higher elasticity of demand and thus, smaller mark-up). The long-run real wage is the same in both bargaining schemes. When it comes to the effects of a relaxation in labour market regulation, recall from the discussion of Griffith et al. (2007) that wages do not depend on the bargaining power of workers. Hence, wages remain unchanged and unemployment decreases both in the short and long term.

In comparison to the two previously mentioned theoretical frameworks, Spector (2004) introduces capital to the model of imperfect competition in the product market and bargaining in the labour market in an open economy facing an exogenous world interest rate. He provides insight into the potential reasons for opposition to reform. In effect, he shows that increased competition can lead to a decrease in wages both in the short and long run. The model assumes that there are decreasing returns to labour, which is an essential feature because when labour is not the only input used for production then there are two types of distributional conflicts between shareholders and workers: the first arises from economic rents generated by imperfect competition, whereas the second emerges from the quasi-rents of capital investments.

Spector (2004) proves that the existence of decreasing returns to labour engenders a result that increased competition in the product market leads to a rise in employment and a fall in real wages in the short term, for both the *right to manage* and *efficient bargaining* cases. The wage result is explained as follows: in a situation where there are excess profits stemming not only from the mark-up but also from capital investments, workers have an additional opportunity to capture a proportion of the total rents. However, a more intense competition means that workers' bargaining power decreases and hence, it is more difficult for them to obtain a share of the rents.

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[2] The employment and wage equations in Blanchard and Giavazzi (2003) are very similar to equations (1) and (2) above.

In the long run, the number of firms adjusts so that profit per firm remains constant. Product market deregulation induces a rise in employment but the effect on wages depends on the bargaining framework. Spector (2004) argues that the wage is initially above the marginal product of labour in the case of *efficient bargaining*. When competition becomes fiercer, firms have to produce more since they cannot keep prices high anymore by restricting output. Otherwise, they would lose market share. Therefore, firms hire more people in order to raise production, which in turn would lead to a fall in profit per firm if the wage did not adjust. Since each firm's long-term profits are constant in an open economy with capital, the wage falls until it is equal to the marginal product of labour. Hence, even though employment increases, workers may lose in the form of lower real wages if they have a high bargaining power. This wage result is an interesting implication which will be supported by the estimation results in section 5.

As mentioned briefly in section 1, increased competition forces inefficient firms to exit the market and reduces slack which improves the productive efficiency in the workplace (see Hart, 1983; Nickell, 1996 and Schmidt, 1997). This might involve adverse employment effects. For example, trade liberalisation may lead to local plants shutting down their businesses if domestic firms have higher production costs than their foreign competitors. Moreover, unemployment may rise with privatisation if state-owned enterprises have been heavily overmanned, in which case the number of employees is reduced in order to increase productivity. These efficiency considerations are potential explanations for the main results obtained later in the empirical part of this thesis.

To summarise, theory predicts that product market deregulation (especially a reduction in entry barriers) leads to an increase in competition and to a decrease in economic rents appropriated by firms. A more intense competition forces incumbents to produce more and lower prices, hence, employment and real wages rise. However, to the extent that increased competition improves the allocative efficiency and reduces slack in the existing firms, employment may fall. The effect on real wages depends crucially on how bargaining is conducted between firms and unions/workers. Theory is inconclusive as to whether high or low worker bargaining power supports or weakens the effect of competition on employment and wage outcomes.

3. Earlier empirical evidence

Research on the factors affecting employment and wages has consistently focused on the role of labour market institutions and taxes. Despite fairly robust evidence that the aforementioned have an influence on unemployment and wage outcomes, they may not tell the whole story. According to Nickell, Nunziata and Ochel (2005) half of the increase in unemployment between the 1960s and the 1990s is due to institutional characteristics of the labour market. In other words, a sizable part of the variation in unemployment remains unexplained. Since the beginning of the deregulation era, which started from the United States in the 1980s followed by many European countries in the 1990s, there has been a steadily growing interest in exploring how regulation in the product market impacts employment and wages. This section describes the empirical evidence found in that research field and summarises the key findings on the effects of labour market institutions.

Studies investigating the link between regulation and unemployment have mainly concentrated on developed countries for which data is better available. Feldmann (2012) is one of the few examples with a sample of 80 countries instead of a smaller set of industrialised economies. What is more, a large part of the studies explore the effects of product market regulation (PMR) within retail and network sectors and not at the aggregate economy level. When it comes to studies using OECD product market regulation indicators, one of the main reasons for this is that total economy indicators provide substantially smaller period coverage.

Another feature of the previous empirical work relates to the short- and medium-term effects which remain debated. For instance, Cacciatore and Fiori (2016) show that a reduction in barriers to entry leads to a fall in short-term employment although the long-term impact is a decrease in unemployment. This view is supported by Bassanini (2015), among others. On the contrary, Bouis, Duval and Eugster (2016) are among those who claim that there are no short-term costs related to product market reforms. Nevertheless, the potential for adverse short-term impacts might explain why introducing reforms is difficult in a political economy context with winners and losers.

Furthermore, different institutional set-ups are likely to exert interdependencies, which is why many researchers have explored the interaction effects of product and labour market regulation. The results remain ambiguous: some studies (e.g. Fiori, Nicoletti, Scarpetta & Schiantarelli, 2012) show that higher worker bargaining power boosts the positive employment effect of relaxing

PMR, others (for example Bassanini & Duval, 2006, 2009 and Berger & Danninger, 2006) postulate that lower bargaining power supports the increase in employment more.

Apart from a great number of studies using cross-country panel data, micro-level studies have provided additional information about the impacts of individual deregulation measures within specific sectors in different countries. Bertrand and Kramarz (2002) estimate that zoning regulations reduced the long-run retail employment by more than 10% in France in the 1970s. In addition, Kugler and Pica (2003) report for Italy that for labour market deregulation to be effective in creating new jobs, countries also have to remove administrative burdens that generate barriers to entrepreneurship. On the other hand, Schmitz (2005) shows that privatisation of iron ore mines in North America resulted in a negative employment outcome in the sectors most affected. A potential explanation for this is that government enterprises may have higher production costs and less efficient processes than private firms as they do not have pressure from competition. In this case, privatising may entail a reduction of the overmanned workforce in order to increase productivity as discussed in section 2.

The evidence in general suggests that the sector investigated matters, especially for the short-term developments. The retail industry tends to accumulate rapid gains in employment, whereas network industries (e.g. energy and transport) seem to encounter short-term adverse effects because adjustment takes time. This includes, among other things, reducing overmanning within the existing firms when they reorganise to the new competitive environment. OECD (2016) provides a discussion regarding the short-term adjustment costs in different sectors.

All in all, the majority of the previous empirical literature documents that increased competition in the product market is associated with higher employment. Most of the newer empirical work use dynamic DSGE models with calibrations based on earlier studies and theory. The reason why I make use of an older empirical strategy is that the estimations are run with actual collected data and that the IV approach gives an intuitive link between the mark-up, competition and unemployment. Table 1 provides a summary on the empirical evidence regarding the impact of PMR on employment outcomes and wages/labour costs. The list is not exhaustive but serves as a relatively extensive overview.

There is less empirical evidence for the impact of competition on wages and labour costs and the results themselves are inconclusive. For example, Nicoletti and Scarpetta (2005) and Cacciatore, Duval, Fiori and Ghironi (2016b) claim that increased competition increases wages, while Schivardi

and Viviano (2011) as well as Denk (2016) report a decrease in real wages among the reformed industries' workers following a relaxation of product market regulation. Moreover, Griffith et al. (2007) show that decreasing product market regulation leads to an increase in real wages and that the wage effect is smaller when workers' bargaining power is high.

When it comes to labour market institutions, Nickell (1997), Elmeskov, Martin and Scarpetta (1998), Nickell and Layard (1999), Nickell et al. (2005) and Bassanini and Duval (2006, 2009) are examples of previous econometric work investigating the effects of labour market policies on employment and wage outcomes. Boeri and van Ours (2008) as well as Boeri, Cahuc and Zylberberg (2015) summarise the theory and evidence for each labour market institution separately.

Nickell (1997, 72) postulates that high unemployment is linked with high collective bargaining coverage with no coordination between unions and firms in the wage bargaining process. Additionally, high unionisation and coordination are associated with higher wages and lower wage dispersion (Boeri & van Ours, 2008, 69–71). On the other hand, Elmeskov et al. (1998) as well as Belot and van Ours (2004) found an insignificant employment effect for union density. A potential explanation for the sometimes low explanatory power of union density and/or collective bargaining coverage is that changes in bargaining coordination may have a stronger influence on macroeconomic events than developments in union membership and coverage. Indeed, the evidence shows that high coordination within the wage-setting process reduces unemployment as it increases the sensitivity of real wages to shocks by allowing for wage moderation (see e.g. Bassanini & Duval, 2006; Calmfors & Driffill, 1988 and Elmeskov et al., 1998).

A relatively robust result concerns unemployment benefits and taxes for which earlier studies have shown that reducing the tax wedge or the unemployment benefit replacement rate tends to decrease unemployment (see e.g. Gal & Theising, 2015). However, Belot and van Ours (2004) find an insignificant impact for the tax wedge. What is more, higher unemployment benefits are associated with an increase in wages since they decrease the fear of unemployment among the employed (Nickell, 1997, 67). Moreover, Boeri and van Ours (2008, 90) elaborate that an increase in payroll taxes will lower employment if taxes cannot be passed on to workers in the form of lower wages. In other words, a full compensation ensures that employers do not meet rising labour costs and hence a fall in employment can be avoided. Evidence from Chile shows that a substantial decrease in payroll taxation was fully passed on to workers in the form of higher wages

(Gruber, 2007). In the same vein, Korkeamäki and Uusitalo (2009) report the results from a regional experiment in Finland where a payroll tax reduction increased wages in the region affected by the reform. The increase in wages did not entirely offset the decrease in firms' labour costs.

The impact of stringent employment protection legislation (EPL) remains somewhat ambiguous. Bassanini and Duval (2006) obtain a result where EPL reduction has an insignificant impact on employment. Nickell et al. (2005) as well as Martin and Scarpetta (2012) show that a strict EPL increases unemployment. In addition, Bentolila, Cahuc, Dolado and Le Barbanchon (2012) found that two-tier reforms[3] of job protection might raise the equilibrium unemployment rate by increasing unemployment turnover (i.e., entry into and exit from unemployment). On the other hand, Boeri and Garibaldi (2007) point to positive short-term employment effects resulting from a relaxation of EPL for new hires. They add that this positive impact gradually disappears as firms change their hiring so that they replace the stock of permanent workers by flexible contracts. By contrast, Cacciatore et al. (2016b) find that in the short term the reduction of EPL leads to an increase in the unemployment rate. However, in the long run unemployment falls to a lower level compared to the pre-reform situation. Real wages decrease (as workers' bargaining power decreases) following the reform and they remain below the pre-reform level also in the long term. Van der Wiel (2010) documents similar wage effects for the Netherlands. A different result is obtained by OECD (2016), stating that in the long term more flexible dismissal legislation tends to increase average wages. Kugler, Jimeno and Hernanz (2005) as well as Behaghel, Crépon and Sédillot (2008) provide evidence regarding the outcomes for specific groups of workers.

As for the effects of extension clauses (i.e. the mandatory extension of collective agreements to non-organised employers), using firm-level data for Portugal Martins (2014) found that they exert a negative impact on both employment and wages in the firms involved. Villanueva (2015) points out to similar findings in the empirical literature.

When it comes to the role of housing, home ownership is often seen to deteriorate the matching efficiency and labour mobility within the labour market (Blanchflower & Oswald, 2013a, 2013b). In effect, the most common finding in the literature points out to high home ownership rates being associated with high unemployment (Oswald, 1996, 1997). However, research on the link between housing markets and labour market performance has not yet given completely clear and

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[3] Two-tier reforms mean situations where EPL is reduced only at the margin for new hires, while the same stricter employment protection remains valid for permanent contract staff.

unambiguous results. Bassanini and Duval (2006) provide one reason for the difficulty to obtain conclusive outcomes by asserting that owner-occupied housing might be endogenous since countries experiencing low degrees of internal and external migration are likely to have higher rates of home ownership. This caveat in mind, Laamanen (2013) avoids this endogeneity issue by exploring the effects of a regional experiment in Finland. He finds that an increase in home ownership leads to a rise in unemployment even though home owners seem to be less likely to face unemployment. This may be due to externalities stemming from a reduction in consumption (home ownership financing usually necessitates debt) and increased competition for jobs. In contrast to Blanchflower and Oswald (2013a, 2013b), the results from Laamanen (2013) suggest that there is a link between the home ownership rate and unemployment also in the short term.

Finally, Baker, Glyn, Howell and Schmitt (2004) as well as Freeman (2005) express criticism against the empirical evidence stating beneficial effects stemming from labour market deregulation. They point out that high regulation in the labour market is not always the reason for high unemployment and claim a need for research making more use of micro-level data in order to understand better the effect of labour market institutions on unemployment and employment. In the same vein, Baccaro and Rei (2007) do not support many of the findings mentioned above and postulate that other than institutional determinants (such as monetary policy) are more important in explaining unemployment.

Table 1. Empirical evidence for the impact of product market regulation on employment outcomes and wages/labour costs

Study	Sample	Outcome
Burda (2000)	1985–mid-1990s The Netherlands, Germany and the United States	Shop closing laws had a negative effect on employment.
Bertrand and Kramarz (2002)	1970s France	Zoning regulations in France in the 1970s reduced long-run retail employment by more than 10%.
Jean and Nicoletti (2002)	1990s 12 OECD countries	Product market regulation is significantly associated with wage premia in manufacturing and non-manufacturing industries.
Kugler and Pica (2003)	1986–1995 Italy	Deregulating the labour market results in greater positive employment outcomes in less regulated product markets.
Griffith and Harrison (2004)	1985–2000 12 EU countries	Greater competition is associated with higher levels of employment, particularly in the service sector.
Monteiro (2004)	1989–1997 Portugal	Privatisation in the Portuguese banking sector led to wage losses during the first two years following the introduction of the reform. These effects were reversed after the third year. Top managers experienced stronger and lasting wage growth losses.
Cincera and Galgau (2005)	1997–2003 Nine EU countries	For employment growth, the effect of deregulation (through firm entry and exit) is not significant or has a different sign at different lag lengths of entry, but with a net effect close to zero.
Nicoletti and Scarpetta (2005)	1980–2002 20 OECD countries	Relaxing PMR can lead to significant employment gains in overly regulated countries. The positive employment effects are likely to be higher in countries that have rigid labour markets. The increased labour demand (due to increased competition) tends to raise wages, whereas stronger competition tends to lower prices. Therefore, both real wages and labour supply rise.
Schmitz (2005)	1980s Canada and the United States	Privatisation of iron ore mines in North America resulted in a fall in employment in the sectors most affected.
Skuterud (2005)	1980–2001 Canada	Relaxing restrictions on Sunday shopping resulted in a rise in aggregate retail sector employment. General merchandise stores benefited more than specialised retail firms.

Table 1 *(Continued)*

Study	Sample	Outcome
Bassanini and Duval (2006)	1982–2003 21 OECD countries	Strict anti-competitive PMR increases aggregate unemployment. The impact of a deregulation reform is larger when the institutional framework is employment-friendly.
Faini, Haskel, Navaretti, Scarpa and Wey (2006)	1990s–beginning of 2000s Germany, Italy and the United Kingdom	Liberalising services and network sectors led to an increase in employment in industries such as retail and telecommunications. Other network industries experienced a decrease in employment because firms enhanced competitiveness by reducing initial overmanning.
Berger and Danninger (2007)	1990–2004 27 OECD countries	Lower levels of product and labour market regulation foster aggregate employment growth. Benefits from deregulating one market increase as the level of regulation decreases in the other market. This implies that joint deregulation is more effective in creating employment than partial or sequential deregulation.
Griffith et al. (2007)	1986–2000 14 OECD countries	Increased competition (lower mark-ups) reduces unemployment and increases real wages. The positive employment effect is reinforced by labour market institutions that increase workers' bargaining power.
Sadun (2008)	1993–2003 The United Kingdom	Entry regulations against large retailers have been associated with declines in employment.
Bassanini and Duval (2009)	1982–2003 20 OECD countries	Strict anti-competitive PMR increases aggregate unemployment. Labour and product market reform packages result in larger employment gains than separate reforms.
Branstetter, Lima, Taylor and Venacio (2010)	2000–2008 Portugal	Economy-wide entry deregulation had a modest positive impact on firm and job creation in Portugal. Retail, agriculture and construction sectors experienced the strongest employment gains.
Amable, Demmou and Gatti (2011)	1980–2004 18 OECD countries	There is a negative effect of PMR on employment whereas the impact of EPL is positive. PMR and EPL are substitutes rather than complements: strong EPL magnifies the positive effects of product market deregulation.
Bloom, Draca and Van Reenen (2011)	1996–2007 12 European countries	Increased Chinese import competition led to falls in employment, profits and prices in the sectors most affected by the increase in competition.

Table 1 *(Continued)*

Study	Sample	Outcome
Schivardi and Viviano (2011)	1998–2003 Italy	Liberalising entry in retail increases employment and decreases wages/labour costs (in large shops).
Bouis, Causa, Demmou, Duval and Zdzienicka (2012)	1983–2007 OECD countries	Deregulation in network industries may engender a rise in unemployment (and a fall in employment) when job protection is weak. Hence, product and labour market reforms are substitutes.
Cacciatore, Duval and Fiori (2012)	Model parameters calibrated for 2007 Euro area	Product and labour market (to a lesser extent) reforms reduce unemployment in the long run but it takes at least a couple of years for the positive impact to be seen on aggregate economy. In the long run product and labour market reforms are substitutes rather than complements even if in the short run gains from decreasing PMR are smoother when the labour market is more flexible.
Feldmann (2012)	1980–2007 80 countries	Stricter product market regulation likely increases unemployment and decreases employment. The size of the effect is especially large for the young.
Fiori et al. (2012)	1980–2002 20 OECD countries	Increasing competition raises employment more when labour market regulation is high. Domestic product market deregulation generates a decline in the bargaining power of workers by promoting deregulation of labour markets or by affecting union density and coverage.
Bertinelli, Cardi and Sen (2013)	1985–2003 16 OECD countries	Deregulation leads to a fall in the unemployment rate. Product market deregulation is more effective in countries where product and labour market regulations are high, unemployment benefits are small and labour force is more responsive.
Senftleben-König (2014)	2006–2007 Germany	Deregulation of shop closing legislation resulted in retail sector employment losses.
Bassanini (2015)	1975–2007 23 OECD countries	Removing entry barriers in network sectors leads to large negative short-term employment effects in the affected industries. The employment losses last at least three years and they are larger when reforms are implemented during recessions and insignificant in upturns.
Gal and Theising (2015)	Mid-1980s–2011 25–34 OECD countries	Reforming the product market to be more competition-friendly has a positive and significant impact on aggregate employment rates but this result does not pass all the robustness checks.

Table 1 *(Continued)*

Study	Sample	Outcome
Bordon, Ebeke and Shirono (2016)	1980–2013 26 OECD countries	Labour and product market reforms have a lagged but positive impact on employment creation.
Bouis et al. (2016)	1975–2011 26 countries	Deregulation in five network industries resulted in only weak positive employment effects. In addition, there is no evidence of negative short-term costs from reforms.
Cacciatore and Fiori (2016)	1982–2005 19 OECD countries	Deregulation increases employment in the long term but in the short run unemployment rises.
Cacciatore, Duval, Fiori and Ghironi (2016a)	Based on Cacciatore and Fiori (2016) and earlier empirical evidence.	A reduction in entry costs increases employment in the long run but the adjustment may involve adverse effects. For instance, an announcement of a future product market deregulation reduces employment in the short term.
Cacciatore et al. (2016b)	Based on Cacciatore and Fiori (2016) and earlier empirical evidence.	Product market reforms increase unemployment in the short run as incumbents downsize and worker reallocation takes time. However, in the long term unemployment decreases and wages increase. In the short term, the effect of product market deregulation is smoother if the labour market is more flexible. On the contrary, the long-term gains are smaller with a flexible labour market.
Causa, Ruiz and Hermansen (2016)	Mid-1980s–2012 34 OECD countries	Making regulation more pro-competitive in transport and network industries generates higher employment and real income gains that are broadly shared across society.
Cournède, Denk, Garda and Hoeller (2016)	1994–2012 26 OECD countries	Product market reforms tend to increase aggregate employment.
Denk (2016)	Various datasets and coverage, mid-1970s–2012 26 OECD countries	Deregulation in the network sector decreases the wage and reduces employment stability of the reformed industries' workers.
Gal and Hijzen (2016)	1998–2013 18 advanced countries	Product market reforms exert a positive effect on employment but only after two years.
OECD (2016)	1975–2007(/2012) 23 OECD countries	In the short term, deregulation in network industries reduces employment compared to the pre-reform level in those industries. The negative employment effect lasts for three to four years. In the long run, these reforms do not affect employment and wages in the reformed industries, whereas the downstream industries experience positive employment outcomes.

4. Data and descriptive statistics

This chapter describes the evolution of the main variables over the sample period and presents correlation results between the unemployment rate, the two set of regulation indicators and the mark-up. Annexes 4 and 5 provide a detailed documentation on data availability per country as well as variable definitions.

4.1. Unemployment

Figures 1–4 illustrate the evolution of the seasonally adjusted unemployment rates across the sample countries which are grouped by geographical location. The indicator is measured in numbers of unemployed persons as a percentage of the labour force (which is the total number of unemployed plus persons in civilian employment[4]). Apart from widespread macroeconomic shocks – such as the early 1990s recession and the aftermath of the 2007–2008 global financial crisis – affecting practically all the countries, idiosyncratic shocks have also been a major driver behind the fluctuations in unemployment. The figures show that many European countries have had higher unemployment rates than countries outside Europe. Often cited reasons for the different employment performance between countries have included, among other things, the structure of the economy (in regard to the most important sectors) and labour market's adaptability to respond to shocks.

Figure 1 documents that the Nordic countries, especially Finland, experienced a severe recession at the beginning of the 1990s which resulted in its unemployment rate remaining unnaturally high for many years[5]. After the recession unemployment rates decreased and were lower from late 1990s until the global financial crisis. Except for Norway (3.5%), the unemployment rate in the Nordic countries was around 8% in 2013.

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[4] Civilian employment excludes the members of the armed forces.

[5] The recession in Finland was caused by an overheated economy since financial deregulation and free movement of capital had been brought about fast. The international recession and the collapse of the Soviet Union (being an essential business partner for Finland) further deepened the downturn. The Swedish case was similar except the trade connection with Soviet Union. In Norway the economic downturn was milder and mainly due to oil price shocks. The case of Denmark was also an overheated economy with housing markets collapsing and international recession making the recovery slower.

Figure 1. Unemployment rates in Nordic countries during 1985–2013
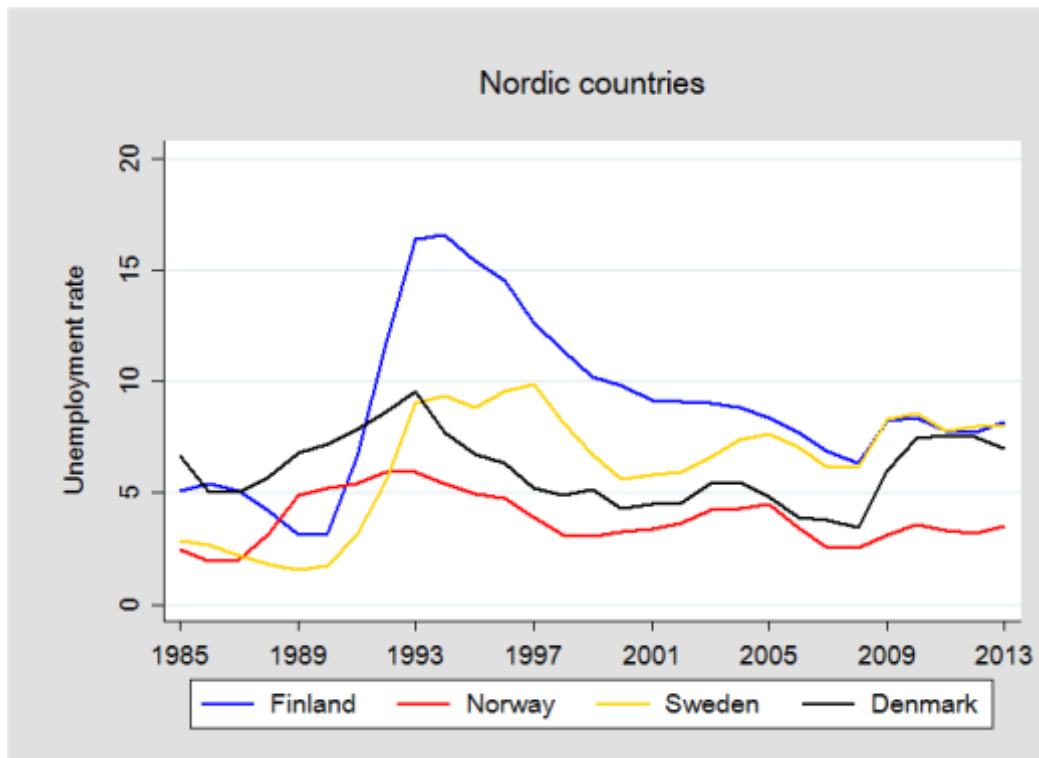
Figure 2 plots the evolution of unemployment in Western Europe where Austria and Switzerland stand out as countries with stable and low unemployment rates throughout the period. As for Germany, the biggest changes in its employment performance are seen in the adjustment period of German unification from 1990 to the beginning of 2000s. East Germany was poor and unemployment there was much higher than in West Germany. For many years Germany was called the "sick man of Europe" contrary to the last ten years' outstanding economic performance within the European Union. An important factor behind the German recovery was the so-called Hartz reforms introduced in 2002–2005. They liberalised the whole German labour market and consisted of a myriad of measures, such as creating low paid mini- and midi-jobs with limited social security contributions, liberalising temporary agency work, improving the matching efficiency of the labour market (i.e. skills offered and demanded are better and faster met) and providing more incentives to work longer. It has been argued that these reforms are a major reason why Germany today stands out as a country having managed to prevent employment from falling substantially during the global financial crisis.[6] (Hüfner & Klein, 2012, 5–8.) What is more, Figure 2 shows that Ireland has encountered high unemployment rates in the late 1980s and it is among those countries which have seen their unemployment soaring the most during the global

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[6] Other factors might have contributed to this as well. These include for example differences in German demographics, sectoral composition and labour shortage before the crisis. (Hüfner & Klein, 2012, 6.)

financial crisis. On the other hand, the country saw a low unemployment period in the first half of the 2000s. As for the other West European countries, Belgium, the Netherlands and the United Kingdom have had a moderately decreasing overall trend. By 2013, these three countries had similar unemployment levels as the Nordic countries. The unemployment rate in France has remained around 10% throughout the study period. Overall, the unemployment rates ranged from around 5% (Switzerland) to 13% (Ireland) in 2013.

Figure 2. Unemployment rates in Western Europe during 1985–2013
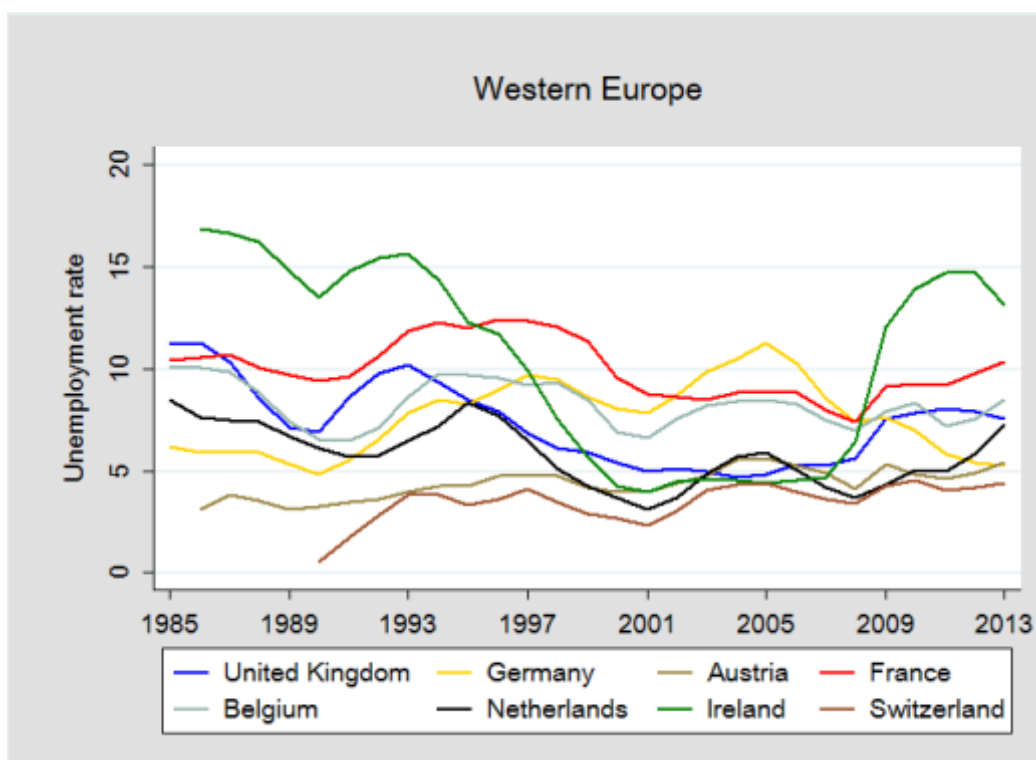
Note: Austria and Ireland starting from 1986 and Switzerland from 1990.
Sources: OECD Main Economic Indicators and OECD Economic Outlook database.

Figure 3 depicts the unemployment rate patterns for Southern Europe. Spain has a history of high unemployment throughout the 1980s and 1990s followed by lower unemployment during 2000–2007. Among this group of countries Italy has experienced relatively steady rates compared to Portugal, Greece and Spain which have all suffered a great deal from unemployment since the financial crisis. The European sovereign debt crisis slowed the recovery process further in these three countries. In 2013, the unemployment rates hiked around 27% in Greece and Spain, 16% in Portugal and 12% in Italy.

Figure 3. Unemployment rates in Southern Europe during 1985–2013
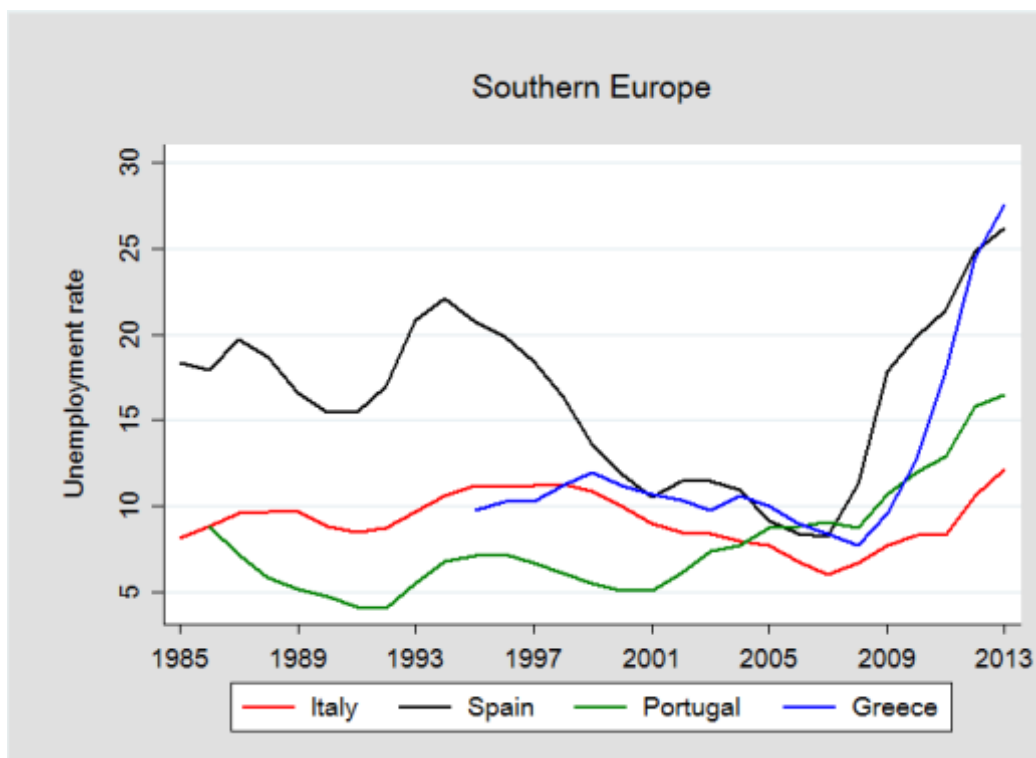

Note: Portugal starting from 1986 and Greece from 1995.
Sources: OECD Main Economic Indicators and OECD Economic Outlook database.

Figure 4. Unemployment rates in countries outside Europe during 1985–2013
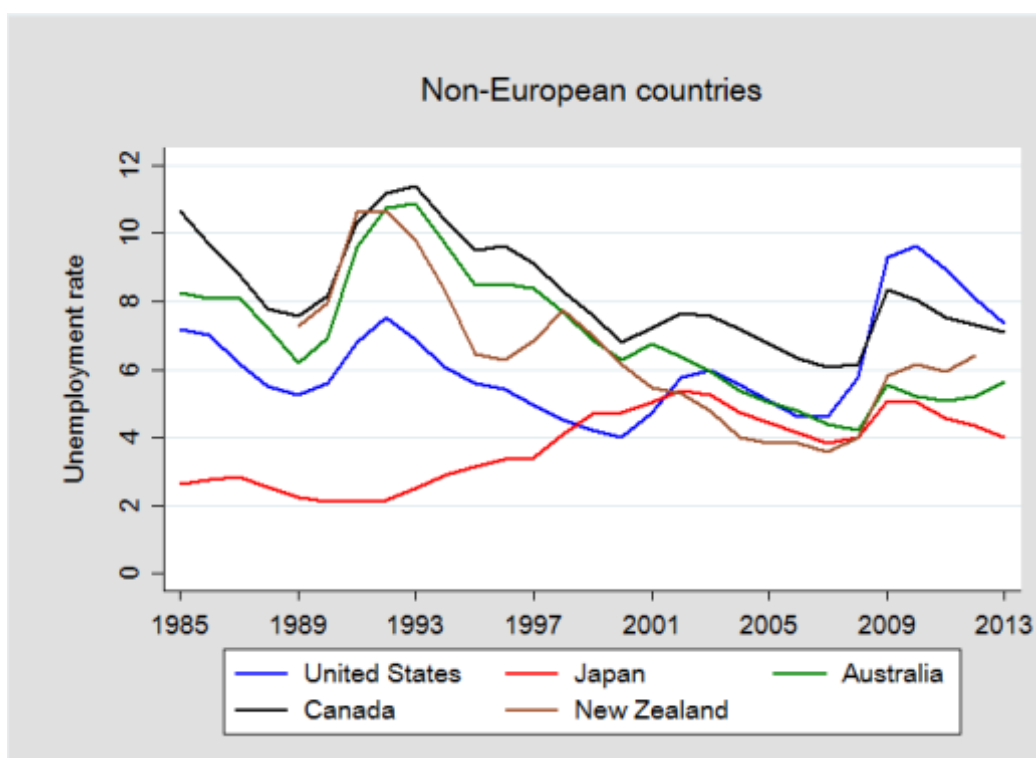
Note: New Zealand from 1989 to 2012.
Source: OECD Main Economic Indicators.

Figure 4 includes the five non-European countries of the sample and it can be seen that these countries have had lower unemployment rates than many European countries. Apart from the global 1990s recession all the countries have experienced lower than 10% unemployment rates. Unemployment in Japan was very low (around 3%) until 1993 when it started to rise but it still remained under 6% during the whole period. Except for Japan, other non-European countries have seen a downward trend in unemployment from 1985 till the global financial crisis of 2007–2008 which hit the United States most severely with unemployment increasing from 4.6% in 2006 to almost 10% in 2010. The unemployment rates ranged from 4% (Japan) to 7.4% (the United States) in 2013.

All in all, the most pronounced unemployment rate fluctuations have erupted during economic booms and busts but an interesting question is why some countries face a rising trend (Japan) while some others have seen a decreasing trend (for example New Zealand and Australia). Yet again, some countries have endured a relatively stable but high unemployment (e.g. France). As mentioned earlier, labour market institutions are one part of the explanation but regulation might also play a role. The impact of product market deregulation on unemployment is further explored in chapter 5. The next section shows the development of the mark-up.

4.2. Mark-up

Figures 5–8 illustrate how the average mark-ups have evolved during the sample period. The mark-up is a measure of economic rents (excess profits) and it serves as the indicator of the extent of competition in the economy. There are economic rents in the economy if the mark-up measure is above 1. The variable itself is calculated as the amount of value-added over labour and capital costs:

$$\mu_{it} = \frac{Value\ added_{it}}{Labour\ Costs_{it}\ +\ Cost\ of\ Capital\ \mathrm{x}\ Net\ Capital\ Stock\ Volume_{it}} \quad (3)$$

where i and t denote country and year respectively. As in Griffith et al. (2007), the data includes private sector (i.e. public sector, agriculture and the real estate are excluded) whenever this was possible.[7] Annex 5 gives thorough definitions on the different components of the mark-up variable and lists the sectors used for each country. In comparison to the benchmark study, the main

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[7] Real estate was left out because it suffers from inflated values owing to increasing property prices.

difference in calculating the mark-up relates to the cost of capital and capital stock data. I use a constant 7% yield demand for the volume of net capital stock for each country over the period.[8] Griffith et al. (2007) apply the US 10-year government bond interest rate for the capital costs and compute capital stocks by using a perpetual inventory method. In the robustness section I estimate the model with the mark-up calculated by a time-varying cost of capital similarly to Griffith et al. (2007).

There are also other measures of competition that could be used, such as the Herfindahl index but it would necessitate firm level data and a well-defined definition for the relevant markets. In addition, the problem with these kinds of indicators is that high concentration or index score do not take into account a high threat of entry which means that the market is actually very competitive. (Griffith & Harrison, 2004, 35–36). Boone (2000), among others, shows that the mark-up is a better measure of competition.

The figures below indicate clearly that the mark-up follows a pro-cyclical behaviour, which is why year dummies are needed as controls when running the estimations. In order to take into account the impacts of country specific business cycles and trade shocks, the output gap and the real exchange rate are included as control variables. What is more, the figures show that the mark-ups have a clear upward trend in most of the countries. For this reason, country dummies are used in the specifications in section 5 as they control for bias stemming from different levels of increasing returns to scale.

Besides potential increasing returns to scale over time, another reason for the upward trend in the mark-up may be the decreased worker bargaining power in the short run. Recall the theory in Blanchard and Giavazzi (2003) discussed in section 2: a reduction in the union bargaining power means that workers are able to capture a smaller part of the rents, whereas firms get a larger share than before. However, in the long term excess profits in a sector should lead to new firms entering the market, hereby increasing competition and suppressing profits back to their original level. Griffith, Harrison and Simpson (2010) conclude that even though product market deregulation as such decreases the overall level of rents, the adjustment process can take a long time and it can be that the rent transfer effect dominates the entry effect. This seems to have happened during the sample period according to the figures below and Table 2 in section 4.4. where the development of union membership and collective bargaining coverage are reported.

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[8] Griffith & Harrison (2004) calculate a corresponding mark-up variable using a constant 10% cost of capital.

Figure 5. Mark-up over labour and capital costs in Nordic countries during 1985–2013
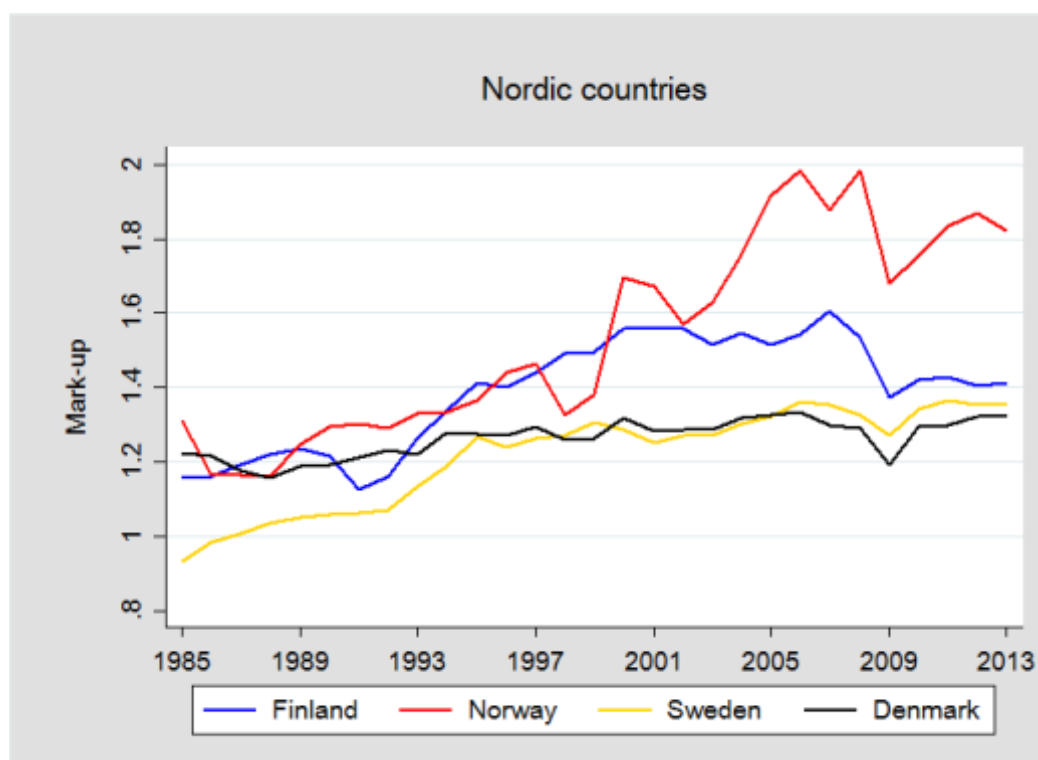
Sources: Own calculations based mainly on OECD STAN database and Eurostat databases.

When it comes to the Nordic countries (Figure 5), the mark-up has been quite steady in Denmark and Sweden and increasing in Finland and Norway which is an extreme case with a mark-up reaching almost 2 before the global financial crisis. The mark-ups in many West European countries (Figure 6) have also seen an upward trend (especially in the United Kingdom and the Netherlands) but there are also economies with stable development (e.g. France and Switzerland). As for the Southern European countries (Figure 7), Portugal and Greece stand out with slightly decreasing mark-ups over time compared to Italy and Spain where the trend has clearly been upward. As for the countries outside Europe, Figure 8 shows that Japan is the only country where mark-ups have decreased during the period. The United States has experienced a stable mark-up amounting to around 1.4 throughout the sample years. Overall, it seems that for most of the countries the mark-ups have increased in a faster pace until the 2000s when they turned to a more stable evolution. What is more, the figures show that the level of the mark-up differs substantially between countries.

Figure 6. Mark-up over labour and capital costs in Western Europe during 1985–2013
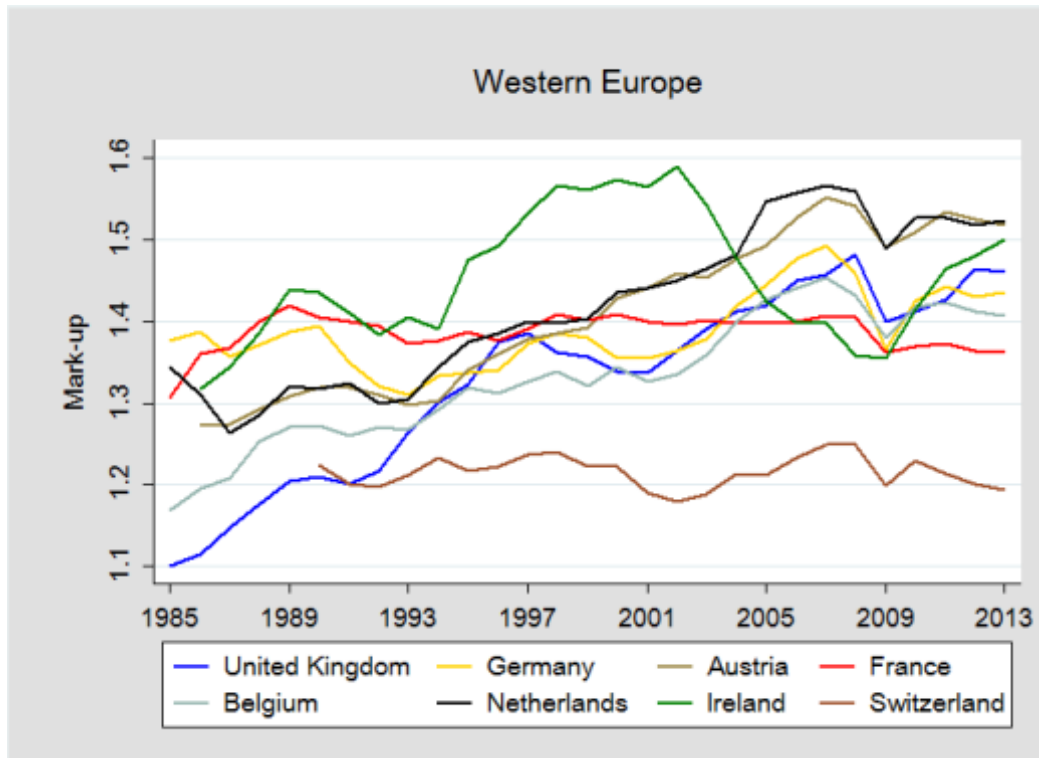
Note: Austria and Ireland starting from 1986 and Switzerland from 1990.
Sources: Own calculations based mainly on OECD STAN database and Eurostat databases.

Figure 7. Mark-up over labour and capital costs in Southern Europe during 1985–2013
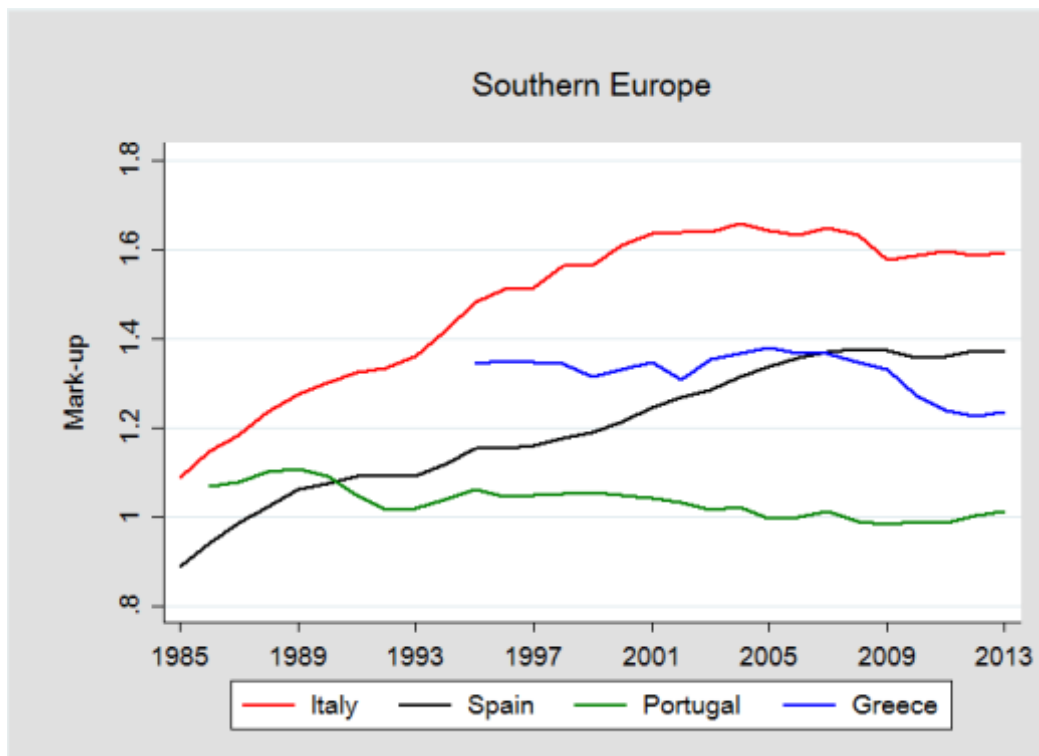
Note: Portugal starting from 1986 and Greece from 1995
Sources: Own calculations based mainly on OECD STAN database and Eurostat databases.

Figure 8. Mark-up over labour and capital costs in countries outside Europe during 1985–2013
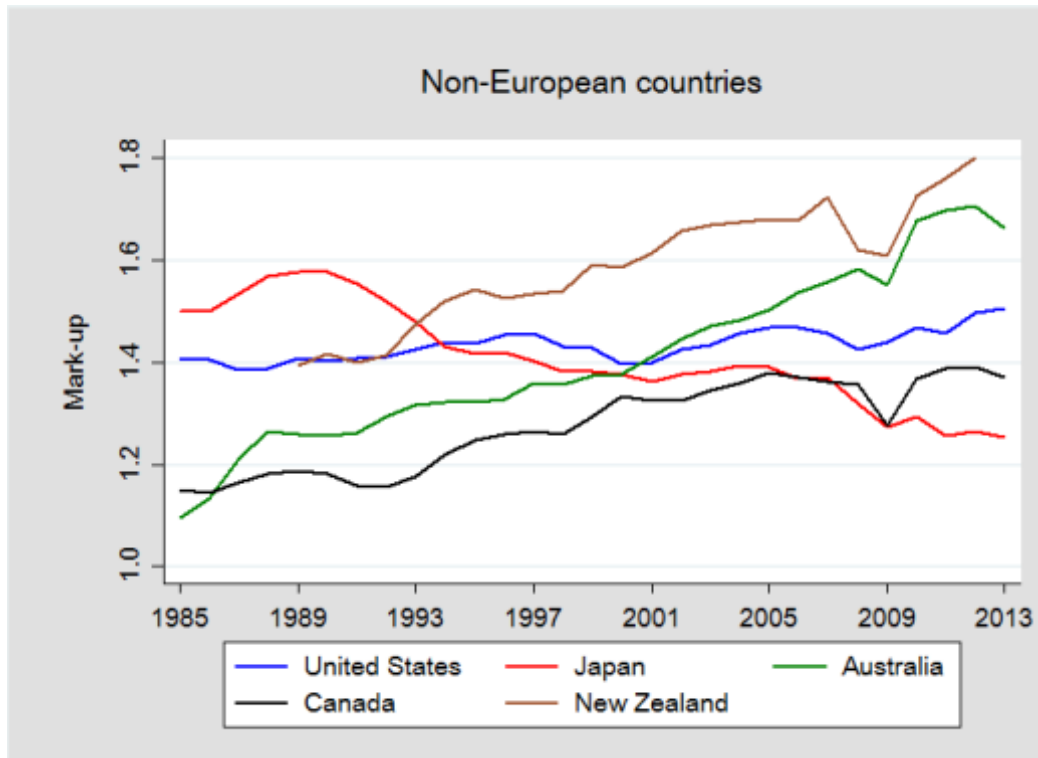
Note: New Zealand from 1989 to 2012.
Sources: Own calculations based mainly on OECD STAN database and Eurostat databases.

Figure 9 plots the correlation between the unemployment rate and the mark-up. There is a modest negative relationship between the two variables as reported by the Pearson correlation coefficient which is significant at the 5% level. Hence, a fall in unemployment is associated with a rise in economic rents, which is a contradictory relationship vis-à-vis the theoretical predictions.

Figure 9. Correlation between the unemployment rate and the mark-up
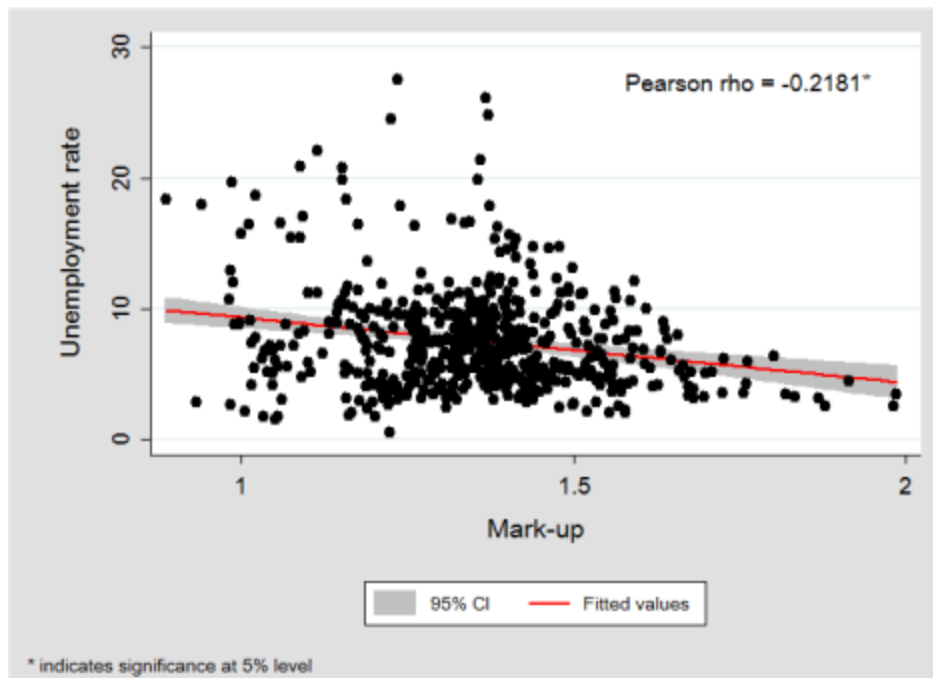
4.3. Product market regulation (PMR)

This section describes the regulatory stance and developments in the past for the sample countries. Firstly, the OECD product market regulation (PMR) indicators are touched upon and secondly, Fraser Institutes' (FI) economic freedom indicators are presented. Thirdly, correlations between these two indicators, the unemployment rate and the mark-up are shown. The indicators include only the ones that are used in the empirical model of section 5 and they were chosen according to their statistical significance with regard to the estimation results.

4.3.1. OECD product market regulation indicators

The OECD launched the product market regulation indicators first time in 1998 and since then data has been collected in 2003, 2008 and 2013. For the years 1985–1997, I have extrapolated the indicator scores backwards using the 1998 value. In addition, from 1998 on the available data points are mapped forward until a new data point is available. The indicators have been constructed using information from governments of OECD and non-OECD countries (through a questionnaire) and the indicator values range from 0 (competition-friendly/no regulation) to 6 (extreme regulation). Koske, Wanner, Bitetti and Barbiero (2015) provide a detailed description of the OECD PMR database. The figures below show that the most unregulated countries tend to be the United Kingdom, New Zealand, Australia and the United States even though there are also exceptions in case of some specific regulations.

Figure 10 describes the extent of state control in the economy by showing two facets, public ownership and state involvement in business operations. There are several ways how government involvement may impact the economy. One is that publicly-owned enterprises might be less efficient than private ones as pointed out in Griffith and Harrison (2004). Moreover, state monopolies exert market power and hence, are able to deter entry, which hinders competition. Yet, state subsidies might support inefficient firms to survive in the market but on the other hand government investment in public goods can reduce costs of private producers and thus increase efficiency.

The indicator for public ownership includes factors such as government involvement in network sectors, direct control over enterprises and the scope and governance of state-owned enterprises. Direct control over enterprises is defined as constraints to the sale of government stakes in publicly-controlled firms and the existence of government special voting rights in privately-owned firms. The second facet of state control – involvement in business operations – incorporates price

controls in 8 sectors and the command and control regulation stating to which degree the state uses either incentive-based or coercive regulation.

During the period of 1998–2013 there has been substantial deregulation especially when it comes to state being involved in business operations. In many countries there has also been a reduction in public ownership although to a lesser extent and it remains as one of the highest scoring areas of regulation. The sectors falling under tighter state control are usually network sectors which are important for a country's infrastructure (Koske et al., 2015, 33). These are for example post services, energy and transport.

Figure 10. OECD product market regulation indicators: extent of state control
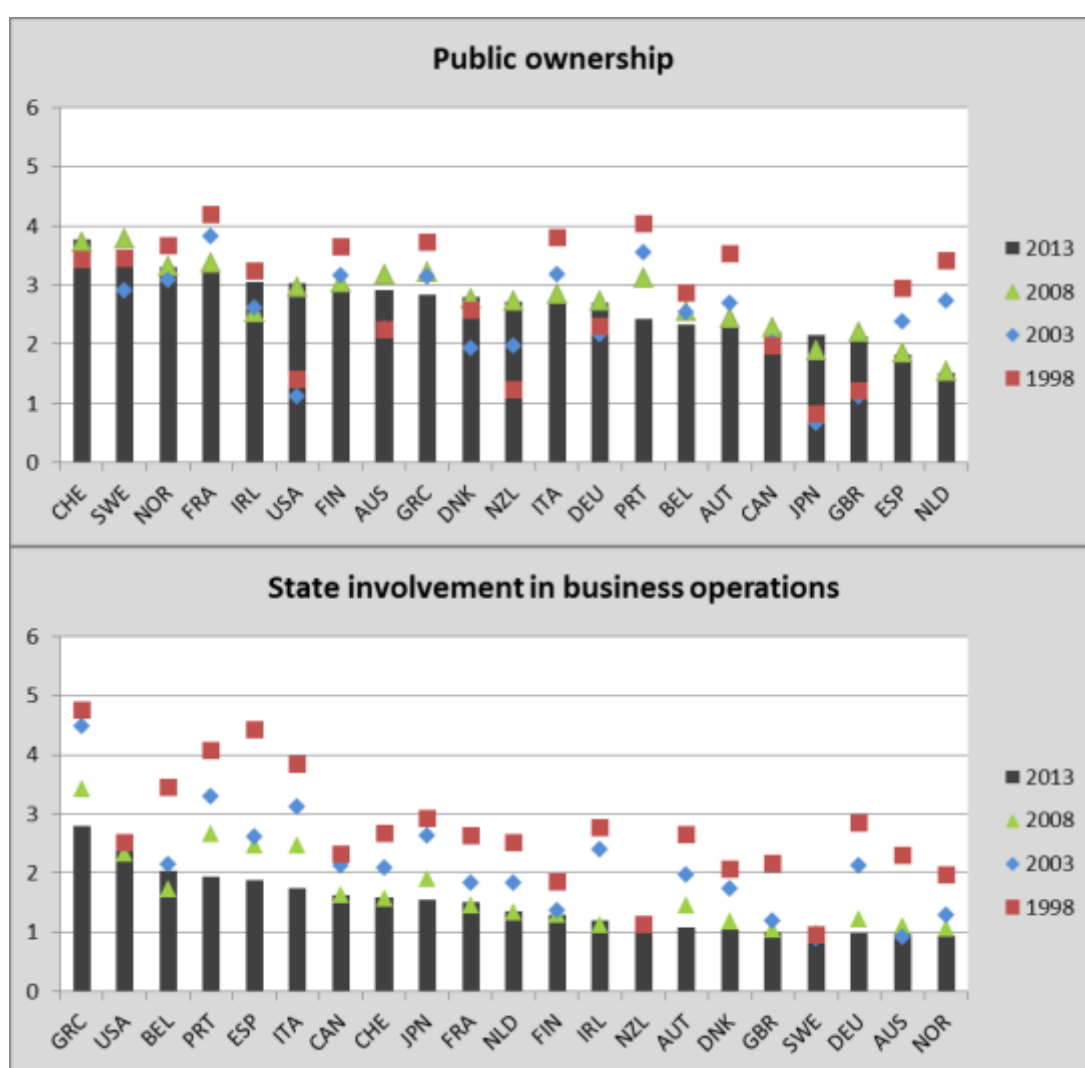
Note: New Zealand till 2012. Indicator scale 0 to 6 from least to most restrictive.
Source: OECD Product Market Regulation database.

Figure 11 illustrates the regulation indicator taking into account the difficulties of creating an individual enterprise or a public limited company. These burdens involve, among other things, the number of procedures and working days required to register a company and the total costs of the

registration. Time- and money-consuming procedures may hinder entry and firms' expansion, which is why they act as obstacles for increasing competition. The indicator also considers entry barriers in professional services, retail distribution and freight transport services which have a higher score than the creation of a new business. The three subcategories (individual firm and corporation establishment and barriers in services) have an equal weight within "administrative burdens on start-ups". Since the average score of barriers in services (3.41) is higher than the one for sole proprietors (1.32) and corporations (1.99), the average for the indicator is 2.24. It can be seen that during 1998–2013 there have been measures taken to reduce administrative barriers for establishing a firm in almost all countries.

Figure 11. OECD product market regulation indicators: administrative burdens on start-ups

Note: New Zealand till 2012. Indicator scale 0 to 6 from least to most restrictive.
Source: OECD Product Market Regulation database.

Figure 12. OECD product market regulation indicators: complexity of regulatory procedures
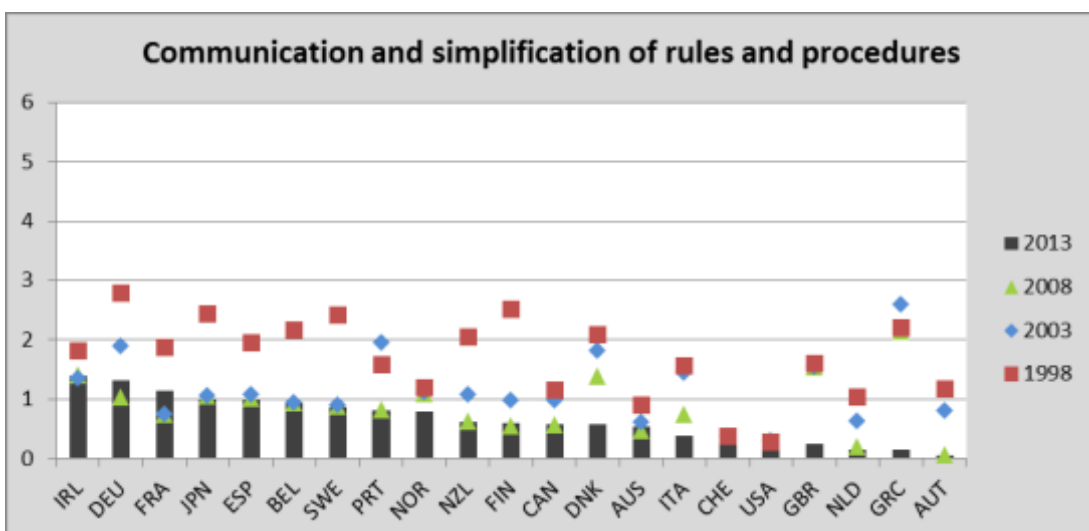
Note: New Zealand till 2012. Indicator scale 0 to 6 from least to most restrictive.
Source: OECD Product Market Regulation database.

The "communication and simplification of rules and procedures" (Figure 12) is an indicator describing the complexity of regulatory procedures and it specifies the communication strategy of the government and the efforts to reduce and simplify the administrative burden of interacting with the public authority. This indicator shows that some countries have moved to practically inexistent regulation.

Figure 13 presents the indicators related to regulatory protection of incumbents, namely legal barriers to entry and entry barriers in network sectors (e.g. gas and electricity). Legal barriers involve laws or other regulations that restrict the number of competitors in different sectors. The figure shows clearly that entry barriers especially in network sectors have been tight in the past and that there has been considerable deregulation from 1998. For example Greece and Italy stand out as countries where the score has dropped from almost 6 to less than 3.

Figure 13. OECD product market regulation indicators: regulatory protection of incumbents
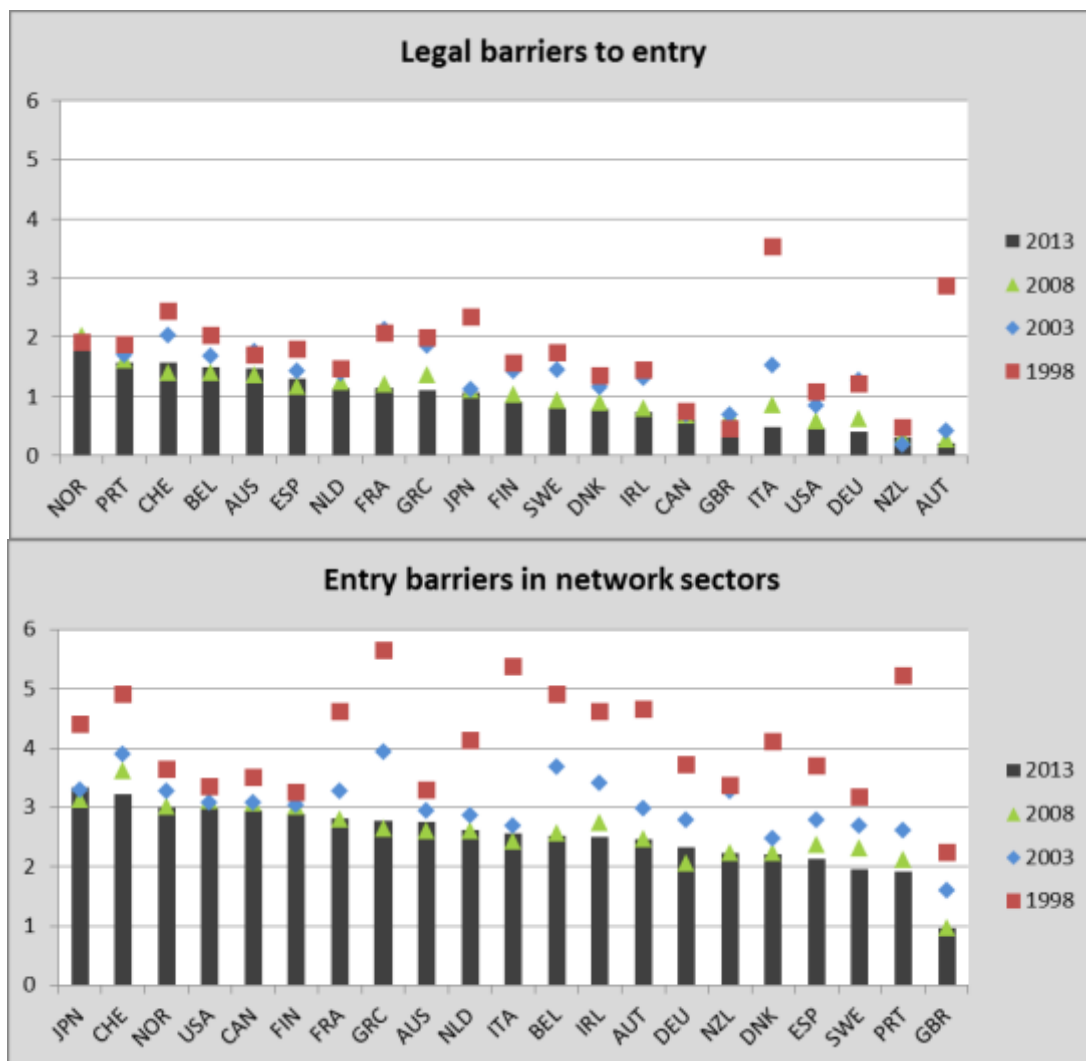
Note: New Zealand till 2012. Indicator scale 0 to 6 from least to most restrictive.
Source: OECD Product Market Regulation database.

The last group of OECD indicators, barriers to trade and investment, is reported in Figure 14. Theory and empirical evidence imply that reducing constraints on goods and services flows increase competition (decrease the mark-up). These indicators consist of tariff barriers (cross-product average of tariffs) and other barriers to trade and investment. The definition of the former is straightforward and the latter incorporates differential treatment of foreign suppliers and barriers to trade facilitation. In other words, other barriers to trade and investment refer to situations where foreign firms are discriminated e.g. with respect to taxes and subsidies, entry regulation and public procurement. In addition, those regulations may not recognise foreign and international regulatory standards. In comparison to the other OECD indicators barriers to trade and investment have very low scores starting from 1998. When it comes to tariff barriers, there is zero variation in tariff rates across European countries because the rates were harmonised within the European Community before 1998.

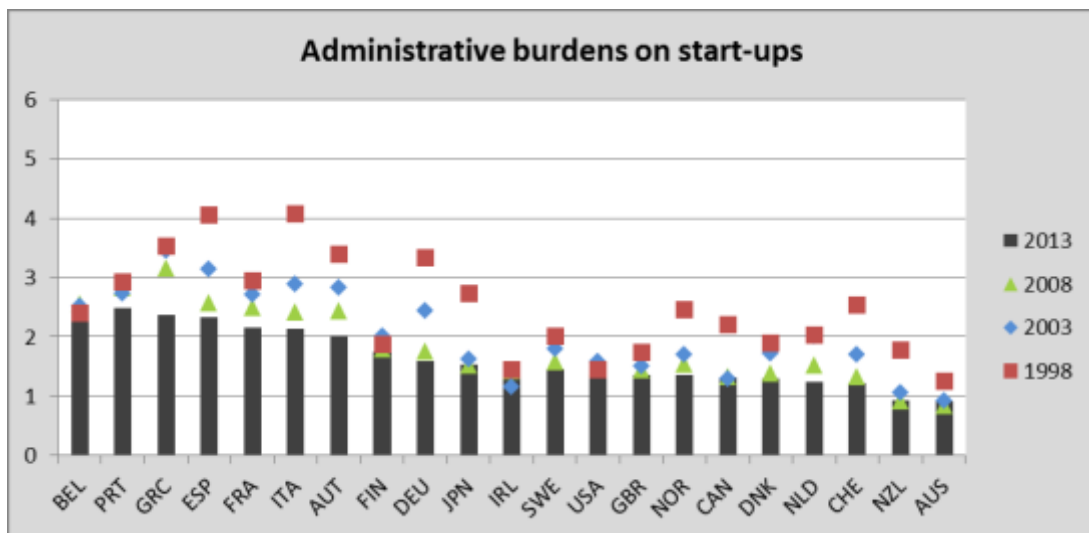**Figure 14. OECD product market regulation indicators: barriers to trade and investment**
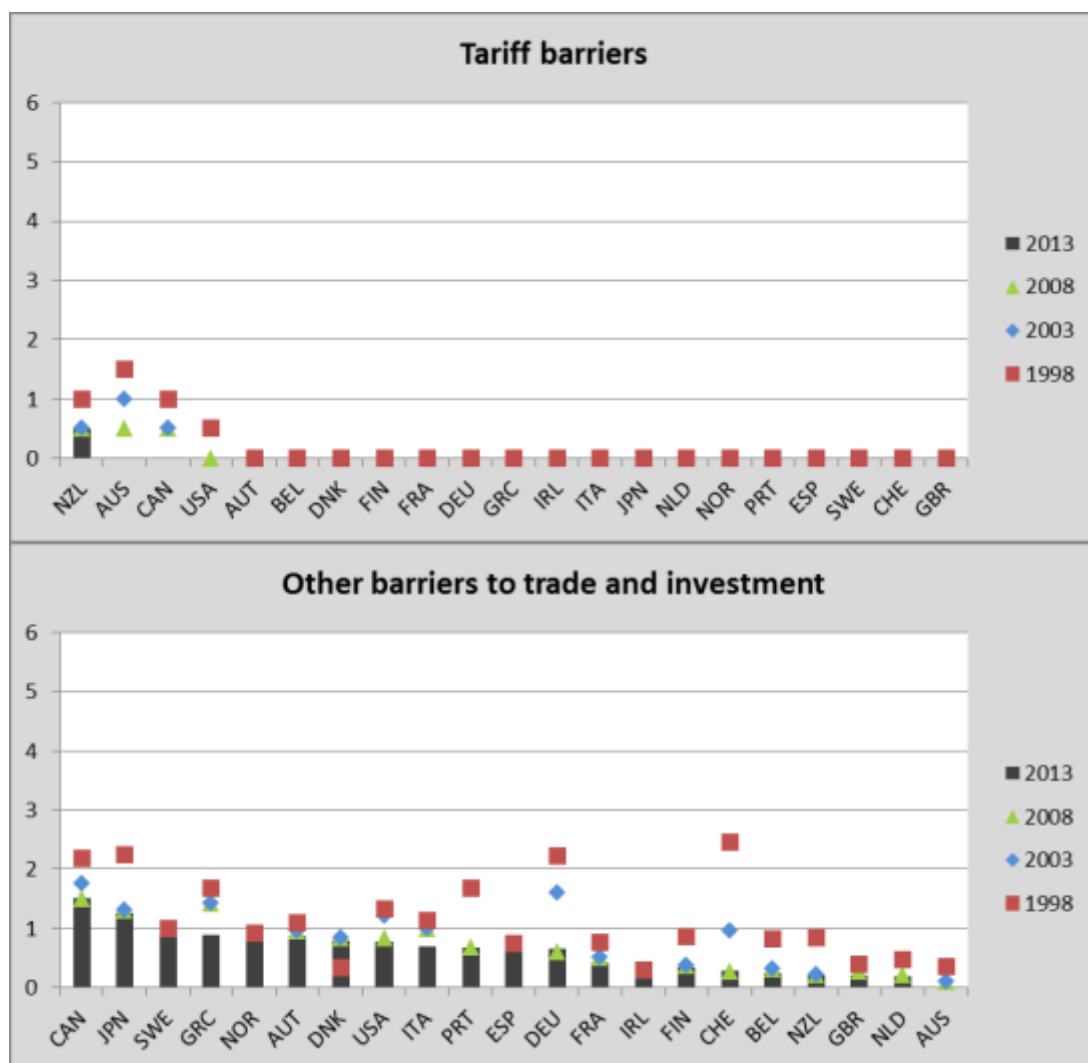
Note: New Zealand till 2012. Indicator scale 0 to 6 from least to most restrictive.
Source: OECD Product Market Regulation database.

4.3.2. Fraser Institute's (FI) economic freedom indicators

Fraser Institute provides information on the degree of policies and institutions supportive to economic freedom. The advantage of using these indicators is that the data has been collected regularly from 1970 (though not in all areas of the economy), first every five years and then every year from 2000 on. The FI variables used in this study have data points available either starting from 1995 or 1985. For those indicators that start from 1995, the values between 1985 and 1994 are extrapolated backwards using the 1995 score. Otherwise, the scores are interpolated between the five years' cycle for those cases where the data availability covers the whole sample period. Gwartney, Lawson and Hall (2016) explain in detail the methodology of these indicators. The scores range from 0 (full regulation) to 10 (no regulation), i.e., the interpretation of the scale is reversed compared to the OECD indicators.

Figure 15. Fraser Institute's economic freedom indicators: size of government
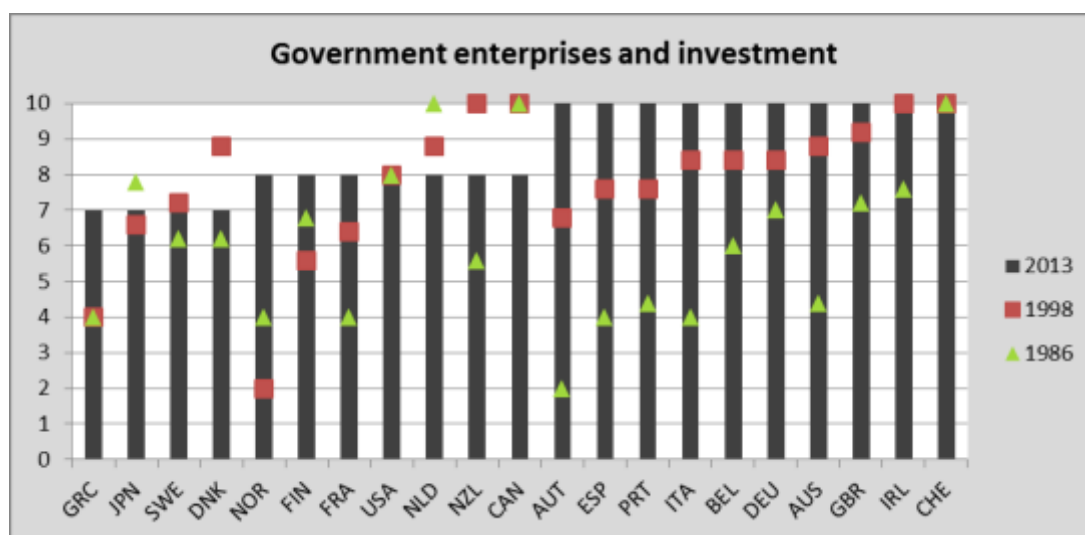
Notes: Instead of 1986 value: 1995 for Greece, 1989 for New Zealand and 1990 for Switzerland. New Zealand till 2012. Indicator scale 0 to 10 from most to least restrictive.
Source: Fraser Institute's 2016 Economic Freedom dataset.

Figure 15 gives information on the size of government. More precisely, the indicator has been formed using government investment as a share of total investment in the economy. For example, when the government investment share is less than 15% of total investment, the country is assigned to a score of 10. A rating of 7 is given to a country when the government investment share ranges between 20% and 25%. The figure shows that in most of the countries the share of government investment has decreased over the years.

When it comes to average tariff rates and regulatory trade barriers (Figure 16) the picture is very similar to the OECD indicators: tariffs have been almost inexistent since the mid-1980s in Europe

and fairly low in non-European countries. However, non-tariff trade barriers have become stricter since 1995 when they were relatively low. The score of this indicator is based on a question whether tariff and non-tariff barriers significantly reduce the ability of imported goods to compete in the domestic market. Hence, this variable is less clearly defined than the OECD PMR indicator on other barriers to trade and investment. Nevertheless, Japan and Switzerland are the most regulated countries in this regard.

Figure 16. Fraser Institute's economic freedom indicators: tariffs and regulatory trade barriers
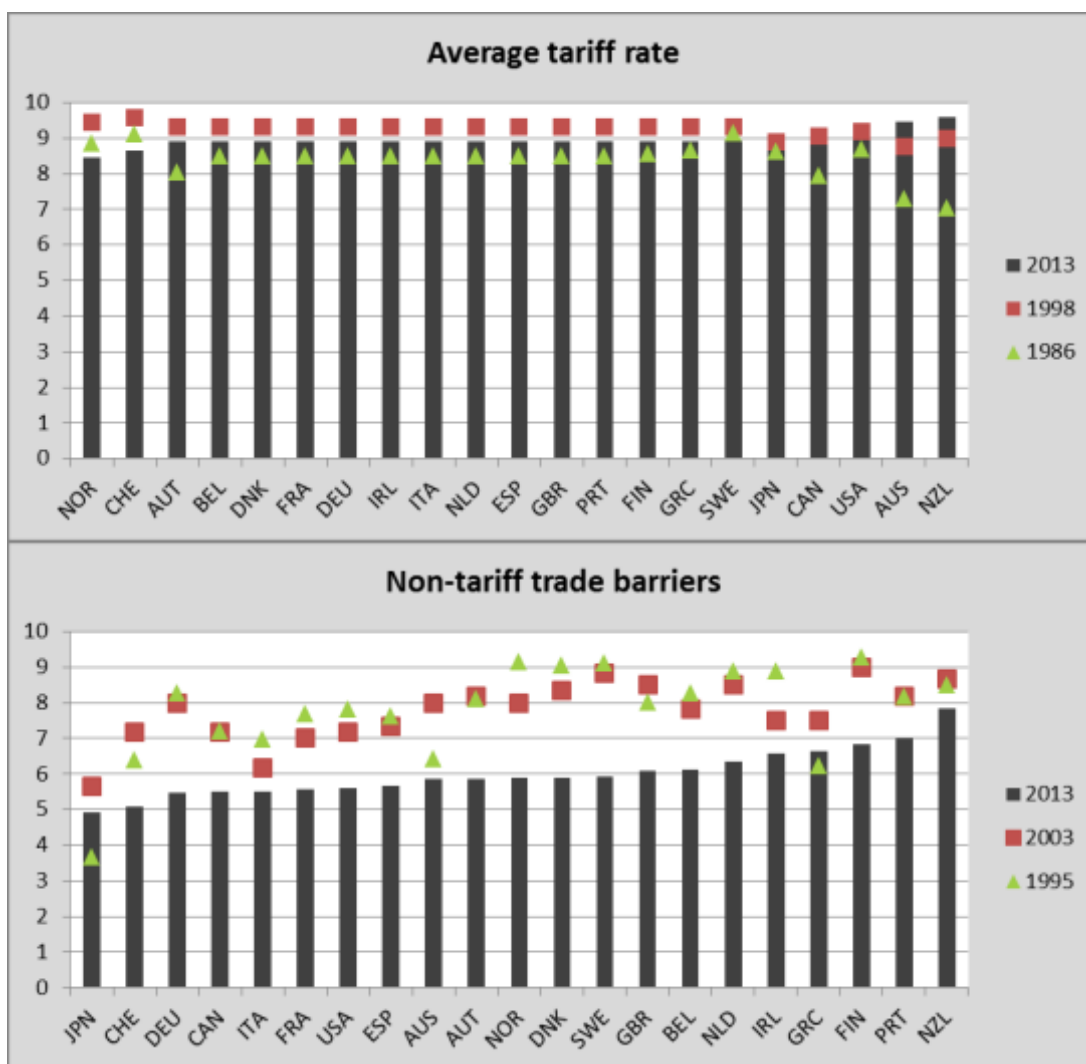
Notes: Instead of 1986 value: 1995 for Greece, 1989 for New Zealand and 1990 for Switzerland. New Zealand till 2012. Indicator scale 0 to 10 from most to least restrictive.
Source: Fraser Institute's 2016 Economic Freedom dataset.

Turning to controls of the movement of capital (Figure 17) one can see that in most of the sample countries capital controls first decreased from 1986 to 1998 and then increased from 1998 to 2013. This measure takes into account 13 types of international capital controls. As for the second component of Figure 17 – foreign ownership and investment restrictions – the scores amounted to

competition-friendly values in 1995 and have since then dropped down toward lower competition. This indicator is compiled by information from two different questions, one asking about the prevalence of foreign ownership of companies in the country and the second inquiring about the restrictiveness of the regulations regarding international capital flows which may affect the level of investments in the economy.

Figure 17. Fraser Institute's economic freedom indicators: controls of the movement of capital
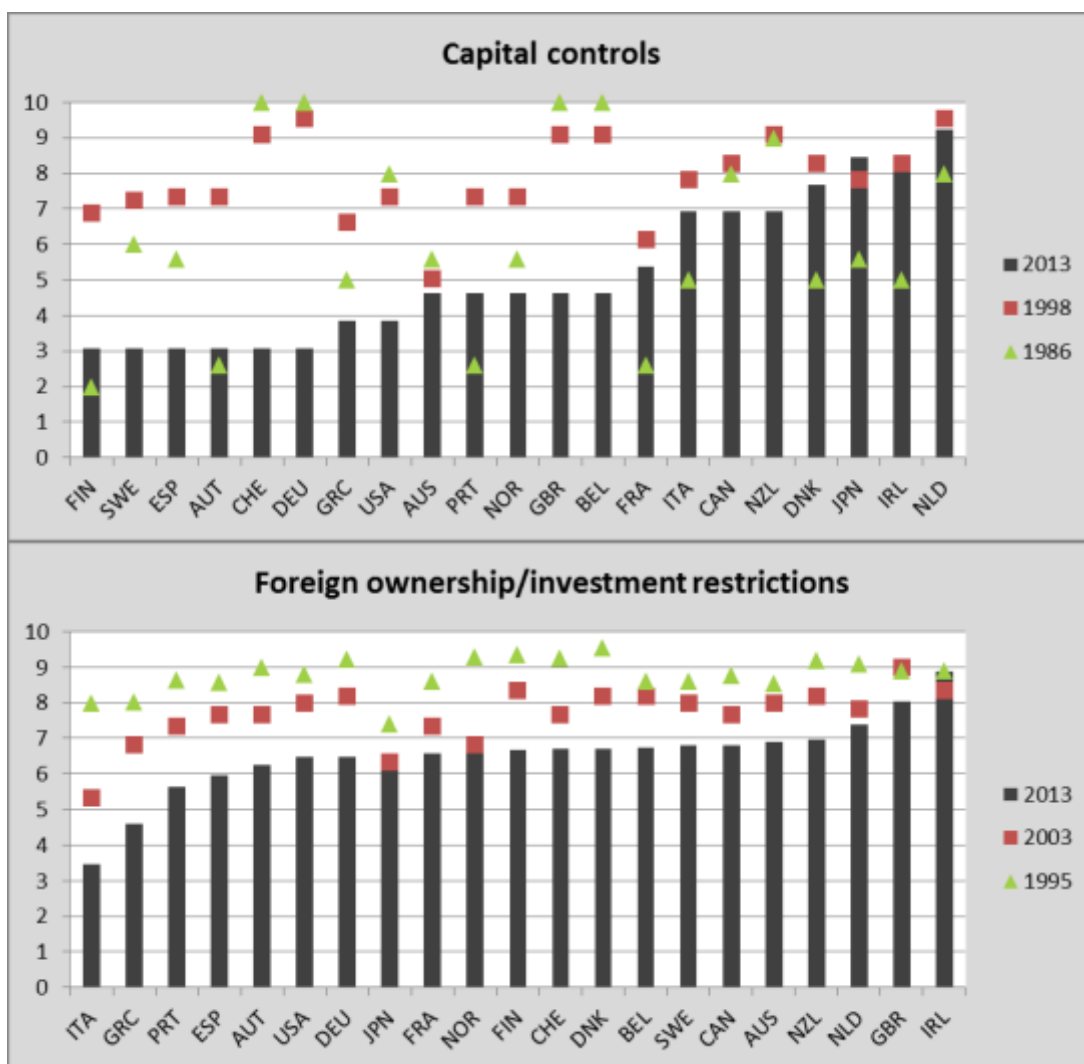
Notes: Instead of 1986 value: 1995 for Greece, 1989 for New Zealand and 1990 for Switzerland. New Zealand till 2012. Indicator scale 0 to 10 from most to least restrictive.
Source: Fraser Institute's 2016 Economic Freedom dataset.

Figure 18 plots the relationship between government borrowing in relation to private sector borrowing and this indicator is part of the more general credit market regulations. If governments borrow to a great extent compared to the private sector, it is an indication about a high central planning in the economy (hence, a low score). Approximately 50% of the countries have experienced an increase in private sector credit compared to government borrowing during the

period. In 2013, borrowing was conducted entirely by the private sector in Germany, Canada, Switzerland and Norway.

Figure 18. Fraser Institute's economic freedom indicators: credit market regulations

Notes: Instead of 1986 value: 1995 for Greece, 1989 for New Zealand and 1990 for Switzerland. New Zealand till 2012. Indicator scale 0 to 10 from most to least restrictive.
Source: Fraser Institute's 2016 Economic Freedom dataset.

Figure 19. Fraser Institute's economic freedom indicators: business regulations
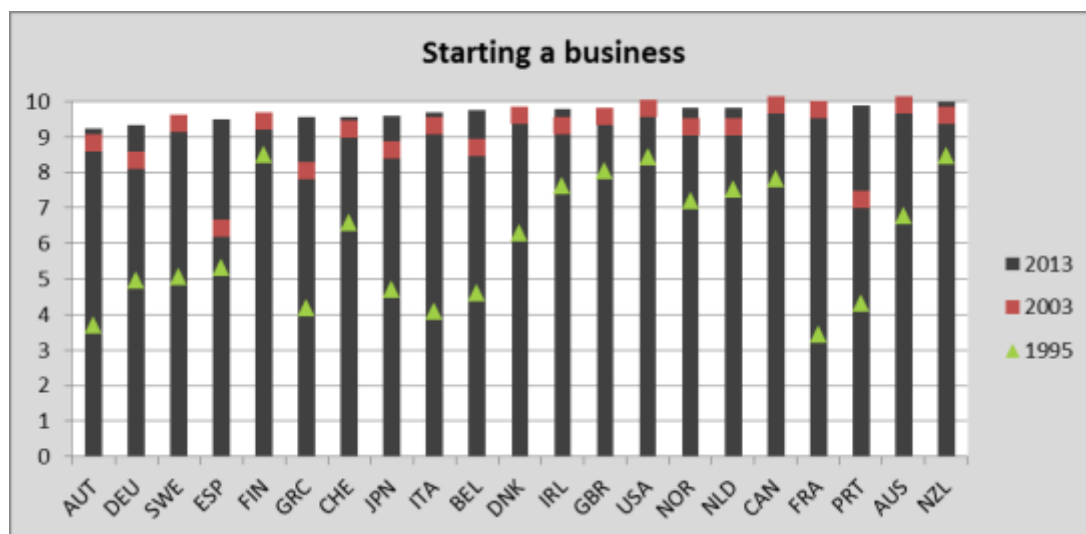
Notes: New Zealand till 2012. Indicator scale 0 to 10 from most to least restrictive.
Source: Fraser Institute's 2016 Economic Freedom dataset.

The last economic freedom indicator presented in this section (Figure 19) shows how difficult it is to establish a new limited liability business. This measure takes into account three conditions necessary in the process of starting a business. The first one considers the amount of days needed in the whole process. The second incorporates monetary costs, such as fees to be paid to regulatory authorities. The third reports minimum capital requirements, i.e., the amount of funds that are required to be deposited into a company bank account. Figure 19 illustrates clearly the

development from a money and time-consuming procedure to an almost entirely deregulated situation between 1995 and 2013.

4.3.3. Correlations between regulation, the mark-up and the unemployment rate

This section provides correlations between the above-mentioned indicators, the unemployment rate and the mark-up and discusses the implied relationships between these variables. Each figure includes the Pearson correlation coefficient and the fitted values within a 95% confidence interval. Figures 20–23 describe the correlations between those OECD and FI indicators which roughly measure the same kind of regulation in the economy. For each case, the OECD PMR indicator is located on the x-axis, while the FI economic freedom indicator is on the y-axis. Figures 24a–c illustrate the connection between specific regulation indicators and the mark-up, while Figure 25 describes the relationship of the unemployment rate in regard to some of the regulation variables.

Figure 20. Correlation between OECD and Fraser Institute's indicators on the size of government

Pearson rho = -0.3027*

* indicates significance at 5% level
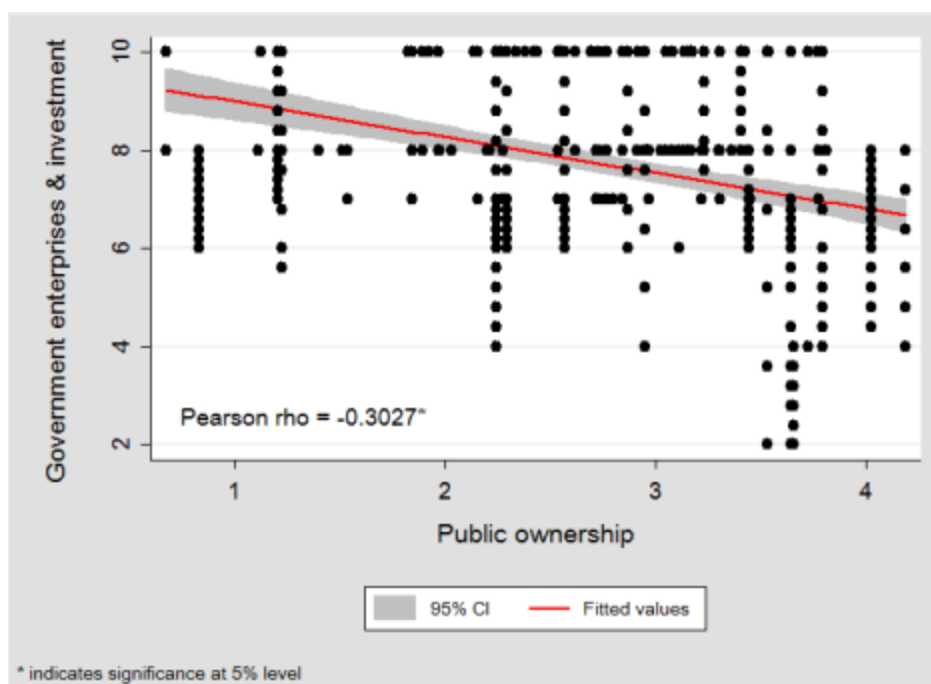
As expected, all the correlations in Figures 20–23 point to a negative relationship between the OECD PMR and FI indicators because the interpretation of the indicators is opposite. What is more, the Pearson correlation coefficients are significant at the 5% level. A coefficient of -0.6348 is found between indicators measuring the ease of establishing a firm. On the other hand, the pairwise correlation between indicators relating to the size of government, non-tariff barriers and

tariffs show a more limited relationship, the Pearson correlation coefficient ranging from -0.2767 to -0.3549.

Figure 21. Correlation between OECD and Fraser Institute's indicators on tariff barriers

Pearson rho = -0.3549*

* indicates significance at 5% level
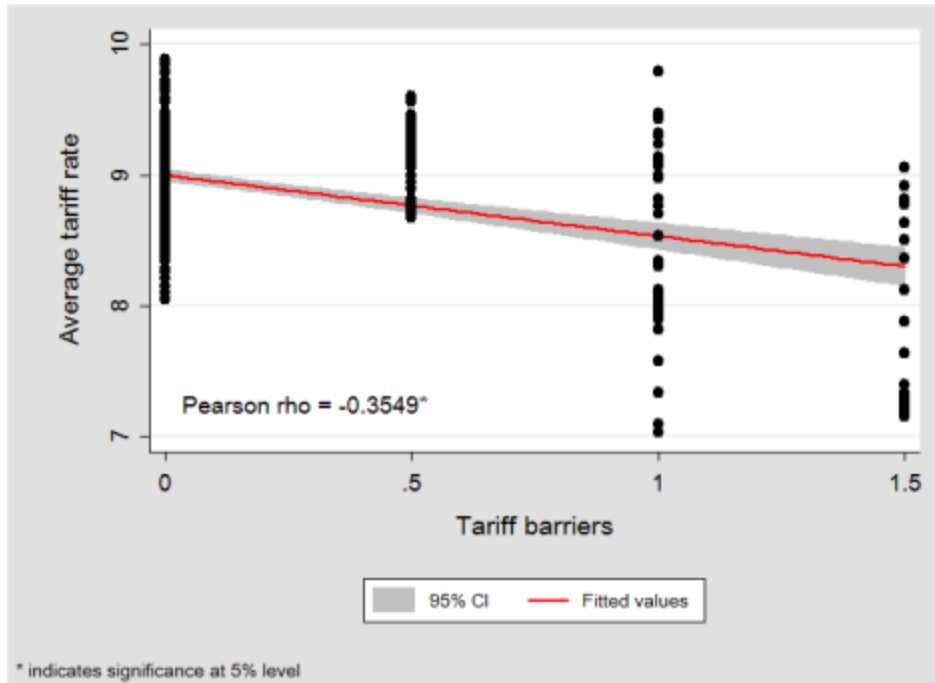
Figure 22. Correlation between OECD and Fraser Institute's indicators on non-tariff barriers

Pearson rho = -0.2767*

* indicates significance at 5% level
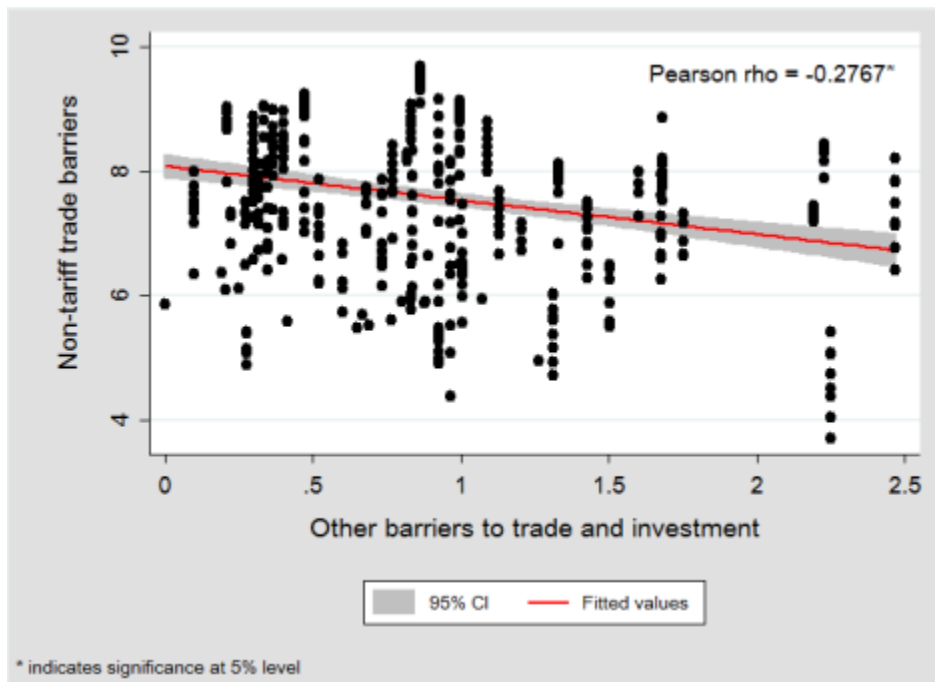
Figure 23. Correlation between OECD and Fraser Institute's indicators on starting a business
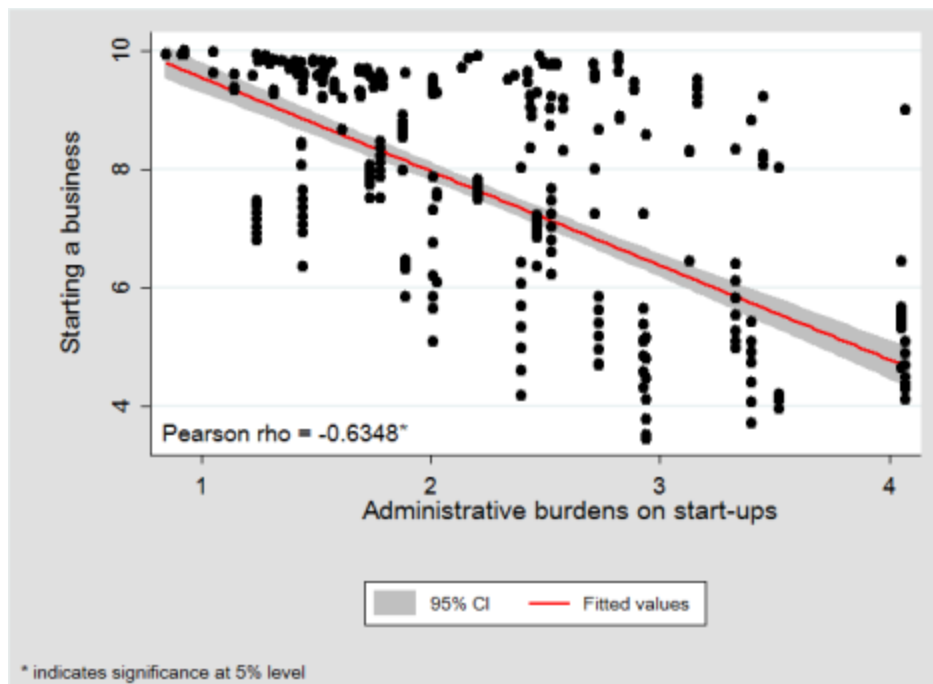
Figure 24a reports the link between state control indicators and the mark-up. The left-hand side shows the case with the FI measure for government investment, whereas the graph on the right depicts the correlation when the OECD public ownership indicator is applied. Firstly, the Pearson correlation coefficients suggest that there is a relationship between the regulation indicators and the mark-up even though the link is relatively low. Secondly, the direction of the connection is opposite comparing the two regulation indicators, which is a consistent finding since the interpretation of the indicators is reversed. Thirdly, both relationships have a logical interpretation: a reduction in publicly-owned enterprises is associated with an increase in economic rents. An explanation for this kind of linkage is that government producers do not necessarily seek maximal profits, thus they might set lower prices or have higher costs than private sector producers (Griffith & Harrison, 2004, 67).

Turning to indicators measuring the ease of starting a firm (Figure 24b), their relationship to the mark-up seems to be stronger than in the case of state control variables. The message from Figure 24b is interpreted the following way: rising mark-ups are associated with easier and less costly establishment of new firms. This link is found significant at the 5% level for both versions of the regulation indicator.

Figure 24a. Correlation between the mark-up and state control
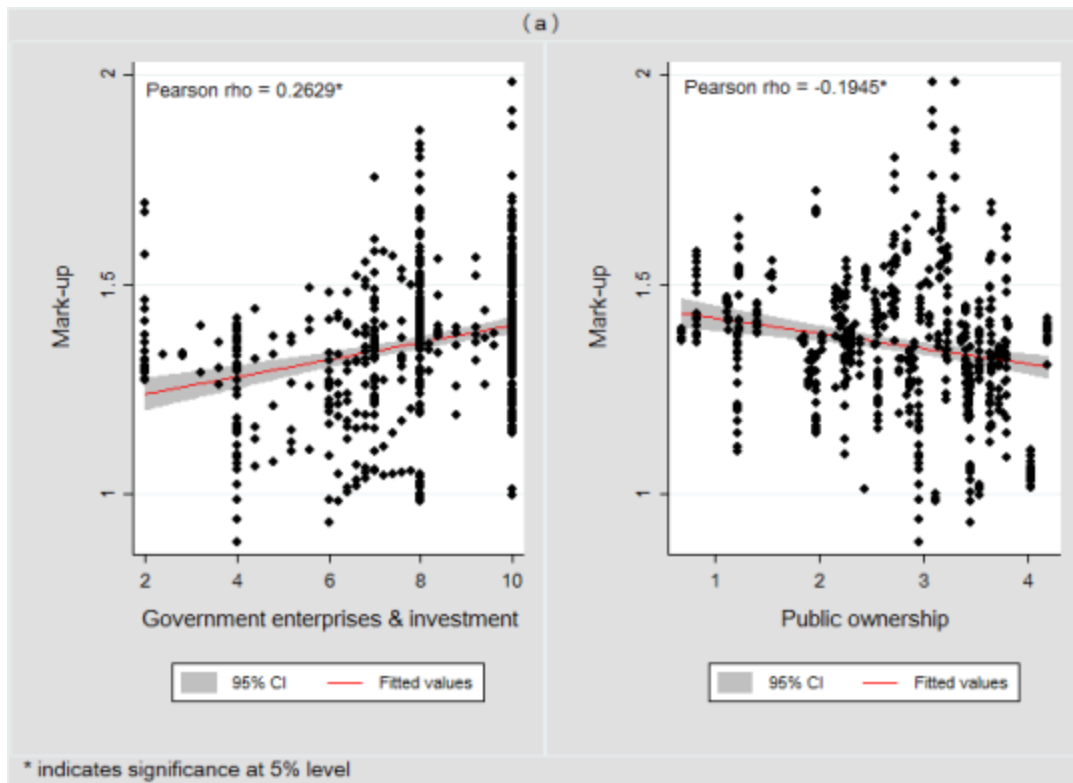
Figure 24b. Correlation between the mark-up and regulation on starting a business
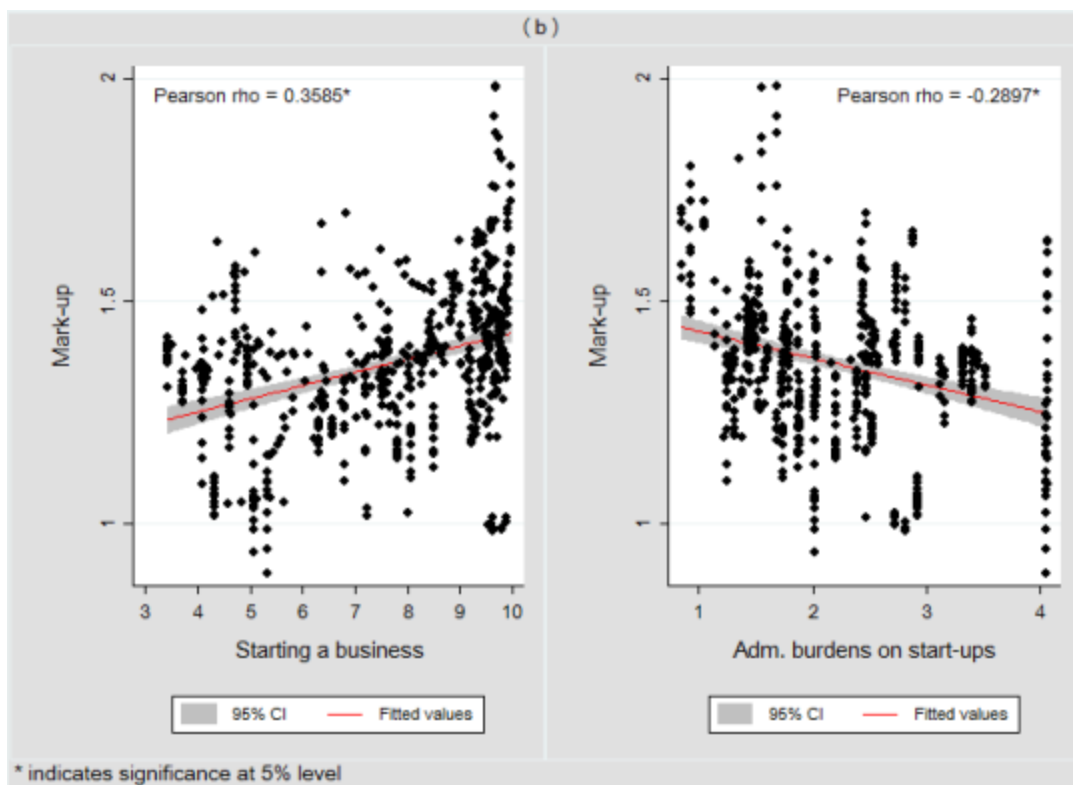
Figure 24c presents the correlations between the mark-up and regulation indicators measuring non-tariff barriers. Unlike in the two previous cases, the different regulation variables have an

analogous relationship with excess profits. In effect, the correlation with the mark-up is negative for both of them. The left-hand side correlation indicates that improving the ability of imported goods to compete in domestic markets is associated with a decrease in the mark-up, which is in line with theory. By contrast, the graph on the right states that facilitating trade by reducing the discrimination of foreign firms and acknowledging foreign standards is linked to a rise in the mark-up. This contradictory finding may be due to the somewhat different definition of the OECD and FI indicators. Moreover, as pointed out earlier, the strictness of non-tariff trade barriers (FI) has increased over time in most of the sample countries, while regulation on other barriers to trade and investment (OECD) has steadily decreased.

Figure 24c. Correlation between the mark-up and regulation on non-tariff trade barriers
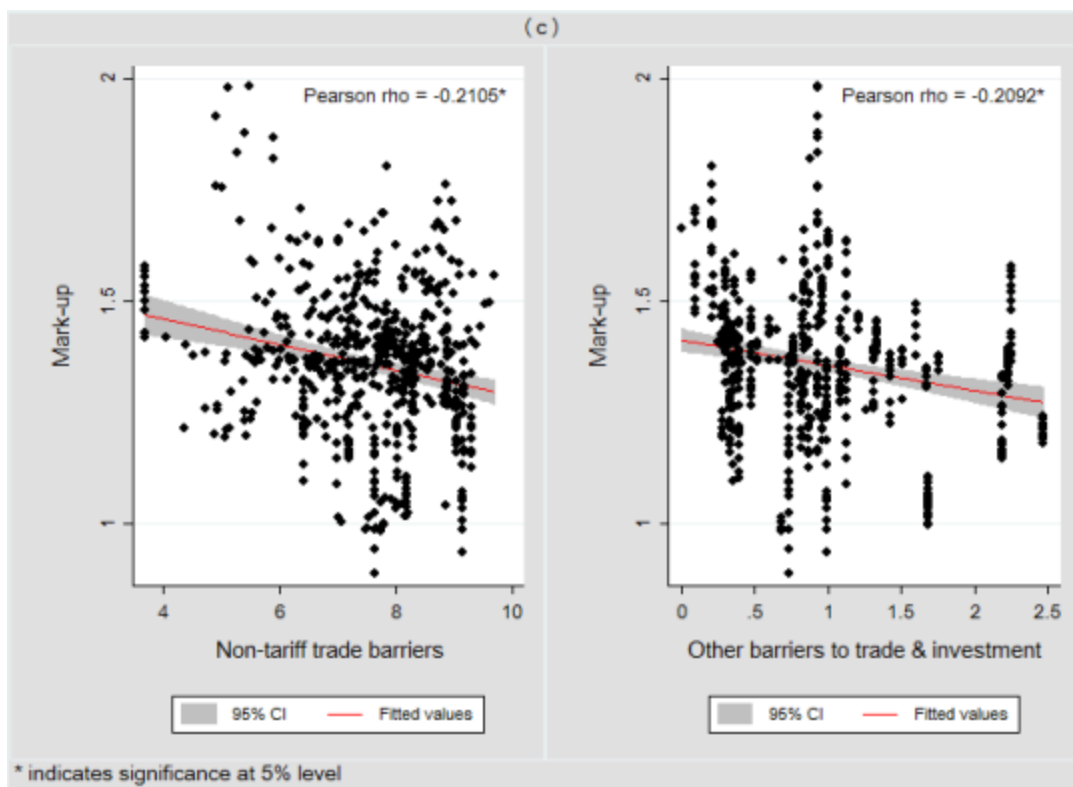
Finally, Figure 25 shows the relationship between the unemployment rate and four specific forms of regulation which have the strongest correlation with the unemployment rate. The first row of the graph includes FI indicators on average tariffs and the extent of private sector credit. The OECD PMR variables relating to state involvement in business operations and administrative burdens on start-ups are presented in the second row. The Pearson correlation coefficients indicate rather weak linkages although all of them are significant at the 5% level. The correlation graphs suggest that decreasing tariffs and increasing private sector credit compared to

government borrowing are associated with a fall in unemployment. Furthermore, the second row shows that reducing state involvement in business operations and simplifying business establishment are linked to lower unemployment.

Figure 25. Correlation between the unemployment rate and specific types of regulation
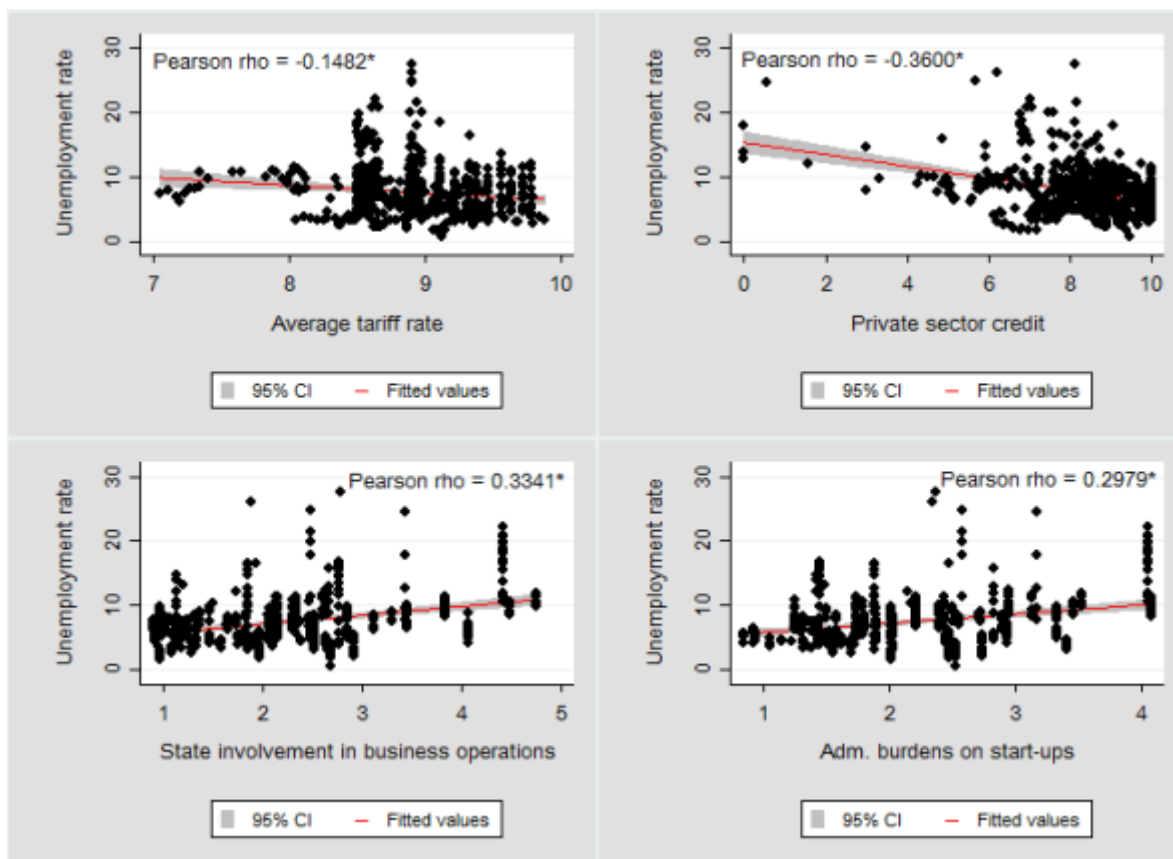
Note: * indicates significance at 5% level

Overall, this section has shown that remarkable deregulation measures have been applied in most of the sample countries over time. However, concerning specific forms of regulation, the evolution has been opposite. What is more, the correlation estimates indicate that the two sets of product market regulation indicators are at least to some extent interconnected. Lastly, the regulation indicators seem to have the following link with the mark-up and unemployment: depending on the type of regulation the relationship between the mark-up and regulation may be positive or negative. However, product market deregulation as such seems to be beneficial for employment.

4.4. Union density and collective bargaining coverage

Union density and collective bargaining coverage measure workers' bargaining power in a country or sector. The former is defined as the proportion of workers registered with a trade union. The

latter indicates the ratio of all wage earners having the right to bargaining, i.e., workers whose contract is regulated by the collective agreements signed by unions. Union density is not regarded as the best possible measure of union bargaining power (Flanagan, 1999) because a country having a low union density may in fact have a very high share or workers earning a wage negotiated by trade unions.

Table 2. Development of union density and collective bargaining coverage

	Union density (%)			Collective bargaining coverage (%)		
	1986[1]	1998	2013[2]	1986[1]	1998	2013[2]
Australia	44	28	17	84	60	61
Austria	51	39	28	99	98	98
Belgium	49	52	55	90	96	96
Canada	35	29	27	38	31	29
Denmark	77	75	67	83	85	84
Finland	70	78	69	79	84	93
France	12	8	8	89	94	98
Germany	34	26	18	90	74	58
Greece	31	27	22	85	84	42
Ireland	52	40	30	44	44	32
Italy	40	36	37	80	80	80
Japan	28	23	18	28	22	17
Netherlands	27	25	18	72	81	85
New Zealand	53	22	21	67	25	15
Norway	57	55	52	70	71	70
Portugal	41	23	19	75	72	73
Spain	12	19	17	86	93	78
Sweden	83	81	68	91	92	89
Switzerland	23	21	16	48	44	49
United Kingdom	46	30	26	62	35	30
United States	17	13	11	19	15	12

Notes: [1] 1995 for Greece, 1989 for New Zealand and 1990 for Switzerland, [2] 2012 for New Zealand.
Sources: OECD Labour Force Statistics; Visser, J. ICTWSS Data base. version 5.1. (September 2016). Amsterdam: Amsterdam Institute for Advanced Labour Studies (AIAS), University of Amsterdam and Nickell (2003) obtained from Ochel (2000).

Table 2 shows that from the mid-1980s both ratios have fallen in most of the countries. This serves as an indication that worker bargaining power has decreased during the period. What is more, union density and collective bargaining coverage seem to be high in the Nordics, whereas the opposite applies to non-European countries. Visser (2013) has pointed out that high collective bargaining coverage can be seen in countries where bargaining takes place at the national or sectoral level, employer organisation is high and extensions are quasi automatic. Moreover, union density is high in countries where trade unions have an active role in the administration of the unemployment benefits system because being member to a union gives access to income in case

of unemployment. One possible explanation for the observed deunionisation has been the extension of employment contracts to non-unionised workers meaning that regardless of whether a worker is a union member or not he or she gets the same wage increases as a worker who pays for the union membership. This lowers the incentive to become a trade union member in the first place as there is the possibility of free-riding at the expense of those who pay the membership fee. (Boeri & van Ours, 2008, 53–54.)

4.5. Coordination and extension clauses

The wage-setting coordination refers to the degree of synchronisation of pay policies within distinct bargaining units. Visser (2013) has provided an indicator of the extent of coordination which is illustrated in Figure 26. The scores range from 1 to 5 where higher scores mean higher coordination. Score 1 is defined as fragmented wage bargaining, confined largely to individual firms or plants. This kind of situation has been in practice for example in the United States and the United Kingdom. France is an example of score 2 which relates to mixed industry and firm-level bargaining with weak government coordination through statutory minimum wage or wage indexation. Score 3 means industry-level bargaining with moderate coordination among major bargaining actors (example being Italy from late 1990s). A score of 4 (e.g. Denmark and Norway) is defined as a situation where wage norms are based on centralised bargaining by peak associations with or without government involvement. It can also be described as an extensive and regularised pattern setting coupled with high degree of union concentration. Finally, the highest degree of coordination (score 5) means centralised bargaining by peak association(s), with or without government involvement, and/or government imposition of wage schedule. Belgium and Finland represent these kind of countries in the sample.

Coordination of wage-setting is one of the many facets of union bargaining and according to Calmfors and Driffill (2000) there is a U-shaped relationship between unemployment and coordination. Unions try to coordinate with sectors that are close substitutes as they strive to decrease the elasticity of demand for the combined product of these sectors. However, union members suffer because prices increase in the economy when the combined union becomes larger and it demands even higher wages. Therefore, worker-consumers moderate their wage demands and employment increases. In other words, high or low degree of coordination should result in highest employment as workers have incentives to consider the effect of wage demands on the aggregate price level.

Figure 26. Coordination of wage-setting
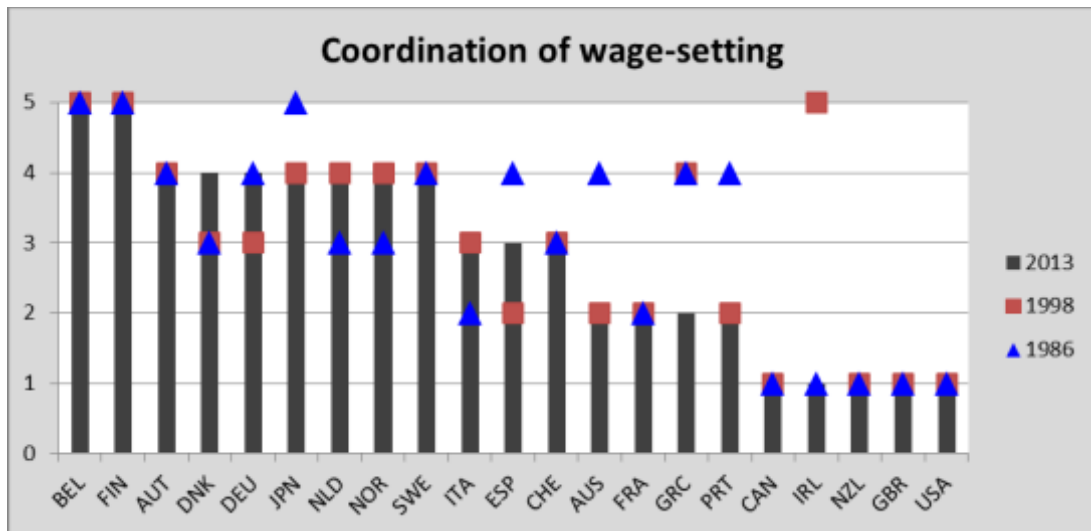
Notes: instead of 1986 value: 1995 for Greece, 1989 for New Zealand and 1990 for Switzerland. New Zealand till 2012. The indicator scores from 1 to 5 where higher values mean higher coordination.
Source: Visser, J. ICTWSS Data base. version 5.1. (September 2016). Amsterdam: Amsterdam Institute for Advanced Labour Studies (AIAS), University of Amsterdam.

Figure 27. Extension clauses
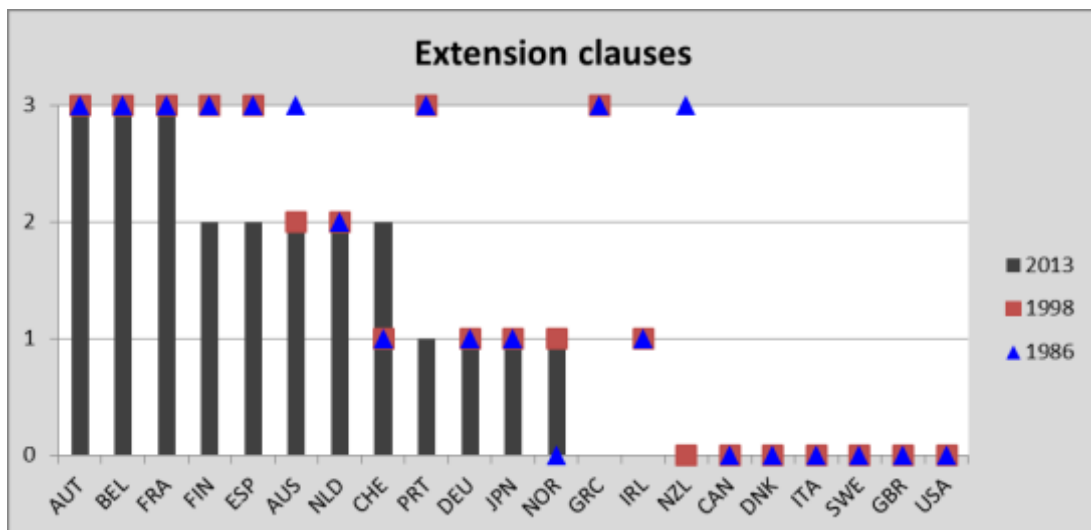
Notes: instead of 1986 value: 1995 for Greece, 1989 for New Zealand and 1990 for Switzerland. New Zealand till 2012. The indicator scores from 0 to 3 where higher values mean quasi-automatic use of extensions.
Source: Visser, J. ICTWSS Data base. version 5.1. (September 2016). Amsterdam: Amsterdam Institute for Advanced Labour Studies (AIAS), University of Amsterdam.

Figure 27 shows the application of mandatory extension of collective agreements to non-organised employers in the sample countries for years 1986, 1998 and 2013. The indicator gets a higher value the more extensions are used in a country. In other words, a value of 0 means that there are no extensions applied in collective agreements, whereas the value 3 indicates virtually automatic extension practices. Firstly, it can be seen that European countries have traditionally had a high usage of extensions compared to non-European countries (except for Australia). Extensions are applied the most in countries such as France, Belgium and Austria where collective

bargaining coverage is also high (see Table 2). Secondly, the scores have remained quite stable throughout the sample period. Thirdly, for the countries where there was a change of the indicator value over the years in the majority of cases the indicator value decreased, that is, extensions were less frequently used.

4.6. Employment protection legislation (EPL)

Employment protection legislation means the set of laws and procedures which apply in hiring and firing of workers. These include for example rules on advance notice periods and compensation that employers must pay for an early termination of an employment contract. Other components of EPL consist of e.g. administrative procedures that the employer has to follow before implementing the firing decision. (Boeri & van Ours, 2008, 199–200.) The strictness of EPL often varies according to the firm size, bigger firms facing stricter rules than smaller ones. This has an impact on firms' decisions whether to grow their business until a certain limit. (OECD, 2013.) On the other hand, EPL aims to reduce job destruction and increase job stability while protecting workers from being fired or laid-off. Therefore, there is a contradiction between the goals of such regulation and the impact it can have on aggregate employment.

Figure 28 illustrates the strictness of EPL by sample countries in three different years. The indicator gets values from 0 to 6 where higher values mean stricter regulation. The measure for regular contracts includes procedural inconveniences, notice and severance pay for no-fault individual dismissals and difficulty of dismissal. The components of EPL for temporary contracts encompass regulation on fixed-term contracts and temporary work agency (TWA) employment.

Since the occurrence of temporary employment has increased during the past decades[9], the strictness of employment protection legislation is shown separately for regular and temporary contracts. Figure 28 shows that European countries tend to have relatively strict EPL, whereas the non-European countries have very low levels of EPL already from the beginning of 1980s. This applies to both regular and temporary employment contracts. Another visible pattern is the reduction of the strictness of EPL from the 1980s to 2000s, which has been more drastic for temporary contracts than for regular ones.

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[9] See for example Table J on temporary employment incidence in statistical annex of OECD (2016).

Figure 28. Strictness of employment protection legislation for regular and temporary contracts
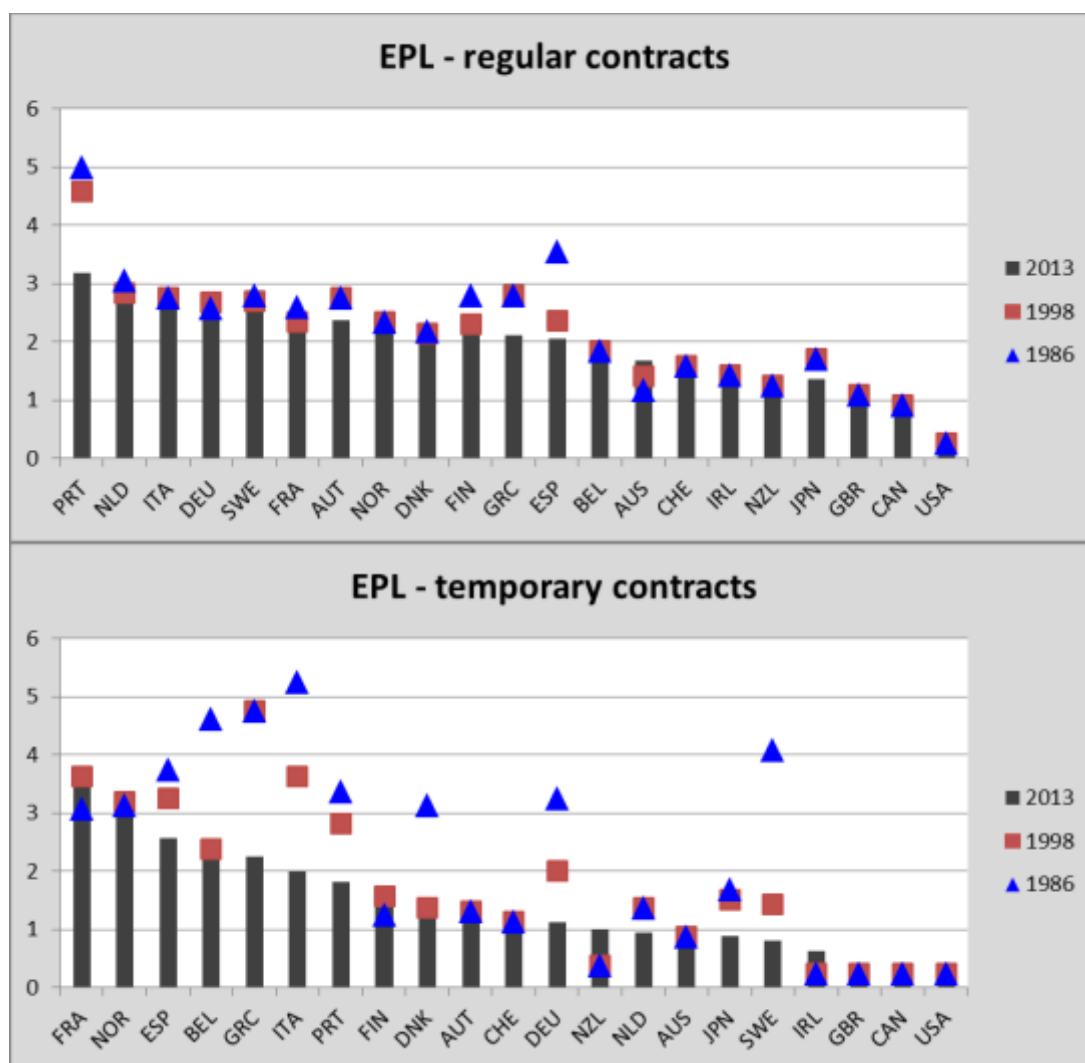
Notes: instead of 1986 value: 1995 for Greece, 1989 for New Zealand and 1990 for Switzerland. New Zealand till 2012.The indicator ranges from 0 (zero regulation) to 6 (extremely high regulation).
Source: OECD Employment Protection database.

4.7. Tax wedge and gross unemployment benefit replacement ratio

Table 3 shows the average tax wedge and gross unemployment benefit replacement ratios for the 21 OECD countries. The tax wedge comprises income tax and employee and employer contributions less cash benefits (as % of labour costs) and it has been calculated for two family situations: one-earner family with two children and single persons without children. The gross unemployment benefit replacement ratio refers to gross unemployment benefit levels as a percentage of previous gross earnings and takes into account two earnings levels, three family situations and three durations of unemployment.

Countries outside Europe tend to have lower average tax wedges and benefit replacement ratios than the European countries. Furthermore, the average tax wedge increased in many of the countries in the second half of the sample period compared to the first half. The contrary can be said for the unemployment benefit replacement ratio. Referring to Table 2 earlier, it is useful to bear in mind that union density is usually high in countries where unions have an active role in the administration of unemployment benefits because being member to a union gives access to income in case of unemployment (Boeri & van Ours, 2008, 53–54).

Table 3. Average tax wedge and gross unemployment benefit replacement ratio

	Tax wedge (%)		Gross unemployment benefit replacement ratio (%)	
	Average of 1985–1999[1]	Average of 2000–2013[2]	Average of 1985–1999[1]	Average of 2000–2013[2]
Australia	20	22	26	22
Austria	34	42	30	29
Belgium	47	49	41	38
Canada	25	25	18	14
Denmark	40	34	56	49
Finland	42	41	36	35
France	44	46	37	37
Germany	41	43	27	24
Greece	36	41	16	11
Ireland	33	17	29	39
Italy	46	42	11	18
Japan	18	27	10	12
Netherlands	42	35	54	40
New Zealand	21	14	30	28
Norway	33	34	39	46
Portugal	30	33	34	40
Spain	35	36	34	33
Sweden	46	44	28	37
Switzerland	24	17	30	31
United Kingdom	29	30	18	13
United States	28	25	12	15

Notes: [1] Australia, Ireland and Portugal from 1986, Greece from 1995, New Zealand from 1989 and Switzerland from 1990. [2] New Zealand till 2012.
Sources: OECD (2004); OECD Taxing Wages 2003; OECD Taxing Wages 2016: Comparative tables; OECD Tax Statistics database and OECD Benefits and Wages Statistics.

4.8. Home ownership rate

Figure 29 illustrates the extent of home ownership in the sample countries where the lowest rates (around 40%–50%) are in Switzerland, Germany and Austria, whereas the highest rates (80%) are

in Norway and Spain. The second remark is the fact that the rate has risen in most of the countries from the first half of the sample period to the second half. Lastly, there are many countries where the incidence of home ownership has remained very stable (e.g. Ireland, Portugal and Japan).

Figure 29. Home ownership rates
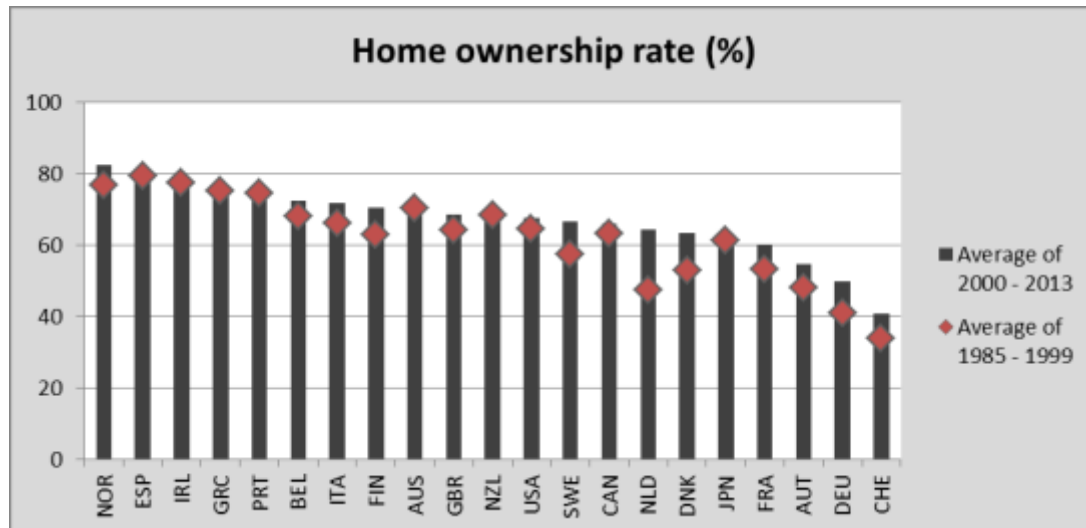
Notes: Australia, Ireland and Portugal from 1986, Greece from 1995, New Zealand from 1989 and Switzerland from 1990. New Zealand till 2012.
Sources: Eurostat; US. Bureau of the Census; Doling & Horsewood (2011); Luxembourg Income Study (LIS); GSOEP; American Housing Survey; Statistics Bureau of Japan; Australian Bureau of Statistics and OECD (2015).

5. Empirical analysis

5.1. Method

Theory and earlier empirical evidence suggest that competition affects unemployment and real wages and the impact varies according to different labour market institutions. This section investigates these connections further. As mentioned in the introduction, the modelling strategy builds up on the method used in Griffith et al. (2007) with differences concerning the variables and sample used. To assess the correct instrumental variables specifications, I also make use of the procedure in Griffith and Harrison (2004) which will be explained later.

The estimations are run in Stata 14 software package and the data covers 21 OECD countries over the period of 1985–2013. Regulation is assumed to affect unemployment and wages through the mark-up (μ) which measures the degree of competition in the economy. Firstly, the impact of product market regulation on the mark-up is estimated and then the effect of the (instrumented) mark-up on unemployment and real wages is explored. The model is estimated for two different sets of PMR indicators which were introduced in the previous section.

The instrumental variables approach has the advantage of taking into account the potential measurement error and endogeneity of the mark-up on unemployment. An example of a bias stemming from reversed causality could be the following: a rise in unemployment lowers the demand for products and services, which translates into smaller mark-ups. In addition, an omitted variable bias could arise for example in the case of a negative demand shock that decreases output and firms' profitability, hereby leading to an increase in unemployment. In that case, it would seem that average profitability and unemployment are correlated even though there is no causal relationship between them. Using instruments that affect the mark-up but do not affect unemployment or wages provides a way to identify a causal relationship.

The first-stage regression has the following form:

$$\mu_{it} = \gamma_1 PMR'_{it} + \gamma_2 LMR'_{it} + \gamma_3 X'_{it} + f_i + t_t + \varepsilon_{it}^{\mu}, \qquad (4)$$

where i and t are country and year, μ represents the mark-up, PMR stands for a vector of time and country varying product market regulation indicators, LMR is a vector of time and country varying indicators of labour market regulation (included also in the unemployment rate and real wage regressions), X incorporates the output gap, the change in inflation, the real exchange rate and the public sector employment rate. Country (f_i) and year (t_t) dummies are also included. The robustness section later on considers how the results change if a slightly different version of the mark-up variable is used.

The estimated $\hat{\gamma}_1$ coefficients give information on how different forms of regulation impact economic rents (i.e. the mark-up). What is more, if the indicators have explanatory power (measured by the F and R^2 statistics) in the first stage, it indicates that they are probably good instruments in the second stage estimations.

In the second stage the unemployment rate regression is tested empirically by the following equation:

$$UR_{it} = \alpha_1 \hat{\mu}_{it} + \alpha_2 \hat{\mu}_{it} BP_i + \alpha_3 LMR'_{it} + \alpha_4 X'_{it} + f_i + t_t + \varepsilon_{it}^{U}, \qquad (5)$$

where i and t denote country and year respectively, UR stands for the unemployment rate, $\hat{\mu}_{it}$ is the instrumented mark-up from the first stage and BP means the bargaining power of workers in the economy measured by either collective bargaining coverage or union density. LMR and X

include the same labour market and control variables as in the first stage. The public sector employment rate controls for any potential impact of public sector employment in crowding out private sector employment. Country and year dummies capture country fixed effects and common macroeconomic shocks. As trade union membership and collective bargaining coverage might be endogenous, country averages of these variables are used for picking up variation in workers' bargaining power. In the robustness section the estimations are run using the 1986 values of these two variables.[10] The endogeneity could arise with e.g. a positive shock on employment or wages which in turn might elicit a decrease in union membership.

It is important to bear in mind that although instrumenting the mark-up addresses its potential endogeneity on outcome variables, there is another source of endogeneity that cannot be controlled for even if country and year dummies are used. In effect, regulation is determined by a political decision process that might be influenced by a country's economic performance. For instance, a sustained economic downturn may increase the probability of deregulatory reforms because the undesirable situation weakens opposition to reform. In this case, the OLS estimator may underestimate the actual impact of deregulation. On the other hand, implementing reforms in an upturn might be easier because their adverse effect on distinct groups may be smaller and/or there may be more resources to compensate the losers. If this happens, the OLS estimator might be upward biased. (Schiantarelli, 2010, 37.)

Apart from investigating the effect of competition on unemployment, the following auxiliary second-stage regression estimates the impact on real wages (proxied by real labour costs):

$$w_{it} = \beta_1 \hat{\mu}_{it} + \beta_2 \hat{\mu}_{it} BP_i + \beta_3 LMR'_{it} + \beta_4 X'_{it} + f_i + t_t + \varepsilon_{it}^w, \qquad (6)$$

where the notation is the same as for the unemployment rate equation (5), except for w standing for the real wage per hour. Due to data availability issues the variable is in fact the log of real hourly labour costs and it includes payroll taxes and other non-wage labour costs. In addition, the public sector employment rate is not included as a control in this specification. When measuring workers' bargaining power (BP) only the estimations with collective bargaining coverage are shown because the wage regression is of secondary interest.

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[10] The 1986 values of union density and collective bargaining coverage are used in the main specification in Griffith et al. (2007).

Owing to detected heteroscedasticity, robust standard errors are used in all specifications. The potential endogeneity of the mark-up was tested and confirmed by Wooldridge's (1995) score test and regression-based test of exogeneity, which justifies the use of instrumental variables approach.[11] Since regulation is expected to influence the outcome variables only through the mark-up, this assumption is verified by the Hansen J test which is a heteroscedasticity robust version of the Sargan test of overidentifying restrictions (Sargan, 1958 and Hansen, 1982). The null hypothesis of the test assumes that all the instruments (i.e., the regulation indicators) are uncorrelated with the error term in equations (5) and (6) and therefore they can legitimately be excluded from the unemployment and wage regressions. The rejection of the null hypothesis gives doubts on the suitability of the instruments since at least one of the instruments is not satisfying the condition of orthogonality with the error process.

However, a rejection of the Hansen J test does not give any implication about which regulation indicator(s) should be included directly in the second-stage equations. Applying a Lagrange Multiplier test of overidentifying restrictions provides some insight into the matter (Griffith & Harrison, 2004). In the case of unemployment, I first estimate the unemployment rate equation (5) and save the estimated residuals. Then, I regress the residuals on all the exogenous variables in the model by normal OLS in the following way:

$$\hat{\varepsilon}_{it}^{U} = \delta_1 PMR'_{it} + \delta_2 LMR'_{it} + \delta_3 X'_{it} + f_i + t_t + u_{it}^{U}, \qquad (7)$$

where the estimated $\hat{\delta}_1$ coefficients are of interest. If they are statistically different from zero it implies that the particular variables should be included directly to the unemployment rate regression (5). The rationale is that if a PMR indicator is correlated with the unexplained variation in unemployment from the main regression then it contains important information about changes in the unemployment rate that are not transmitted by the mark-up. Whenever this happens, I re-estimate equation (5) where the relevant product market regulation indicator is included directly and repeat the process until the Hansen J test does not reject the remaining overidentifying restrictions. The same procedure is applied when estimating the impact of competition on real wages.

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[11] The Durbin and Wu-Hausman tests assume that the error term is i.i.d., which is why they cannot be applied with robust standard errors.

In addition to the Lagrange Multiplier test, I use another test for assessing instruments' independence from the error term. This orthogonality test is also called as a "difference-in-Sargan" statistic or C test and unlike the Hansen J test for overidentifying restrictions this test allows to investigate one or a subset of instruments. In the case of heteroscedasticity, the test calculates two Hansen J statistics: one for a full model with all the instruments and a second for a model in which the suspected instruments are excluded. The difference of these two models has the null hypothesis that the specified orthogonality conditions are satisfied, with degrees of freedom equal to the number of those conditions. If the test rejects the null hypothesis, the suspected instrument(s) should be included to the unemployment (or wage) regressions directly. The estimation results from running type (7) residual regressions and the C test statistics are not reported but can be provided upon request.

Lastly, the estimation results report the test statistics for underidentification and weak identification. The former verifies whether the instruments together are relevant (that is, correlated with the mark-up) and the latter checks if the excluded instruments are only weakly correlated with the mark-up. The underidentification test is basically a rank test where a rejection of the null hypothesis means that the model is identified. The test statistic takes into account heteroscedasticity and is called the Kleibergen-Paap rk statistic (for more information, see Kleibergen & Paap, 2006).

The heteroscedasticity-robust version of the weak instrument test is a Kleibergen-Paap Wald rk F statistic (which is also a rank test) and the critical values are from Stock and Yogo (2002) who take into account two characteristics of poor instruments: the first considers the maximal bias relative to the bias in the OLS coefficient, whereas the second tests for the maximal size distortion. The instruments are not considered weak if the Kleibergen-Paap Wald rk F statistic is higher than the Stock and Yogo critical values which are reported in annexes 6 and 7 respectively. The weak instrument statistics are shown because instrumental variables may be weak even if the first-stage t- and F- statistics are significant (Staiger & Stock, 1997). Stock and Yogo (2002) show that in a model with one endogenous variable, their test procedure is comparable to the Staiger-Stock (1997) rule of thumb that instruments are considered weak if the first-stage F-statistic is less than 10. However, when there are two or more endogenous variables and the number of instruments is large, they claim that their approach is a more convenient measure of weak instruments.

Nonetheless, it is worth pointing out that the Stock and Yogo (2002) critical values are for an IV regression under homoscedasticity.

5.2. Results

The results report first the case when the regressions are run with OECD PMR indicators. Secondly, the same is shown for the Fraser Institute's economic freedom indicators. Thirdly, a comparison of the results between the two set of regulation indicators is conducted.

5.2.1. Results using OECD product market regulation indicators

Table 4 shows the results from the first stage where the mark-up is regressed on the PMR indicators, labour market variables and other controls. Column (1) excludes all the PMR indicators and describes the effect of labour market variables on the mark-up. In column (2) the product market regulation indicators are added to the specification, which is later used to identify the linear competition effect on unemployment in column (3) of Table 6. Column (3) takes into account the interaction of the PMR indicators with average collective bargaining coverage and column (4) is identical to column (3) except for the dependent variable being the interaction of the mark-up and average collective bargaining coverage.

The OECD regulation variables are decreasing with liberalisation, so a positive coefficient implies that reforms that deregulate product markets are associated with lower average profitability. Table 4 shows unambiguously that the mark-up decreases when procedures are simplified, barriers in network sectors and legal barriers are reduced and other barriers to trade and investment are eliminated. In column (2) the coefficient of "entry barriers in network sectors" is 0.0587, meaning that reforms decreasing the indicator value by 1 reduce the mark-up by 5.9 percentage points.

On the other hand, economic rents seem to increase when it becomes easier to start a business. As for the other PMR indicators, the sign of the coefficient depends on whether the interaction with collective bargaining coverage is included but the linear specification in column (2) reports clearly that the signs are negative. For example, when public ownership and state involvement in business operations are reduced the mark-up increases. This makes sense because public sector producers do not necessarily pursue maximal profits, thus they might set lower prices or have higher costs than private sector producers (Griffith & Harrison, 2004, 67).

Table 4. The impact of OECD product market regulation indicators on the mark-up

Dependent variable:	Mark-up			Mark-up x average bargaining coverage
	(1)	(2)	(3)	(4)
OECD PMR indicators				
Public ownership		-0.0520***	0.0350	4.3241**
		[0.0132]	[0.0265]	[1.7942]
State involvement in business operations		-0.0687***	0.1613***	11.5196***
		[0.0155]	[0.0466]	[3.1260]
Administrative burdens on start-ups		-0.0875***	-0.3452***	-23.9885***
		[0.0175]	[0.0732]	[4.9694]
Legal barriers to entry		0.0224*	0.1605***	6.2867**
		[0.0119]	[0.0452]	[2.9382]
Entry barriers in network sectors		0.0587***	0.1003***	8.0991***
		[0.0136]	[0.0139]	[1.0455]
Simplification of rules and procedures		0.0492***	0.1125***	6.8483***
		[0.0131]	[0.0205]	[1.4393]
Tariff barriers		-0.2420***	0.1662**	27.4191***
		[0.0398]	[0.0845]	[6.3516]
Other barriers to trade and investment		0.1025***	0.2859***	19.9706***
		[0.0107]	[0.0848]	[5.9988]
Public ownership x avg. bargaining coverage			-0.0006	-0.0750***
			[0.0004]	[0.0264]
State involvement in business x avg. bargaining coverage			-0.0028***	-0.2121***
			[0.0006]	[0.0399]
Adm. burdens x avg. bargaining coverage			0.0031***	0.2356***
			[0.0009]	[0.0592]
Legal barriers to entry x avg. bargaining coverage			-0.0019***	-0.0936***
			[0.0005]	[0.0332]
Tariff barriers x avg. bargaining coverage			-0.0054***	-0.6208***
			[0.0013]	[0.0989]
Other trade barriers x avg. bargaining coverage			-0.0032***	-0.2052**
			[0.0012]	[0.0869]
Labour market variables				
Tax wedge	0.0001	-0.0013	-0.0049***	-0.2326***
	[0.0013]	[0.0011]	[0.0011]	[0.0732]
Benefit replacement ratio	0.0010	0.0025***	0.0030***	0.2650***
	[0.0011]	[0.0009]	[0.0009]	[0.0664]
Coordination	0.0205***	0.0131**	-0.0024	-0.3270
	[0.0070]	[0.0062]	[0.0063]	[0.4777]
EPL - regular contracts	0.0268	0.0267	0.0100	-2.1744
	[0.0273]	[0.0217]	[0.0214]	[1.5373]
EPL - temporary contracts	0.0022	-0.0163***	-0.0169***	-2.2149***
	[0.0061]	[0.0062]	[0.0065]	[0.5065]

Table 4 *(Continued)*

Dependent variable:	Mark-up			Mark-up x average bargaining coverage
	(1)	(2)	(3)	(4)
Extension clauses	-0.0089	-0.0168*	-0.0137	0.3071
	[0.0101]	[0.0097]	[0.0101]	[0.7323]
Home ownership rate	0.0011	0.0034***	0.0013	0.1920**
	[0.0014]	[0.0013]	[0.0013]	[0.0917]
Control variables				
Output gap	0.0060***	0.0068***	0.0040***	0.2275**
	[0.0018]	[0.0015]	[0.0014]	[0.0973]
Change in inflation	-0.0020	-0.0035	-0.0040	-0.2383
	[0.0044]	[0.0034]	[0.0029]	[0.2128]
Real exchange rate	-0.0009	-0.0029***	-0.0031***	-0.2116***
	[0.0006]	[0.0006]	[0.0005]	[0.0394]
Public sector employment rate	-0.0035	-0.0045	-0.0019	-0.0629
	[0.0058]	[0.0052]	[0.0052]	[0.3747]
Constant	1.5447***	1.2833***	1.7660***	154.7183***
	[0.1596]	[0.1462]	[0.1558]	[11.2742]
F statistic	52.11***	71.70***	73.16***	914.50***
R-squared	0.7606	0.8367	0.8660	0.9844
Observations	586	586	586	586

Notes: The regressions include 21 OECD countries over the period 1985–2013. Robust standard errors are in brackets. All regressions include country and year dummies. */**/*** indicates significance at 10%/ 5%/1% level. Table 6 below reports the tests of the joint significance and partial R^2 of the PMR indicators and tests for underidentification and weak instruments.

In the long run the number of firms in the economy is endogenous and the equilibrium level of rents depends not only on entry costs but also on workers' bargaining power (Blanchard & Giavazzi, 2003). That is why the regulation indicators are interacted with collective bargaining in some of the specifications. The results show that when workers have high bargaining power the positive/negative effects of regulatory reforms are not transmitted 100% to firms' profits. This can be stated when comparing the sign of the interaction variables to the sign of the pure regulation indicators in column (4): the signs of the coefficients are opposite.

Turning to the labour market and control variables, increasing the tax wedge (e.g. employer social security contributions) affects negatively firms' profits as expected. Furthermore, as the regulation for temporary work is reduced, the mark-ups are likely to rise since usually temporary workforce is less paid compared to persons having a permanent employment contract. What is more, the mark-up is pro-cyclical since the output gap is significant and positive. The negative coefficient of

the real exchange rate indicates that an appreciated currency is associated with a decrease in the mark-up.

All in all, both the linear and interacted PMR indicators are highly significant in almost all the specifications in Table 4 and the indicators are together significant at the 1% level (see the F statistic). What is more, the R^2 is relatively high. The first-stage results suggest that regulation variables exert explanatory power in the variation of the mark-up and serves as an indication that the PMR indicators are likely to be strong instruments.

Before moving to the effects of product market regulation on unemployment, Table 5 illustrates the results from the reduced form estimations, i.e. the case when the unemployment rate is directly regressed on the PMR indicators and other variables. Column (1) includes the linear effects, whereas columns (2) and (3) include the interaction of workers' bargaining power. The table shows that especially legal barriers to entry, state control and other trade barriers seem to have a strong direct linkage with the unemployment rate. This is good to bear in mind when discussing the results of the second-stage estimations.

Table 6 shows the results of the main equation of interest where the unemployment rate is regressed on the mark-up of the first stage, labour market variables and controls. Column (1) considers the relationship between labour market institutions and the unemployment rate. As in previous empirical evidence (e.g. Nickell et al., 2005), the tax wedge and unemployment benefit replacement ratio have a positive and significant effect on the unemployment rate. The coefficients of extension clauses indicate a negative effect on unemployment and the home ownership rate has a positive effect but neither is significant. Furthermore, employment protection legislation and coordination exert a significantly negative effect implying that higher coordination and stricter EPL lead to a decrease in unemployment. Noteworthy is that reforms focusing on the strictness of temporary contracts have a more statistically significant impact than reforms targeted to regular contracts.[12]

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[12] Griffith et al. (2007) use an aggregate measure of EPL which is not statistically significant.

Table 5. Reduced form estimations of the unemployment rate regression (OLS, OECD indicators)

Dependent variable: Unemployment rate	(1)	(2)	(3)
Public ownership	-0.617***	-0.395	-1.859***
	[0.223]	[0.403]	[0.427]
State involvement in business operations	1.606***	1.626**	2.882***
	[0.312]	[0.766]	[0.707]
Administrative burdens on start-ups	0.146	5.500***	-2.305*
	[0.351]	[1.099]	[1.274]
Legal barriers to entry	0.789***	3.737***	2.327***
	[0.221]	[0.855]	[0.796]
Entry barriers in network sectors	-0.410*	-0.729***	-0.247
	[0.221]	[0.239]	[0.228]
Simplification of rules and procedures	0.538**	-0.378	0.405
	[0.240]	[0.358]	[0.320]
Tariff barriers	1.269**	1.734	-11.495***
	[0.531]	[1.520]	[3.054]
Other barriers to trade and investment	-0.884***	-9.458***	-2.907***
	[0.256]	[1.538]	[0.542]
Interaction with average collective bargaining coverage			
Public ownership		-0.006	
		[0.006]	
State involvement in business operations		-0.004	
		[0.011]	
Administrative burdens on start-ups		-0.071***	
		[0.016]	
Legal barriers to entry		-0.027***	
		[0.009]	
Tariff barriers		-0.014	
		[0.023]	
Other barriers to trade and investment		0.124***	
		[0.024]	
Interaction with average union density			
Public ownership			0.021*
			[0.012]
State involvement in business operations			-0.039***
			[0.014]
Administrative burdens on start-ups			0.065**
			[0.031]
Legal barriers to entry			-0.039*
			[0.020]
Tariff barriers			0.432***
			[0.105]
Other barriers to trade and investment			0.073***
			[0.016]
Labour market controls: Tax wedge, EPL (regular & temporary contracts), benefit replacement ratio, coordination, extension clauses, home ownership rate	Yes	Yes	Yes
Other controls: output gap, change in inflation, real exchange rate, public sector employment rate, country and year dummies, constant	Yes	Yes	Yes
F statistic	61.36***	61.69***	57.69***
R-squared	0.888	0.898	0.896
Observations	586	586	586

Notes: The regressions include 21 OECD countries over the period 1985–2013. Robust standard errors are in brackets.
*/**/*** indicates significance at 10%/5%/1% level.

As for the control variables, the significantly negative coefficient of the output gap means that when the economy is doing well unemployment is falling. The real exchange rate has a negative effect on unemployment suggesting that a more appreciated exchange rate is associated with a lower level of unemployment. Neither the change in inflation nor the public sector employment rate is significant. The latter is higher than minus one, which implies that an increase in public sector employment decreases the unemployment rate less than 1:1.

Column (2) includes the linear (OLS) effect of the mark-up on unemployment. The negative but insignificant coefficient indicates that increasing competition (a decrease in the mark-up) increases the unemployment rate. When the potential endogeneity of competition is controlled for by using the instrumental variable (IV) estimator in column (3) one can see that the OLS estimate is positively biased because the instrumented mark-up becomes more negative. What is more, using the IV approach turns the competition coefficient to highly significant. Instrumenting reduces bias that might arise owing to measurement error in the mark-up.

The bottom of Table 6 shows test statistics indicating the strength and validity of the excluded instruments. The first-stage F statistic and partial R^2 of the excluded instruments indicate that the regulation indicators have explanatory power. Nevertheless, the Hansen J test rejects the overidentifying restrictions of column (3) at the 1% level of significance when all eight PMR instruments are excluded from the main unemployment regression. This means that one or several of the instruments should be directly included in the unemployment rate equation and it may be that because of this the mark-up coefficient in column (3) is biased.

In order to find out which of the PMR indicators should not be used as instruments, the procedure described earlier is conducted. The Lagrange Multiplier and C tests show that the specification of column (4) is the correct one. The Hansen J test does not reject the overidentifying restrictions at the 5% level when state control indicators, legal barriers to entry and simplification of rules and procedures enter directly the main unemployment rate regression. The coefficient of the competition variable in column (4) does not change much compared to that in column (3). This means that even though the exclusion of the four PMR indicators from the unemployment rate regression was not supported by the data, this did not seriously bias the estimate of the mark-up coefficient.

Table 6. The impact of competition on the unemployment rate using OECD PMR indicators

Dependent variable: Unemployment rate	(1) OLS	(2) OLS	(3) IV	(4) IV	(5) OLS	(6) IV	(7) IV	(8) OLS	(9) IV	(10) IV
	LMR & controls	Linear	Linear	Preferred linear	Interaction - coverage	Interaction - coverage	Preferred interaction - coverage	Interaction - density	Interaction - density	Interaction - density
Competition variables (OECD)										
Mark-up		-0.547 [0.691]	-3.876*** [1.408]	-5.986*** [1.375]	-4.604* [2.605]	14.670*** [4.183]	1.698 [10.107]	-8.412*** [1.826]	-6.315* [3.289]	14.402*** [5.507]
Mark-up x avg. bargaining coverage					0.060 [0.037]	-0.267*** [0.064]	-0.092 [0.133]			
Mark-up x avg. union density								0.182*** [0.033]	0.055 [0.071]	-0.384*** [0.119]
Public ownership				-0.806*** [0.203]						-1.244*** [0.241]
State involvement in business operations				1.078*** [0.299]			1.131*** [0.356]			3.900*** [0.787]
Administrative burdens on start-ups							4.344*** [0.789]			
Legal barriers to entry				0.779*** [0.164]			4.243*** [1.444]			1.204*** [0.215]
Simplification of rules and procedures				0.783*** [0.260]						
Tariff barriers							3.816** [1.859]			1.810* [0.929]
Other barriers to trade and investment							-7.900*** [1.137]			-3.108*** [0.715]
Public ownership x avg. bargaining coverage							-0.014*** [0.003]			
Adm. burdens x avg. bargaining coverage							-0.060*** [0.013]			
Legal barriers to trade x avg. bargaining coverage							-0.037** [0.014]			

Table 6 *(Continued)*

Dependent variable: Unemployment rate	(1) OLS LMR & controls	(2) OLS Linear	(3) IV Linear	(4) IV Preferred linear	(5) OLS Interaction - coverage	(6) IV Interaction - coverage	(7) IV Preferred interaction - coverage	(8) OLS Interaction - density	(9) IV Interaction - density	(10) IV Interaction - density
Tariff barriers x avg. bargaining coverage							-0.059* [0.030]			
Other trade barriers x avg. bargaining coverage							0.105*** [0.017]			
State involvement x avg. union density										-0.054*** [0.014]
Other trade barriers x avg. union density										0.076*** [0.022]
Labour market & control variables										
Tax wedge	0.133*** [0.025]	0.133*** [0.025]	0.133*** [0.024]	0.157*** [0.026]	0.123*** [0.025]	0.178*** [0.029]	0.156*** [0.033]	0.124*** [0.025]	0.130*** [0.025]	0.213*** [0.030]
Benefit replacement ratio	0.032*** [0.012]	0.033*** [0.012]	0.036*** [0.013]	0.041*** [0.014]	0.029** [0.012]	0.054*** [0.015]	0.038** [0.015]	0.018 [0.013]	0.032** [0.013]	0.062*** [0.015]
Coordination	-0.667*** [0.161]	-0.656*** [0.160]	-0.588*** [0.151]	-0.468*** [0.160]	-0.641*** [0.161]	-0.664*** [0.163]	-0.676*** [0.150]	-0.558*** [0.156]	-0.557*** [0.151]	-0.598*** [0.178]
EPL - regular contracts	-1.072* [0.552]	-1.057* [0.554]	-0.968* [0.520]	-1.198** [0.518]	-0.831 [0.580]	-1.990*** [0.577]	-0.789 [0.677]	-1.308*** [0.493]	-1.041** [0.481]	-1.319* [0.678]
EPL - temporary contracts	-0.817*** [0.112]	-0.816*** [0.111]	-0.809*** [0.106]	-0.936*** [0.108]	-0.755*** [0.121]	-1.081*** [0.135]	-1.233*** [0.145]	-0.716*** [0.108]	-0.779*** [0.116]	-1.085*** [0.144]
Extension clauses	-0.217 [0.222]	-0.222 [0.222]	-0.251 [0.212]	-0.256 [0.225]	-0.297 [0.227]	0.090 [0.231]	-0.273 [0.306]	-0.243 [0.217]	-0.258 [0.210]	-0.126 [0.276]
Home ownership rate	0.030 [0.025]	0.031 [0.025]	0.035 [0.025]	0.005 [0.027]	0.023 [0.026]	0.070** [0.029]	-0.037 [0.032]	0.008 [0.024]	0.028 [0.023]	-0.039 [0.032]
Output gap	-0.526*** [0.036]	-0.523*** [0.037]	-0.502*** [0.037]	-0.488*** [0.040]	-0.522*** [0.037]	-0.507*** [0.037]	-0.495*** [0.036]	-0.515*** [0.038]	-0.500*** [0.036]	-0.526*** [0.041]
Change in inflation	0.010 [0.058]	0.009 [0.058]	0.002 [0.054]	-0.016 [0.052]	0.010 [0.058]	0.000 [0.057]	-0.029 [0.053]	0.013 [0.052]	0.003 [0.052]	0.003 [0.066]

Table 6 *(Continued)*

Dependent variable: Unemployment rate	(1) OLS	(2) OLS	(3) IV	(4) IV	(5) OLS	(6) IV	(7) IV	(8) OLS	(9) IV	(10) IV
	LMR & controls	Linear	Linear	Preferred linear	Interaction - coverage	Interaction - coverage	Preferred interaction - coverage	Interaction - density	Interaction - density	Interaction - density
Real exchange rate	-0.027***	-0.027***	-0.030***	-0.034***	-0.026***	-0.035***	-0.037***	-0.011*	-0.026***	-0.045***
	[0.008]	[0.008]	[0.008]	[0.009]	[0.008]	[0.009]	[0.012]	[0.007]	[0.009]	[0.013]
Public sector employment rate	-0.054	-0.056	-0.068	-0.186**	-0.059	-0.052	-0.003	-0.109*	-0.084	-0.139
	[0.067]	[0.067]	[0.070]	[0.083]	[0.067]	[0.075]	[0.085]	[0.061]	[0.070]	[0.105]
Constant	3.929	4.775*	10.038***	15.886***	7.354*	-13.983**	5.071	13.371***	12.734***	-6.625
	[2.436]	[2.488]	[2.972]	[3.403]	[3.794]	[6.113]	[13.724]	[3.047]	[4.054]	[6.972]
1st stage F statistic:										
linear			30.15***	57.89***		23.44***	14.16***		19.51***	16.01***
interaction			-	-		25.07***	16.80***		14.11***	10.92***
1st stage partial R^2:										
linear			0.32	0.28		0.44	0.14		0.44	0.25
interaction			-	-		0.41	0.15		0.38	0.21
No. of overid. restrictions			7	3		12	2		12	5
Hansen test p-value			0.000	0.240		0.000	0.055		0.000	0.377
Underid. test p-value			0.000	0.000		0.000	0.000		0.000	0.000
Weak id. F statistic			30.15	57.89**		16.80	11.06		13.49	13.35
R-squared	0.874	0.874	0.869	0.873	0.875	0.850	0.882	0.882	0.873	0.838
Observations	586	586	586	586	586	586	586	586	586	586

Notes: The regressions include 21 OECD countries over the period 1985–2013. Robust standard errors are in brackets. All regressions include country and year dummies. */**/*** indicates significance at 10%/5%/1% level. The 1st stage F statistic is for testing the joint significance of the excluded product market regulation indicators. The 1st stage Partial R^2 is for the excluded product market regulation indicators. The underidentification test verifies that the instruments together are relevant, whereas the weak identification statistic reports the Kleibergen-Paap Wald rk F statistic for testing whether the excluded instruments are only weakly correlated with the mark-up. The critical values provided by Stock and Yogo (2002) are in annexes 6 and 7. In column (3) the excluded PMR variables are from the estimates in column (2) of Table 4, in column (6) they are based on the estimates in columns (3) and (4) of Table 4 and in column (9) they are from the equivalent specification to columns (3) and (4) in Table 4 but with average collective bargaining coverage replaced by average union density.

The correctly specified linear IV model states that reducing state involvement in business operations, decreasing legal barriers to entry as well as simplifying rules and procedures all lead to a fall in unemployment. On the other hand, unemployment is likely to increase when public ownership decreases. As mentioned earlier, this may be due to a lengthy adjustment period when overmanned workforce is reduced in order to improve productivity.

The aggregate impacts of the directly included regulation indicators are obtained by combining the direct and indirect effects. The indirect impact is calculated by combining the effect of the regulation indicator on the mark-up from column (2) of Table 4 with the effect of the mark-up on unemployment from column (4) of Table 6. For example, the indirect impact of "legal barriers to entry" is obtained by multiplying 0.0224 with -5.986, which gives an indirect effect of -0.134. From column (4) of Table 6 above one can see that the direct effect of legal barriers to entry is 0.779. So the overall impact is 0.645 (0.779-0.134): unemployment is likely to fall when legal barriers to entry are removed. The magnitude of the effect is consistent with the coefficient of legal barriers (0.789) in the reduced form regression in column (1) of Table 5 as expected.

Columns (5)–(7) and (8)–(10) consider how the effects of product market regulation vary with collective bargaining coverage and union density which are measured as averages over the whole sample period. As in column (2), the OLS estimates for the mark-up in columns (5) and (8) are negative. However, the OLS estimates are now negatively biased since when using the IV approach in columns (6)–(7) and (9)–(10) the coefficients become positive.

As in the linear case the Hansen J test again rejects the exclusion restrictions. After having tested for the excluded instruments by using the Lagrange Multiplier and C tests, the correct versions for the interaction specifications are columns (7) and (10) where the validity of the overidentifying exclusion restrictions cannot be rejected at the 5% level. When it comes to the model with collective bargaining coverage, the impact of competition on unemployment becomes positive but insignificant. As for union density, the positive coefficient of the mark-up is significant at the 1% level. Both coefficients suggest that increased competition leads to a decrease in unemployment, which is in line with the majority of previous studies on this topic. Furthermore, the positive employment effect is dampened when union bargaining power is taken into account. This can be seen from the negative sign of the interacted mark-up compared to the simple mark-up coefficient which is positive. Therefore, the interpretation of columns (7) and (10) is the following: an increase in competition decreases the unemployment rate but less so in the presence of strong

worker bargaining power. In Griffith et al. (2007) strong bargaining power instead supports the effect of competition on unemployment.

When workers' bargaining power is taken into consideration, there are additional regulation indicators that have a highly significant and direct impact on unemployment. These include tariffs and other trade barriers as well as administrative burdens on start-ups. Unemployment should fall when starting a business is made easier and tariffs are decreased. By contrast, when barriers to trade facilitation are removed and foreign suppliers are being treated similarly to local businesses, unemployment is likely to increase. As discussed in section 2, to the extent that foreign competitors might have lower production costs, local firms may have to close down their businesses.

What are the total impacts of those regulation types that enter directly the unemployment rate regression in columns (7) and (10)? To address this question, it is interesting to compare the results between countries having low and high bargaining power. In other words, the focus is not on calculating the effect at the sample average (which is usual in the instrumental variables approach). The following calculation examples use the case of collective bargaining coverage in column (7) even if the competition coefficient is not significant. This is because union membership is not regarded as the best possible measure of union bargaining power (Flanagan, 1999). Nevertheless, it is good to bear in mind that the calculation examples below do not say anything about the statistical significance of the effects. The interest lies in evaluating whether there seem to be remarkable differences between countries of low and high collective bargaining coverage.

The United States is among the low collective bargaining countries with an average rate of around 15%, whereas Belgium represents an economy with extremely high average collective bargaining coverage of approximately 94% over the sample period. Using the coefficients from column (7) of Table 6 and column (4) of Table 4, the aggregate impact of "other barriers to trade and investment" on the unemployment rate is -0.953 for the United States[13] and -2.769 for Belgium. In other words, when import competition increases unemployment increases (as stated above). The higher is the bargaining power of workers, the greater is the rise in unemployment. Furthermore, the overall effect of "legal barriers to entry" amounts to 5.241 for the United States and 18.221 for

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[13] From column (4) of Table 4 the impact of other trade barriers on the mark-up is 16.8926 [(19.9706 + (-0.2052 x 15)]. Hence, by combining 16.8926 with information from column (7) of Table 6 gives the indirect impact 5.372 [16.8926 x (1.698 + 15 x (-0.092)] and the total effect is therefore -0.953 [(-7.900 + 15 x 0.105) + 5.372]. The calculation method is identical for Belgium, except for changing the value of average collective bargaining coverage.

Belgium: removing legal entry barriers leads to a decrease in unemployment, more so in countries where workers have a high bargaining power. These two examples show that, concerning the regulation indicators that directly affect unemployment, the aggregate effects of regulation are reinforced by high worker bargaining power.

Overall, Table 6 confirms the validity of the instruments by the rejection of the underidentification test and reports highly significant first-stage F statistics. In addition, the partial R^2 of the excluded instruments and the R-squares show that the regulation indicators have power and that the model variables together explain a large part of the variation in the unemployment rate. The weak instrument Kleibergen-Paap statistic is usually above the critical values provided by Stock and Yogo (2002) at least at the 10% level when it comes to the bias relative to OLS but it does not exceed the critical value for the size distortion, except in column (4).

The preferred instrumental variable specifications are columns (4) for the linear case and (7) for the model with workers' bargaining power. The estimation results using OECD product market regulation indicators suggest that regulation affects the extent of competition in the economy. Moreover, the linear specification implies that increased competition results in increasing unemployment but that specific forms of regulation exert a direct beneficial influence on employment outcomes. When workers' bargaining power enters the picture, the effect of competition on unemployment may be positive but stronger bargaining power dampens this positive effect. By contrast, the direct effects of regulation on unemployment (whether they are positive or negative) are enlarged by high union bargaining power.

Table 7 presents the results of the wage equation introduced earlier. Since comparable real wage data is not available for the sample countries, the dependent variable is the logarithm of real hourly labour costs for the total economy. This measure includes payroll taxes and other non-wage labour costs. Since the main interest of this thesis lies on the effects of competition on unemployment, only the linear impact and the interaction with collective bargaining coverage are considered. The second modification compared to Table 6 is that the public sector employment rate is not used as a control variable when estimating the labour cost regression.

Columns (1) and (2) report the reduced form estimation results where labour costs are regressed on the PMR indicators and other variables. These results show that some PMR indicators have a direct influence on the dependent variable. In column (3) the focus is on the impact of labour market institutions on real wages. The positive coefficient of the unemployment benefit

replacement ratio is in line with previous academic research on this topic (e.g. Nunziata, 2005) and the control variables deliver coefficients that are consistent with those in Table 5 of Griffith et al. (2007). Since the dependent variable is interpreted as a proxy for real wages the negative coefficient of the tax wedge means that when for example payroll taxes increase the real wage of workers falls.

The theoretical predictions and empirical evidence regarding the impact of employment protection are not clear-cut (see for example Nunziata, 2005). In this sample employment protection legislation and coordination indicators all exert a negative impact on labour costs. The use of extension clauses in the economy has a positive but mainly insignificant impact on labour costs. In other words, wage schedules that are imposed to cover all sectors of the economy lead to rising labour costs. The home ownership rate is negatively associated with real wages and the coefficient is significant at the 5% level in many of the specifications: real wages/labour costs decrease when home ownership increases.

Columns (4)–(9) introduce the mark-up to the specifications and the results clearly show that increased competition decreases labour costs (real wages). This conclusion is opposite to that in Griffith et al. (2007) but is supported by Spector (2004), among others. In any case, as mentioned earlier the empirical literature and theory are ambiguous on the effects of regulation on wages.

In columns (5) and (6) the mark-up is instrumented by the product market regulation indicators to control for the potential endogeneity. The difference between (5) and (6) is that the latter takes into consideration that some of the instruments should actually enter the labour cost regression directly because the Hansen J test rejects the null hypothesis of the overidentifying restrictions in column (5). In order to define the instruments that should not be excluded from the labour cost regression, the same procedures and testing are applied as in the case of the unemployment rate regression. Comparing the OLS and IV coefficients of the mark-up one can see that OLS is biased downwards. This is expected if there is a negative correlation between profitability and wages due to unobserved shocks or other factors.

The correctly specified linear IV model of column (6) suggests that removing legal barriers and administrative burdens on new firm establishment result in decreasing real labour costs. Furthermore, simplifying rules and procedures and reducing other barriers to trade and investment also decrease labour costs. By contrast, real wages increase when barriers in network

Table 7. The Impact of competition on labour costs using OECD PMR indicators

Dependent variable: Log of real hourly labour cost	(1) Reduced form OLS	(2) Reduced form OLS	(3) OLS - LMR & controls	(4) OLS - linear	(5) IV - linear	(6) IV - preferred linear	(7) OLS - interaction	(8) IV - interaction	(9) IV - preferred interaction
Competition variables (OECD)									
Mark-up				72.390*** [11.028]	105.237*** [14.802]	97.475*** [19.972]	212.098*** [34.419]	311.605*** [44.816]	255.435*** [29.545]
Mark-up x avg. bargaining coverage							-2.072*** [0.459]	-3.113*** [0.643]	-2.316*** [0.443]
Public ownership	-7.872*** [2.777]	-13.743*** [4.837]							-9.505** [3.715]
State involvement in business operations	-3.382 [2.479]	8.960 [6.439]							
Administrative burdens on start-ups	4.092** [1.811]	30.122*** [8.071]				13.121*** [3.076]			62.918*** [4.198]
Legal barriers to entry	10.831*** [1.919]	17.991** [7.887]				8.352*** [1.835]			
Barriers in network sectors	-2.313 [2.239]	-2.253 [2.249]				-8.189*** [2.107]			-9.664*** [2.256]
Simplification of rules and procedures	13.005*** [1.767]	14.233*** [2.463]				8.177*** [1.723]			
Tariff barriers	-24.559*** [7.114]	-42.233*** [14.986]							
Other barriers to trade and investment	18.044*** [2.013]	34.332*** [10.306]				9.114*** [2.497]			
Public ownership x avg. bargaining coverage		0.216*** [0.065]							0.145*** [0.049]
State involvement x avg. bargaining coverage		-0.054 [0.082]							0.140*** [0.025]
Adm. burdens x avg. bargaining coverage		-0.460*** [0.106]							-0.719*** [0.062]

Table 7 *(Continued)*

Dependent variable: Log of real hourly labour cost	(1) Reduced form OLS	(2) Reduced form OLS	(3) OLS - LMR & controls	(4) OLS - linear	(5) IV - linear	(6) IV - preferred linear	(7) OLS - interaction	(8) IV - interaction	(9) IV - preferred interaction
Legal barriers x avg. bargaining coverage		-0.085 [0.082]							0.105*** [0.019]
Tariff barriers x avg. bargaining coverage		0.419* [0.225]							
Other barriers x avg. bargaining coverage		-0.413*** [0.153]							
Labour market & control variables									
Tax wedge	-0.785*** [0.201]	-0.759*** [0.193]	-1.028*** [0.243]	-1.036*** [0.219]	-1.040*** [0.210]	-0.688*** [0.179]	-0.690*** [0.213]	-0.519** [0.232]	-0.118 [0.201]
Benefit replacement ratio	0.596*** [0.115]	0.495*** [0.107]	0.360*** [0.121]	0.290** [0.124]	0.258* [0.132]	0.369*** [0.136]	0.435*** [0.130]	0.479*** [0.143]	0.328*** [0.119]
Coordination	-1.297 [1.144]	-2.223* [1.195]	-1.909* [1.134]	-3.367*** [1.132]	-4.029*** [1.162]	-2.622** [1.114]	-3.862*** [1.137]	-4.701*** [1.184]	-2.667** [1.195]
EPL - regular contracts	-22.789*** [4.569]	-26.161*** [4.327]	-23.035*** [4.403]	-25.542*** [4.215]	-26.680*** [4.172]	-26.892*** [3.823]	-33.600*** [4.826]	-38.663*** [5.109]	-34.489*** [4.499]
EPL - temporary contracts	-3.565*** [1.169]	-1.346 [1.308]	-1.654 [1.166]	-1.774* [1.024]	-1.829* [0.970]	-1.799* [0.986]	-3.861*** [1.206]	-4.958*** [1.257]	-2.204* [1.187]
Extension clauses	-0.232 [1.497]	1.461 [1.308]	0.142 [2.106]	0.957 [2.186]	1.326 [2.228]	1.567 [1.750]	3.641 [2.305]	5.320** [2.438]	6.443*** [1.620]
Home ownership rate	-0.192 [0.218]	-0.696*** [0.203]	-0.412* [0.219]	-0.505** [0.197]	-0.548*** [0.191]	-0.410** [0.172]	-0.230 [0.199]	-0.129 [0.202]	-0.780*** [0.175]
Output gap	1.057*** [0.310]	0.849*** [0.290]	0.832** [0.354]	0.395 [0.358]	0.196 [0.357]	0.424 [0.344]	0.389 [0.332]	0.209 [0.319]	0.281 [0.276]
Change in inflation	0.081 [0.729]	0.121 [0.687]	0.612 [0.802]	0.782 [0.812]	0.859 [0.813]	0.473 [0.719]	0.764 [0.788]	0.825 [0.782]	0.610 [0.677]
Real exchange rate	0.219* [0.119]	0.228** [0.108]	0.566*** [0.127]	0.642*** [0.117]	0.676*** [0.109]	0.513*** [0.087]	0.606*** [0.106]	0.618*** [0.096]	0.561*** [0.086]

Table 7 *(Continued)*

Dependent variable: Log of real hourly labour cost	(1) Reduced form OLS	(2) Reduced form OLS	(3) OLS - LMR & controls	(4) OLS - linear	(5) IV - linear	(6) IV - preferred linear	(7) OLS - interaction	(8) IV - interaction	(9) IV - preferred interaction
Constant	427.642***	319.970***	342.831***	233.848***	196.121***	204.405***	413.298***	-66.901	9.983
	[18.407]	[24.974]	[25.146]	[27.400]	[29.230]	[32.745]	[31.341]	[61.601]	[43.210]
1st stage F statistic:									
linear					31.40***	21.45***		25.91***	28.20***
interaction					-	-		27.16***	23.51***
1st stage partial R^2:									
linear					0.32	0.14		0.44	0.29
interaction					-	-		0.41	0.25
No. of overid. restrictions					7	2		12	5
Hansen test p-value					0.000	0.151		0.000	0.191
Underid. test p-value					0.000	0.000		0.000	0.000
Weak id. F statistic					31.40	21.45		16.75	22.19
R-squared	0.967	0.973	0.949	0.958	0.956	0.968	0.961	0.959	0.973
Observations	586	586	586	586	586	586	586	586	586

Notes: The regressions include 21 OECD countries over the period 1985–2013. Robust standard errors are in brackets. All regressions include country and year dummies. */**/*** indicates significance at 10%/5%/1% level. The 1st stage F statistic is for testing the joint significance of the excluded product market regulation indicators. The 1st stage Partial R^2 is for the excluded product market regulation indicators. The underidentification test verifies that the instruments together are relevant, whereas the weak identification statistic reports the Kleibergen-Paap Wald rk F statistic for testing whether the excluded instruments are only weakly correlated with the mark-up. The critical values provided by Stock and Yogo (2002) are in annexes 6 and 7. In column (5) the excluded PMR variables are from the estimates in column (2) of Table 4 and in column (8) they are based on the estimates in columns (3) and (4) of Table 4. The log of real hourly labour costs has been multiplied by 100 in order to have a clearer presentation.

sectors are removed. These sectors have traditionally been characterised by high state ownership, which may explain this result. The aggregate impact of other trade barriers on labour costs is 19.105[14] and the one for burdens on start-ups amounts to 4.592, both of which are close to the reduced form coefficients of column (1) in Table 7 above.

Columns from (7) to (9) illustrate how the results change when workers' bargaining power is included to the specification. The OLS estimator is again downwards biased and the mark-up is positive in all cases as in the linear specification. The coefficient of competition interacted with collective bargaining coverage is negative and highly significant. In other words, increased competition leads to a decrease in wages but this decrease is smaller when workers have a higher bargaining power. Column (9) reports the correctly specified IV model for the interaction case and supports the findings of column (6) when it comes to the PMR indicators that need to be included directly to the labour cost regression. Public ownership is an additional indicator not to be used as an instrument. Its negative coefficient means that real wages rise as public ownership decreases, which is comparable to the direct impact of reducing entry barriers in network industries (column (6)). Goerke (1998) uses a shirking model of efficiency wages and finds that wages increase or decrease with privatisation, depending on the wage setting mechanism and whether privatisation introduces stricter control or stronger profit orientation.

In column (9) the total effect of those regulation indicators which have a direct influence on labour costs depends on the average collective bargaining coverage. Using the same calculation method as previously with examples for Belgium and the United States, the aggregated impact of burdens on start-ups is -4462.073 for the United States and -74.172 for Belgium. This indicates that reducing burdens for creating new businesses leads to an increase in real wages, more so in countries with low bargaining power. This example shows that the total effect of a certain type of regulation may substantially differentiate from the implied direct effect when workers' bargaining power is included in the specification. In effect, the direct impact of administrative burdens on start-ups is positive (62.918) but the calculations above give a negative aggregate impact on real hourly labour costs.

Overall, the R^2 improves when the right instruments are used and the preferred specifications are therefore columns (6) and (9). All the specifications pass the underidentification test at 1% level. The null hypothesis of weak instruments stemming from bias relative to OLS is rejected either at

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[14] The indirect effect is 9.991 (97.475 x 0.1025). As the direct effect is 9.114, the aggregate impact is 19.105 (9.991 + 9.114).

5% or 10% level of significance but the size distortion bias is not. Nevertheless, the R^2 is very high in all the Table 7 specifications and the instruments together exert explanatory power when looking at the first-stage F statistics and partial R^2 values.

The estimations using OECD PMR indicators suggest that increased competition results in increasing unemployment. However, when union bargaining power is taken into account, the effect of competition on unemployment may be positive and stronger bargaining power dampens this positive effect. Moreover, specific types of deregulation have direct beneficial impacts on employment outcomes. Furthermore, increased competition decreases real wages in general but on the other hand certain deregulation reforms may lead to increasing real wages when bargaining in the labour market is included to the specifications.

5.2.2. Results using Fraser Institute's (FI) economic freedom indicators

This section reports the estimation results for Fraser Institute's (FI) economic freedom indicators but otherwise the table structure is identical to that seen in section 5.2.1. That is why the emphasis is on interpreting the results. Griffith et al. (2007) uses two of the FI indicators that are also used in this thesis, namely, the average tariff rate and non-tariff barriers.

Table 8 includes the first-stage regression where the average profitability (i.e., the mark-up) is explained by the economic freedom indicators and other variables. Tables 9 and 10 show the results from the unemployment rate regression. Table 11 reports the findings when the dependent variable is the logarithm of real hourly labour costs.

Table 8 shows how the economic freedom indicators affect the mark-up. As mentioned earlier, the interpretation of the FI indicators' scale is opposite to the one used for the OECD indicators. Hence, the values are increasing with liberalisation, which is why a negative coefficient indicates that reforms liberalising product markets are associated with lower mark-ups. This is the case for non-tariff trade barriers, the ease of starting a new business and foreign ownership restrictions. In other words, when establishing a business is made easier and non-tariff trade barriers and foreign ownership restrictions reduced the average mark-ups decrease. The positive coefficient of capital controls, private sector credit and government investment mean that when there are no restrictions to the availability of capital and private sector borrowing and when the share of government investment is reduced, the profitability of firms is likely to increase, which is a

reasonable outcome. Moreover, a decrease in average tariffs is associated with an increase in economic rents.

The indicators describing government involvement in the economy, the difficulty to start a business and the extent of private sector credit all have a highly significant impact on the mark-up in all the specifications. The variable "starting a business" has a coefficient of -0.0437 in column (2) which means that reforms increasing the indicator value by 1 (i.e., simplifying the process of establishing a firm) reduce the mark-up by 4.4 percentage points.

The average tariff rate and non-tariff trade barriers are highly significant in the linear case of column (2) but not significant at 5% level when the impact of workers' bargaining power is included in the model in columns (3) and (4). Capital controls and foreign ownership restrictions have an insignificant coefficient in the linear case but significant at least at 10% level when collective bargaining coverage is taken into account. The interacted economic freedom indicators have opposite signs compared to the pure impact of those indicators in columns (3) and (4), implying that the existence of worker bargaining power prevents the effect of regulation from manifesting 100% to the mark-up.

When it comes to the labour market and control variables, the results between Table 4 and 8 are somewhat similar though the coefficients are either insignificant or less significant when using the FI economic freedom indicators. However, the tax wedge is positive, whereas in Table 4 it is negative. Contrary to the model with OECD PMR indicators, extension clauses are positively and the home ownership negatively associated with profitability. The output gap is insignificant when regulation indicators are added to the specifications in columns (2)–(4) compared to the same columns in Table 4 where the coefficients are positive and significant. This implies that the mark-up is not necessarily pro-cyclical when FI economic freedom indicators are used. Finally, the R^2 and F statistic suggest that the variables together explain a remarkable part of the variation in the mark-up at the 1% level of significance.

Table 9 shows the estimation results from the reduced form estimation of the unemployment rate regression. As in Table 5, there are indications that some of the regulation variables should not be used as instruments but rather enter the unemployment regression directly. Especially government investment and average tariffs seem to be strongly associated with the unemployment rate.

Table 8. The impact of Fraser Institute's economic freedom indicators on the mark-up

Dependent variable:	Mark-up			Mark-up x average bargaining coverage
	(1)	(2)	(3)	(4)
Economic freedom indicators (FI)				
Government enterprises and investment		0.0196***	0.0458***	2.7068***
		[0.0030]	[0.0095]	[0.6286]
Average tariff rate		0.0491***	0.0466*	-2.4132
		[0.0187]	[0.0260]	[1.7305]
Non-tariff trade barriers		-0.0476***	-0.0253	1.1329
		[0.0081]	[0.0166]	[1.0968]
Foreign ownership/investment restrictions		-0.0108	-0.0542**	-2.5010*
		[0.0078]	[0.0217]	[1.3053]
Capital controls		0.0029	0.0273***	1.9187***
		[0.0029]	[0.0070]	[0.4693]
Private sector credit		0.0144***	0.0107***	0.9166***
		[0.0033]	[0.0032]	[0.2271]
Starting a business		-0.0437***	-0.1319***	-8.0177***
		[0.0055]	[0.0182]	[1.1928]
Government investment x avg. bargaining coverage			-0.0004***	-0.0194**
			[0.0001]	[0.0082]
Average tariff rate x avg. bargaining coverage			-0.0001	0.0598**
			[0.0004]	[0.0252]
Non-tariff trade barriers x avg. bargaining coverage			-0.0000	-0.0403**
			[0.0002]	[0.0162]
Foreign own. restrictions x avg. bargaining coverage			0.0004	0.0213
			[0.0003]	[0.0196]
Capital controls x avg. bargaining coverage			-0.0003***	-0.0213***
			[0.0001]	[0.0060]
Starting a business x avg. bargaining coverage			0.0009***	0.0480***
			[0.0002]	[0.0115]
Labour market variables				
Tax wedge	0.0001	0.0015	0.0031**	0.2661***
	[0.0013]	[0.0013]	[0.0014]	[0.0941]
Benefit replacement ratio	0.0010	-0.0001	0.0005	0.0834
	[0.0011]	[0.0008]	[0.0009]	[0.0635]
Coordination	0.0205***	0.0065	0.0025	0.0610
	[0.0070]	[0.0065]	[0.0069]	[0.5281]
EPL - regular contracts	0.0268	0.0141	0.0172	-1.2394
	[0.0273]	[0.0218]	[0.0213]	[1.6147]
EPL - temporary contracts	0.0022	-0.0144**	-0.0145*	-1.5829***
	[0.0061]	[0.0073]	[0.0077]	[0.5967]
Extension clauses	-0.0089	0.0180**	0.0386***	3.1236***
	[0.0101]	[0.0085]	[0.0095]	[0.6795]

Table 8 *(Continued)*

Dependent variable:	Mark-up			Mark-up x average bargaining coverage
	(1)	(2)	(3)	(4)
Home ownership rate	0.0011	-0.0026**	-0.0040***	-0.2410***
	[0.0014]	[0.0012]	[0.0012]	[0.0895]
Control variables				
Output gap	0.0060***	0.0003	-0.0001	-0.0117
	[0.0018]	[0.0016]	[0.0015]	[0.1089]
Change in inflation	-0.0020	0.0025	0.0020	0.1510
	[0.0044]	[0.0034]	[0.0033]	[0.2366]
Real exchange rate	-0.0009	-0.0007	-0.0006	-0.0593
	[0.0006]	[0.0005]	[0.0005]	[0.0366]
Public sector employment rate	-0.0035	-0.0135***	-0.0129***	-0.9637***
	[0.0058]	[0.0050]	[0.0049]	[0.3558]
Constant	1.5447***	1.5170***	2.1029***	172.6551***
	[0.1596]	[0.2380]	[0.2763]	[20.0006]
F statistic	52.11***	53.12***	57.65***	1175***
R-squared	0.7606	0.8388	0.8558	0.9831
Observations	586	586	586	586

Notes: The regressions include 21 OECD countries over the period 1985–2013. Robust standard errors are in brackets. All regressions include country and year dummies. */**/*** indicates significance at 10%/5%/1% level. Table 10 below reports the tests of the joint significance and partial R^2 of the economic freedom indicators and tests for underidentification and weak instruments.

Table 9. Reduced form estimations of the unemployment rate regression (OLS, FI indicators)

Dependent variable: Unemployment rate	(1)	(2)	(3)
Government enterprises and investment	-0.313***	-0.523***	-0.468***
	[0.050]	[0.162]	[0.136]
Average tariff rate	-1.353***	-3.044***	-1.021**
	[0.278]	[0.521]	[0.470]
Non-tariff trade barriers	-0.260**	0.263	0.042
	[0.122]	[0.337]	[0.226]
Foreign ownership/investment restrictions	-0.137	-1.238***	-1.003***
	[0.157]	[0.336]	[0.302]
Capital controls	0.073	-0.449***	-0.182*
	[0.052]	[0.157]	[0.093]
Private sector credit	-0.122	-0.097	-0.132
	[0.080]	[0.085]	[0.081]
Starting a business	0.212**	-0.946***	-0.040
	[0.092]	[0.300]	[0.151]
Interaction with average collective bargaining coverage			
Government enterprises and investment		0.002	
		[0.002]	
Average tariff rate		0.017***	
		[0.006]	
Non-tariff trade barriers		-0.005	
		[0.005]	
Foreign ownership/investment restrictions		0.017***	
		[0.005]	
Capital controls		0.007***	
		[0.002]	
Starting a business		0.013***	
		[0.003]	
Interaction with average union density			
Government enterprises and investment			0.004
			[0.003]
Average tariff rate			-0.009
			[0.009]
Non-tariff trade barriers			-0.007
			[0.005]
Foreign ownership/investment restrictions			0.025***
			[0.006]
Capital controls			0.008***
			[0.002]
Starting a business			0.014***
			[0.003]
Labour market controls: Tax wedge, EPL (regular & temporary contracts), benefit replacement ratio, coordination, extension clauses, home ownership rate	Yes	Yes	Yes
Other controls: output gap, change in inflation, real exchange rate, public sector employment rate, country and year dummies, constant	Yes	Yes	Yes
F statistic	59.00***	62.31***	63.69***
R-squared	0.891	0.904	0.899
Observations	586	586	586

Notes: The regressions include 21 OECD countries over the period 1985–2013. Robust standard errors are in brackets. */**/*** indicates significance at 10%/5%/1% level.

The impact of competition on the unemployment rate is presented in Table 10. The linear specification results in columns from (2) to (4) follow closely the case when the OECD indicators are used: OLS is biased upwards because the competition coefficient becomes more negative when instrumenting. Since the Hansen J test rejects the exclusion of the overidentifying restrictions, some of the instruments should be directly entered to the unemployment regression. The Lagrange Multiplier method reveals that tariffs and non-tariff barriers as well as the extent of government investment are to be included in the unemployment rate equation. They all have a negative sign meaning that abolishing tariffs and other trade barriers and reducing the share of government investment lead to a fall in unemployment. The aggregate impact of, for example, non-tariff barriers on unemployment is obtained by combining the direct and indirect effects: the indirect impact is first calculated by multiplying the effect of non-tariff barriers on the mark-up from column (2) of Table 8 (-0.0476) with the effect of the mark-up on unemployment from column (4) of Table 10 (-6.383), which amounts to 0.304. Since the direct effect is -0.587, the total impact is -0.283 (0.304-0.587) which is very similar with regard to the reduced form coefficient of non-tariff barriers in column (1) of Table 9.

Turning to columns (5)–(10) where workers' bargaining power is taken into account, one noteworthy remark is that the OLS coefficient is still positively biased contrary to Table 6 results. In addition, the very different mark-up coefficients in columns (6) and (7) imply that the wrong IV specification in column (6) results in the coefficient being seriously biased since it turns from positive to negative when instrumenting correctly.

Table 10 reports negative and highly significant competition coefficients which suggest that increasing competition leads to an increase in unemployment. Moreover, the correctly specified IV models in columns (7) and (10) have positive coefficients for competition interacted with workers' bargaining power. In other words, the existence of union bargaining in the labour market reduces the increase in unemployment generated by increased competition. The column (7) specification with collective bargaining coverage is preferred to column (10) because union density is not regarded as the best possible measure for workers' bargaining power (Flanagan, 1999).

Table 10. The impact of competition on the unemployment rate using FI indicators

Dependent variable: Unemployment Rate	(1) OLS LMR & controls	(2) OLS Linear	(3) IV Linear	(4) IV Preferred linear	(5) OLS Interaction - coverage	(6) IV Interaction - coverage	(7) IV Preferred interaction - coverage	(8) OLS Interaction - density	(9) IV Interaction - density	(10) IV Interaction - density
Competition variables (FI)										
Mark-up		-0.547 [0.691]	-5.652*** [1.318]	-6.383*** [2.169]	-4.604* [2.605]	4.214 [3.472]	-12.699** [5.031]	-8.412*** [1.826]	-15.471*** [2.549]	-18.990*** [3.213]
Mark-up x avg. bargaining coverage					0.060 [0.037]	-0.143*** [0.052]	0.131** [0.064]			
Mark-up x avg. union density								0.182*** [0.033]	0.253*** [0.045]	0.194*** [0.065]
Government investment				-0.194*** [0.060]			-0.299*** [0.078]			
Average tariff rate				-0.921*** [0.314]			-1.858*** [0.264]			
Non-tariff trade barriers				-0.587*** [0.200]						-0.568*** [0.189]
Foreign own. restrictions							-1.704*** [0.336]			-1.718*** [0.306]
Capital controls							-0.389*** [0.142]			
Starting a business							-1.758*** [0.463]			-0.893*** [0.155]
Foreign own. restrictions x avg. bargaining coverage							0.021*** [0.004]			
Capital controls x avg. bargaining coverage							0.007*** [0.002]			
Starting a business x avg. bargaining coverage							0.020*** [0.003]			

Table 10 *(Continued)*

Dependent variable: Unemployment Rate	(1) OLS LMR & controls	(2) OLS Linear	(3) IV Linear	(4) IV Preferred linear	(5) OLS Interaction - coverage	(6) IV Interaction - coverage	(7) IV Preferred interaction - coverage	(8) OLS Interaction - density	(9) IV Interaction - density	(10) IV Interaction - density
Average tariff rate x avg. union density										-0.014** [0.006]
Foreign own. restrictions x avg. union density										0.035*** [0.005]
Capital controls x avg. union density										0.004*** [0.001]
Starting a business x avg. union density										0.020*** [0.004]
Labour market & control variables										
Tax wedge	0.133*** [0.025]	0.133*** [0.025]	0.133*** [0.025]	0.194*** [0.031]	0.123*** [0.025]	0.157*** [0.028]	0.189*** [0.026]	0.124*** [0.025]	0.120*** [0.025]	0.194*** [0.035]
Benefit replacement ratio	0.032*** [0.012]	0.033*** [0.012]	0.038*** [0.013]	0.041*** [0.014]	0.029** [0.012]	0.048*** [0.014]	0.027** [0.013]	0.018 [0.013]	0.015 [0.013]	0.022 [0.017]
Coordination	-0.667*** [0.161]	-0.656*** [0.160]	-0.552*** [0.160]	-0.471*** [0.157]	-0.641*** [0.161]	-0.591*** [0.163]	-0.608*** [0.126]	-0.558*** [0.156]	-0.438*** [0.158]	-0.421*** [0.162]
EPL - regular contracts	-1.072* [0.552]	-1.057* [0.554]	-0.921* [0.515]	-0.872* [0.485]	-0.831 [0.580]	-1.467*** [0.548]	-0.469 [0.485]	-1.308*** [0.493]	-1.299*** [0.458]	-0.606 [0.488]
EPL - temporary contracts	-0.817*** [0.112]	-0.816*** [0.111]	-0.805*** [0.107]	-0.802*** [0.110]	-0.755*** [0.121]	-0.951*** [0.128]	-0.882*** [0.138]	-0.716*** [0.108]	-0.669*** [0.106]	-0.532*** [0.144]
Extension clauses	-0.217 [0.222]	-0.222 [0.222]	-0.267 [0.215]	-0.734*** [0.243]	-0.297 [0.227]	-0.085 [0.229]	-0.962*** [0.256]	-0.243 [0.217]	-0.287 [0.208]	-0.550** [0.232]
Home ownership rate	0.030 [0.025]	0.031 [0.025]	0.037 [0.025]	-0.017 [0.029]	0.023 [0.026]	0.056** [0.028]	-0.049* [0.026]	0.008 [0.024]	0.004 [0.025]	-0.006 [0.028]
Output gap	-0.526*** [0.036]	-0.523*** [0.037]	-0.492*** [0.037]	-0.458*** [0.035]	-0.522*** [0.037]	-0.493*** [0.037]	-0.448*** [0.031]	-0.515*** [0.038]	-0.488*** [0.038]	-0.435*** [0.040]

Table 10 *(Continued)*

Dependent variable: Unemployment Rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	OLS	IV	IV	OLS	IV	IV	OLS	IV	IV
	LMR & controls	Linear	Linear	Preferred linear	Interaction - coverage	Interaction - coverage	Preferred interaction - coverage	Interaction - density	Interaction - density	Interaction - density
Change in inflation	0.010	0.009	-0.001	0.017	0.010	-0.003	0.016	0.013	0.006	-0.007
	[0.058]	[0.058]	[0.056]	[0.053]	[0.058]	[0.056]	[0.049]	[0.052]	[0.049]	[0.057]
Real exchange rate	-0.027***	-0.027***	-0.032***	-0.022***	-0.026***	-0.035***	-0.008	-0.011*	-0.008	-0.012
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]	[0.009]	[0.007]	[0.007]	[0.007]	[0.009]
Public sector employment rate	-0.054	-0.056	-0.074	-0.214***	-0.059	-0.066	-0.174**	-0.109*	-0.143**	-0.194**
	[0.067]	[0.067]	[0.075]	[0.078]	[0.067]	[0.077]	[0.079]	[0.061]	[0.061]	[0.093]
Constant	3.929	4.775*	12.801***	29.796***	7.354*	0.045	69.355***	13.371***	22.973***	49.657***
	[2.436]	[2.488]	[3.335]	[5.554]	[3.794]	[5.420]	[11.617]	[3.047]	[3.880]	[6.462]
1st stage F statistic:										
linear			27.06***	20.41***		21.82***	7.09***		16.72***	15.40***
interaction			-	-		24.31***	10.43***		18.85***	13.56***
1st stage partial R^2:										
linear			0.33	0.13		0.40	0.07		0.36	0.19
interaction			-	-		0.36	0.08		0.43	0.18
No. of overid. restrictions			6	3		11	3		11	4
Hansen test p-value			0.000	0.114		0.000	0.305		0.000	0.463
Underid. test p-value			0.000	0.000		0.000	0.000		0.000	0.000
Weak id. F statistic			27.06	20.41		20.42	7.31		15.84	13.14
R-squared	0.874	0.874	0.863	0.870	0.875	0.856	0.897	0.882	0.874	0.857
Observations	586	586	586	586	586	586	586	586	586	586

Notes: The regressions include 21 OECD countries over the period 1985–2013. Robust standard errors are in brackets. All regressions include country and year dummies. */**/*** indicates significance at 10%/5%/1% level. The 1st stage p-value is for testing the joint significance of the excluded economic freedom indicators. The 1st stage Partial R^2 is for the excluded economic freedom indicators. The underidentification test verifies that the instruments together are relevant, whereas the weak identification statistic reports the Kleibergen-Paap Wald rk F statistic for testing whether the excluded instruments are only weakly correlated with the mark-up. The critical values provided by Stock and Yogo (2002) are in annexes 6 and 7. In column (3) the excluded economic freedom indicators are from the estimates in column (2) of Table 8, in column (6) they are based on the estimates in columns (3) and (4) of Table 8 and in column (9) they are from the equivalent specification to columns (3) and (4) in Table 8 but with average collective bargaining coverage replaced by average union density.

Apart from those economic freedom indicators that enter directly the unemployment regression in column (4), columns (7) and (10) include additional indicators that are strongly and directly linked to unemployment. These are foreign ownership restrictions, capital controls and the ease of starting a business. The negative coefficients mean that removing foreign ownership and capital restrictions and making it easier to start a business lead to a decrease in unemployment.

The total effect of "starting a business" on unemployment can again be assessed by an example of two countries – the United States and Belgium – with low and high average collective bargaining coverage rates. Using the coefficients from column (7) of Table 10 and column (4) of Table 8, the impacts are 76.876 for the United States[15] and 1.472 for Belgium. In other words, reforms that facilitate the creation of new businesses (an increase in the indicator value) increase unemployment and the increase in unemployment is lower in countries where workers possess a high bargaining power. The overall effect of foreign ownership restrictions amounts to 22.027 for the United States and 0.462 for Belgium. This means that removing foreign ownership restrictions leads to rising unemployment, to a lesser extent when unions have a strong bargaining position. These two examples show that even if specific types of deregulation have direct beneficial employment effects, the total effect may be an increase in unemployment when union bargaining power is taken into consideration.

Turning to the impact of labour market institutions and control variables, Table 10 shows that the coefficients are in line with those seen in Table 6 with the OECD PMR indicators. Interestingly, when the IV approach is correctly specified the coefficient of extension clauses becomes significant at the 5% level. In other words, the automatic use of extension clauses is associated with a decrease in unemployment. What is more, a high home ownership rate seems to be linked with a fall in unemployment although the effect is not usually significant at the 5% level. The lower part of Table 10 reports various test statistics. In comparison to Table 6 the R^2 values are similar and the validity of the instruments is confirmed by the rejection of the underidentification test.

To summarise, the estimation results using Fraser Institute's economic freedom indicators show that an increase in competition engenders a rise in unemployment which is dampened by high bargaining power from the workers' side. In addition, there are strong implications that many

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[15] From column (4) of Table 8 the impact of starting a business on the mark-up is -7.2977 [-8.0177 + (0.048 x 15)]. Hence, by combining -7.2977 with the effect of competition from column (7) of Table 10 gives the indirect impact 78.334 [-7.2977 x (-12.699 + 15 x 0.131)]. The direct effect of starting a business on unemployment is -1.458 (-1.758 + 0.02 x 15). Hence, the total effect is 76.876 (-1.458 + 78.334). The calculation method is identical for Belgium, except for changing the value of average collective bargaining coverage.

forms of regulation exert a direct effect on unemployment. What is more, these direct impacts are beneficial for employment outcomes but when union bargaining is included in the model the aggregate impact of these types of reforms may be an increase in unemployment.

Table 11 below describes the impact of competition on labour costs. The first two columns show the reduced form estimations, i.e. the case when labour costs are regressed directly on the economic freedom indicators. The highly significant coefficients concerning some of the economic freedom indicators mean that some of them should directly enter the labour cost regression. Column (3) documents the influence of labour market institutions. Column (4) introduces the linear effect of competition on labour costs and columns (5)–(6) and (8)–(9) control for the potential endogeneity of competition.

First of all, the results are very much like those estimated in Table 7 when it comes to the impact of labour market institutions and control variables. For example, employment protection has a negative impact on labour costs and the size of the effect is larger for regular than temporary contracts. The significant and positive coefficient of the real exchange rate is interpreted so that an appreciated currency results in a rise in real wages/labour costs.

The first-stage F statistic, partial R-squares and R^2 are also similar to Table 7, i.e., the excluded economic freedom indicators add explanatory power to the model. The preferred specifications are columns (6) and (9) where the Hansen J test does not reject the overidentifying restrictions of the excluded economic freedom indicators.

In both the linear and interacted cases, the OLS coefficient is biased upwards since the coefficient of the correctly instrumented mark-up becomes lower. By contrast, in Table 7 the OLS coefficients are negatively biased. In any case, the positive values mean that when mark-ups decrease (competition increases) real wages decrease as well, which is supported by the theoretical implications in Spector (2004). What is more, the coefficient of the mark-up interacted with average collective bargaining coverage in column (9) is positive, which suggests that the fall in wages is reinforced by high union bargaining power.

The preferred specifications report that non-tariff trade barriers and capital controls enter directly the labour cost regression in both the linear case and in the specification where workers' bargaining power is included. Real wages (labour costs) are likely to fall when import goods can freely compete in domestic markets and they are likely to increase when capital controls are

removed. From column (6), the aggregate linear impacts of non-tariff barriers and capital controls on real hourly labour costs are -8.028[16] and 1.852, respectively. Both of these magnitudes are in line with the reduced form coefficients in column (1).

When union bargaining power is included in the model (column (9)), average tariffs and the extent of private sector credit exert an additional direct influence on labour costs. Their negative signs imply that reducing tariffs and increasing the share of private sector credit lead to a decrease in labour costs/wages. As in the previous calculation examples, the cumulative impact of e.g. non-tariff barriers can be assessed by comparing Belgium and the United States, the former having a high rate of average collective bargaining coverage (94%) and the latter representing an economy with low average collective bargaining (15%). In effect, the aggregate effect of non-tariff barriers is -691.697 for Belgium and 76.924 for the United States. In other words, in countries where workers have a low bargaining power, increased import competition leads to a rise in real wages, whereas it engenders a fall in wages in economies where workers possess a strong bargaining power. This further supports the remark made for the positive value of both the linear and interacted competition coefficient stating that increased competition in general results in falling labour costs, more so when workers have high bargaining power.

All in all, the messages from Tables 8–11 are the following: firstly, the extent of economic freedom (i.e. regulation) affects the level of the mark-up but different forms of regulation impact the mark-up differently. Secondly, increased competition increases unemployment but less so when unions possess a high bargaining power. Furthermore, many types of deregulation have direct and beneficial employment outcomes. However, taking into account the existence of union bargaining in the labour market, the aggregate impact of these specific deregulation reforms may be an increase in unemployment. Thirdly, lower mark-ups (increased competition) are associated with a fall in real labour costs and the fall is stronger in countries where union bargaining power is high. Some forms of regulation have a direct impact on labour costs and their cumulative effect depends on the regulation in question and the degree of union bargaining power.

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[16] The indirect impact combining information from column (2) of Table 8 with column (6) of Table 11 gives -2.572 (-0.0476 x 54.033). The direct impact from column (6) of Table 11 is -5.456. Therefore, the aggregate impact is -8.028 (-2.572 - 5.456).

Table 11. The impact of competition on labour costs using FI indicators

Dependent variable: Log of real hourly labour cost	(1) Reduced form OLS	(2) Reduced form OLS	(3) OLS - LMR & controls	(4) OLS - linear	(5) IV - linear	(6) IV - preferred linear	(7) OLS - interaction	(8) IV - interaction	(9) IV - preferred interaction
Competition variables (FI)									
Mark-up				72.390*** [11.028]	85.385*** [15.003]	54.033*** [14.741]	212.098*** [34.419]	233.552*** [39.299]	142.546* [73.340]
Mark-up x avg. bargaining coverage							-2.072*** [0.459]	-1.775*** [0.539]	1.304 [1.183]
Government investment	1.526*** [0.512]	10.585*** [1.944]							
Average tariff rate	3.321 [3.370]	-0.534 [4.996]							-12.894*** [4.407]
Non-tariff trade barriers	-8.299*** [1.717]	-18.889*** [3.438]				-5.456*** [1.406]			-12.723*** [3.526]
Foreign own. restrictions	1.783 [1.546]	-4.527 [4.450]							
Capital controls	1.791*** [0.546]	8.040*** [1.851]				1.695*** [0.451]			2.043*** [0.614]
Private sector credit	-0.404 [0.745]	-0.540 [0.648]							-3.253*** [1.042]
Starting a business	-3.203*** [0.894]	-25.598*** [3.950]							
Government investment x avg. bargaining coverage		-0.133*** [0.024]							-0.050*** [0.012]
Average tariff rate x avg. bargaining coverage		-0.017 [0.061]							
Non-tariff trade barriers x avg. bargaining coverage		0.276*** [0.050]							0.266*** [0.056]

Table 11 *(Continued)*

Dependent variable: Log of real hourly labour cost	(1) Reduced form OLS	(2) Reduced form OLS	(3) OLS - LMR & controls	(4) OLS - linear	(5) IV - linear	(6) IV - preferred linear	(7) OLS - interaction	(8) IV - interaction	(9) IV - preferred interaction
Foreign own. restrictions x avg. bargaining coverage		0.025 [0.054]							
Capital controls x avg. bargaining coverage		-0.076*** [0.024]							
Starting a business x avg. bargaining coverage		0.235*** [0.041]							0.074*** [0.013]
Labour market & control variables									
Tax wedge	-0.581** [0.290]	0.114 [0.246]	-1.028*** [0.243]	-1.036*** [0.219]	-1.038*** [0.208]	-0.685*** [0.212]	-0.690*** [0.213]	-0.744*** [0.224]	-0.610* [0.327]
Benefit replacement ratio	0.201 [0.123]	0.364*** [0.119]	0.360*** [0.121]	0.290** [0.124]	0.277** [0.122]	0.235** [0.112]	0.435*** [0.130]	0.374*** [0.140]	0.174 [0.216]
Coordination	-2.274* [1.175]	-3.203** [1.315]	-1.909* [1.134]	-3.367*** [1.132]	-3.629*** [1.147]	-2.984*** [1.068]	-3.862*** [1.137]	-4.627*** [1.233]	-3.468* [1.771]
EPL - regular contracts	-20.020*** [4.419]	-20.236*** [4.497]	-23.035*** [4.403]	-25.542*** [4.215]	-25.992*** [4.125]	-22.084*** [3.870]	-33.600*** [4.826]	-33.880*** [4.728]	-25.124*** [6.468]
EPL - temporary contracts	-4.996*** [1.595]	-4.173** [1.652]	-1.654 [1.166]	-1.774* [1.024]	-1.796* [0.965]	-2.706** [1.068]	-3.861*** [1.206]	-3.630*** [1.158]	-0.122 [1.605]
Extension clauses	0.485 [2.184]	5.771*** [1.884]	0.142 [2.106]	0.957 [2.186]	1.103 [2.128]	-0.514 [1.992]	3.641 [2.305]	3.723 [2.335]	-3.234 [2.815]
Home ownership rate	-0.851*** [0.215]	-1.001*** [0.219]	-0.412* [0.219]	-0.505** [0.197]	-0.522*** [0.188]	-0.852*** [0.184]	-0.230 [0.199]	-0.323* [0.190]	-0.498* [0.287]
Output gap	0.551 [0.371]	0.402 [0.348]	0.832** [0.354]	0.395 [0.358]	0.316 [0.343]	0.488 [0.326]	0.389 [0.332]	0.139 [0.330]	0.521 [0.426]
Change in inflation	0.577 [0.780]	0.435 [0.708]	0.612 [0.802]	0.782 [0.812]	0.812 [0.786]	0.636 [0.739]	0.764 [0.788]	0.864 [0.807]	0.241 [0.971]

Table 11 *(Continued)*

Dependent variable: Log of real hourly labour cost	(1) Reduced form OLS	(2) Reduced form OLS	(3) OLS - LMR & controls	(4) OLS - linear	(5) IV - linear	(6) IV - preferred linear	(7) OLS - interaction	(8) IV - interaction	(9) IV - preferred interaction
Real exchange rate	0.567***	0.557***	0.566***	0.642***	0.655***	0.614***	0.606***	0.654***	0.865***
	[0.118]	[0.110]	[0.127]	[0.117]	[0.112]	[0.106]	[0.106]	[0.106]	[0.150]
Constant	448.940***	473.397***	342.831***	233.848***	226.216***	313.178***	413.298***	30.002	264.888***
	[34.693]	[40.148]	[25.146]	[27.400]	[30.242]	[31.961]	[31.341]	[53.664]	[97.892]
1st stage F statistic:									
linear					26.43***	24.00***		22.27***	15.77***
interaction					-	-		24.25***	12.42***
1st stage partial R^2:									
linear					0.31	0.21		0.39	0.17
interaction					-	-		0.35	0.13
No. of overid. restrictions					6	4		11	4
Hansen test p-value					0.000	0.261		0.000	0.636
Underid. test p-value					0.000	0.000		0.000	0.000
Weak id. F statistic					26.43	24.00		19.01	9.23
R-squared	0.956	0.968	0.949	0.958	0.958	0.960	0.961	0.958	0.930
Observations	586	586	586	586	586	586	586	586	586

Notes: The regressions include 21 OECD countries over the period 1985–2013. Robust standard errors are in brackets. All regressions include country and year dummies. */**/*** indicates significance at 10%/5%/1% level. The 1st stage p-value is for testing the joint significance of the excluded economic freedom indicators. The 1st stage Partial R^2 is for the excluded economic freedom indicators. The underidentification test verifies that the instruments together are relevant, whereas the weak identification statistic reports the Kleibergen-Paap Wald rk F statistic for testing whether the excluded instruments are only weakly correlated with the mark-up. The critical values provided by Stock and Yogo (2002) are in annexes 6 and 7. In column (5) the excluded economic freedom indicators are from the estimates in column (2) of Table 8 and in column (8) they are based on the estimates in columns (3) and (4) of Table 8. The log of real hourly labour costs has been multiplied by 100 in order to have a clearer presentation.

5.2.3. Comparison of results between the OECD and Fraser Institute's indicators

Table 12 summarises the findings of this section by comparing the results obtained with the two different sets of product market regulation indicators. It includes only those indicators which are roughly comparable and the signs of the coefficients are taken directly from the estimation tables presented earlier. Since the interpretation of the two sets of indicators is reversed, the signs for specific regulation variables are expected to be opposite, which seems to be the case in general. Most discrepancies arise in the first-stage results (i.e. the impact of regulation on the mark-up) when it comes to the effects of state control, starting a business and non-tariff trade barriers.

It is important to bear in mind that the definitions between the indicators are not identical and hence they are not measuring exactly same things. For example, the OECD PMR indicator for "administrative burdens on start-ups" includes not only time and costs related to establishing a firm but also takes into account similar barriers in services which has traditionally been a tightly regulated sector in many countries. By contrast, the FI economic freedom indicator for "starting a business" does not make a distinction between different sectors. This might be the reason for the different impacts on the mark-up. Furthermore, Fraser Institute's size of government indicator measures the extent of public investment, whereas the OECD state control indicators (public ownership and state involvement in business operations) describe the direct economic influence of the public sector in the form of business owner. Lastly, "non-tariff trade barriers" reported by the Fraser Institute is a perception measure over the ability of imported goods to compete in domestic markets. The corresponding indicator compiled in the OECD has a similar component including the differential treatment of foreign suppliers but it also incorporates barriers to trade facilitation, such as recognition of foreign and international standards.

These differences notwithstanding, the direct effects of regulation on the unemployment rate and wages are comparable between the OECD and FI indicators: decreasing tariffs and reducing burdens to creating new businesses result in falling unemployment. In addition, promoting import competition and the recognition of foreign standards is likely to decrease labour costs (wages).

All in all, the estimation results using Fraser Institute's economic freedom indicators suggest that increasing competition leads to higher unemployment but less so if workers' bargaining power is high. The estimations using OECD PMR indicators point out to a similar impact if one considers the linear case but indicate positive employment effects from increased competition when workers' bargaining power is included. There can be several reasons for this discrepancy of results, one

being the fact that the indicators are not entirely comparable and they do not cover the same time horizon. As for the wage affects, both estimation results show clearly that increasing competition leads to a decrease in real wages. On the other hand, the results are ambiguous on whether the decrease in wages is dampened or supported by strong union bargaining power.

Table 12. Comparison of results using OECD and Fraser Institute's regulation indicators

Impact	OECD		Fraser Institute	
	Sign of the coefficient		Sign of the coefficient	
	Linear	Interaction[1]	Linear	Interaction[1]
Regulation on the mark-up				
Public ownership of enterprises	-	+ (-)		
State involvement in business	-	+ (-)		
Government investment			+	+ (-)
Tariff barriers	-	+ (-)	+	- (+)
Other trade barriers	+	+ (-)	-	+ (-)
Ease of starting a business	-	- (+)	-	- (+)
Competition on unemployment				
Aggregate impact of competition	-	+ (-)	-	- (+)
Direct effect of regulation:				
Public ownership of enterprises	-	n/a (-)		
State involvement in business	+	+ (n/a)		
Government investment			-	- (n/a)
Tariff barriers	n/a	+ (-)	-	- (n/a)
Other trade barriers	n/a	- (+)	-	n/a
Ease of starting a business	n/a	+ (-)	n/a	- (+)
Competition on real wages				
Aggregate impact of competition	+	+ (-)	+	+ (+)
Direct effect of regulation:				
Other trade barriers	+	n/a	-	- (+)

Notes: The signs of the coefficients are taken from columns (2)–(4) of Tables 4 and 8, columns (4) and (7) of Tables 6 and 10 and columns (6) and (9) of Tables 7 and 11. [1]Specification where the interaction of collective bargaining coverage is included. The sign states the impact of the variable and the sign in parentheses describes the impact of the variable interacted with worker bargaining power. The cell has "n/a" whenever the regulation indicator (or its interaction) does not directly enter the correctly specified IV model, in which case one cannot say anything about its direct impact on the dependent variable.

Finally, the results are quite different compared to the benchmark study (Griffith et al., 2007), but it is good to bear in mind that the variables used and the sample size itself are not the same as in the mentioned paper. Moreover, as pointed out in section 4.3., there are many indicators in the sample where regulation has decreased at first but then increased somewhat toward the end of the sample period. The results would probably be very different if only those indicators were used where a constant deregulation was in place. What is more, the choice for modelling strategy may be one factor behind the findings of this study compared to the previous empirical literature. Nonetheless, the instrumental variables approach considers the potential endogeneity issue of the mark-up variable, which is not always the case in other studies. In addition, the theoretical framework concerning the link between regulation, the mark-up and unemployment/wages is intuitive.

5.3. Robustness

This section presents robustness checks for the impact of competition on the unemployment rate using the preferred specifications of Fraser Institute's economic freedom indicators as a benchmark. From Table 10 the preferred OLS and IV specifications are columns (2) and (4) for the linear case and columns (5) and (7) for the interaction with collective bargaining coverage. First, Table 13 shows how the main results change if control variables are left out from the model.

Secondly, Table 14 reports three alternative models for the benchmark specifications. The first incorporates a modified version of the mark-up variable which is calculated using a varying cost of capital. It is the 10-year US government bond yield deducted by inflation and where a 5% yield demand is added. The second alternative specification illustrates the results of the preferred interaction case when collective bargaining coverage is assumed to be at the 1986 value instead of a simple average per country over the sample period. The third case introduces the log of employment as the dependent variable. In this check the civilian labour force is an additional control variable (hence, labour force is not anymore restricted to equal one) and the public sector employment rate is in logarithmic form (as in Griffith et al., 2007). Otherwise the control variables are exactly same as in the preferred specifications.

Dependent variable: Unemployment rate	(1) OLS LMR variables	(2) OLS LMR & control variables	(3) OLS f_i and t_t included	(4) OLS Linear	(5) IV Preferred linear - w/o controls	(6) IV Preferred linear	(7) OLS Interaction	(8) IV Preferred interaction - w/o controls	(9) IV Preferred interaction
Competition variables (FI)									
Mark-up				-0.547	-11.293***	-6.383***	-4.604*	-19.871***	-12.699**
				[0.691]	[2.930]	[2.169]	[2.605]	[6.999]	[5.031]
Mark-up x avg. bargaining coverage							0.060	0.157*	0.131**
							[0.037]	[0.083]	[0.064]
Government investment					-0.290***	-0.194***		-0.377***	-0.299***
					[0.077]	[0.060]		[0.109]	[0.078]
Average tariff rate					-1.350***	-0.921***		-2.344***	-1.858***
					[0.445]	[0.314]		[0.399]	[0.264]
Non-tariff trade barriers					-0.705***	-0.587***			
					[0.259]	[0.200]			
Foreign own. restrictions								-2.028***	-1.704***
								[0.506]	[0.336]
Capital controls								-0.535***	-0.389***
								[0.190]	[0.142]
Starting a business								-2.395***	-1.758***
								[0.703]	[0.463]
Foreign own. restrictions x avg. bargaining coverage								0.024***	0.021***
								[0.005]	[0.004]
Capital controls x avg. bargaining coverage								0.008***	0.007***
								[0.003]	[0.002]
Starting a business x avg. bargaining coverage								0.025***	0.020***
								[0.005]	[0.003]

Table 13 *(Continued)*

Dependent variable: Unemployment rate	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) IV	(6) IV	(7) OLS	(8) IV	(9) IV
	LMR variables	LMR & control variables	f_i and t_t included	Linear	Preferred linear - w/o controls	Preferred linear	Interaction	Preferred interaction - w/o controls	Preferred interaction
Labour market & control variables									
Tax wedge	0.160***	0.176***	0.133***	0.133***	0.274***	0.194***	0.123***	0.259***	0.189***
	[0.016]	[0.015]	[0.025]	[0.025]	[0.035]	[0.031]	[0.025]	[0.032]	[0.026]
Benefit replacement ratio	-0.006	0.022**	0.032***	0.033***	0.076***	0.041***	0.029**	0.058***	0.027**
	[0.010]	[0.011]	[0.012]	[0.012]	[0.018]	[0.014]	[0.012]	[0.017]	[0.013]
Coordination	-0.962***	-0.787***	-0.667***	-0.656***	-0.577***	-0.471***	-0.641***	-0.774***	-0.608***
	[0.109]	[0.091]	[0.161]	[0.160]	[0.178]	[0.157]	[0.161]	[0.164]	[0.126]
EPL - regular contracts	-0.248	-0.283*	-1.072*	-1.057*	-0.706	-0.872*	-0.831	-0.255	-0.469
	[0.188]	[0.165]	[0.552]	[0.554]	[0.565]	[0.485]	[0.580]	[0.636]	[0.485]
EPL - temporary contracts	-0.031	0.053	-0.817***	-0.816***	-0.990***	-0.802***	-0.755***	-1.140***	-0.882***
	[0.129]	[0.108]	[0.112]	[0.111]	[0.160]	[0.110]	[0.121]	[0.200]	[0.138]
Extension clauses	0.682***	0.316***	-0.217	-0.222	-1.391***	-0.734***	-0.297	-1.521***	-0.962***
	[0.114]	[0.096]	[0.222]	[0.222]	[0.351]	[0.243]	[0.227]	[0.360]	[0.256]
Home ownership rate	0.116***	0.113***	0.030	0.031	0.007	-0.017	0.023	-0.046	-0.049*
	[0.013]	[0.011]	[0.025]	[0.025]	[0.035]	[0.029]	[0.026]	[0.036]	[0.026]
Output gap		-0.544***	-0.526***	-0.523***		-0.458***	-0.522***		-0.448***
		[0.059]	[0.036]	[0.037]		[0.035]	[0.037]		[0.031]
Change in inflation		-0.023	0.010	0.009		0.017	0.010		0.016
		[0.090]	[0.058]	[0.058]		[0.053]	[0.058]		[0.049]
Real exchange rate		-0.036***	-0.027***	-0.027***		-0.022***	-0.026***		-0.008
		[0.008]	[0.008]	[0.008]		[0.008]	[0.008]		[0.007]
Public sector employment rate		-0.194***	-0.054	-0.056		-0.214***	-0.059		-0.174**
		[0.030]	[0.067]	[0.067]		[0.078]	[0.067]		[0.079]
Constant	-2.535***	2.215**	3.929	4.775*	35.435***	29.796***	7.354*	89.413***	69.355***
	[0.915]	[1.069]	[2.436]	[2.488]	[6.292]	[5.554]	[3.794]	[16.620]	[11.617]

Table 13 *(Continued)*

Dependent variable: Unemployment rate	(1) OLS LMR variables	(2) OLS LMR & control variables	(3) OLS f_i and t_t included	(4) OLS Linear	(5) IV Preferred linear - w/o controls	(6) IV Preferred linear	(7) OLS Interaction	(8) IV Preferred interaction - w/o controls	(9) IV Preferred interaction
Country and year dummies	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1st stage F statistic:									
linear					19.93***	20.41***		6.96***	7.09***
interaction					-	-		9.98***	10.43***
1st stage partial R^2:									
linear					0.13	0.13		0.06	0.07
interaction					-	-		0.07	0.08
No. of overid. restrictions					3	3		3	3
Hansen test p-value					0.149	0.114		0.087	0.305
Underid. test p-value					0.000	0.000		0.000	0.000
Weak id. F statistic					19.93	20.41		7.14	7.31
R-squared	0.315	0.555	0.874	0.874	0.769	0.870	0.875	0.811	0.897
Observations	586	586	586	586	586	586	586	586	586

Notes: Robust standard errors are in brackets. */**/*** indicates significance at 10%/5%/1% level. The 1st stage F statistic is for testing the joint significance of the excluded economic freedom indicators. The 1st stage Partial R^2 is for the excluded economic freedom indicators. The underidentification test verifies that the instruments together are relevant, whereas the weak identification statistic reports the Kleibergen-Paap Wald rk F statistic for testing whether the excluded instruments are only weakly correlated with the mark-up. The critical values provided by Stock and Yogo (2002) are in annexes 6 and 7. Columns (1)–(3) show the impact of labour market institutions, controls as well as country and year effects on unemployment, whereas columns from (4) to (9) add the impact of competition on the unemployment rate. The excluded instruments in columns (5)–(6) and (8)–(9) are the ones in columns (4) and (7) in Table 10.

Columns (1) and (2) in Table 13 show the effects of labour market institutions and control variables on unemployment. The third column includes country and year dummies and the results imply that including country and year effects is important since they raise substantially the explanatory power of the model. Columns from (4) to (9) include the effect of competition and its interaction with collective bargaining coverage as well as the direct effects of the regulation indicators. The preferred IV specifications from Table 10 are reported in columns (6) and (9). The exclusion of the control variables does not significantly alter the results although the impacts are somewhat larger compared to including all the control variables.

Not taking into account bias due to different levels of increasing returns to scale in the mark-up and the pro-cyclical behaviour of many of the variables, the direct effects of regulation would deliver misleading results since some of the coefficients have an opposite and insignificant sign. This was revealed by estimating the preferred IV specifications above without country and year dummies. Those robustness checks are available upon request.

Table 14 presents the results from three alternative specifications for the preferred linear and interaction cases. Columns (1)–(4) deliver the estimations when the mark-up variable is calculated with a time-varying component for the cost of capital as explained above. The competition coefficients are very similar to the preferred specifications in Table 10. The direct impacts of the economic freedom indicators and the effect of labour market and control variables are also well in line with the preferred cases from the main results.

Columns (5) and (6) illustrate how the results change if collective bargaining coverage is assumed to be at the 1986 level. Both the OLS and IV coefficients are remarkably similar to the ones in columns (5) and (7) of Table 10. Furthermore, the lower part of the table indicates that using the 1986 value for workers' bargaining power increases the explanatory power of the excluded instruments. However, the Hansen J test rejects the overidentifying restrictions, which means that there is still at least one product market regulation indicator that should be included directly to the unemployment rate regression.

The third alternative model in columns (7)–(10) reports the impact of competition on employment. Firstly, the R^2 values of the employment regression are higher than those estimated for the unemployment rate regression and almost equal to 1. Secondly, the sign of the competition coefficient as well as all other variables are expected to be opposite compared to the results of the unemployment rate regression. In effect, all the competition coefficients are

positive. In other words, employment is likely to fall when competition in the product market increases, which supports the result of Table 10. What is more, the direct effects of the economic freedom indicators are also opposite even though the impacts of government investment and non-tariff trade barriers are insignificant. In addition, the Hansen J test rejects the overidentifying restrictions in both the linear and interaction specifications, meaning that the specified instrumental variable models are not correct and that there is at least one indicator which should enter the employment regression directly. In any case, the effect of tariffs is clear-cut: employment increases when tariffs decrease. This is comparable to the finding in Table 10 where a reduction in tariffs lowers the unemployment rate.

The labour market variables and controls mainly have an opposite sign of the coefficient compared to the unemployment rate regression, which is as expected. Nevertheless, the impact of employment protection for regular contracts stays negative. In addition, the home ownership rate has a highly significant negative influence on employment. In other words, rising home ownership is associated with a decrease in employment. What is more, the public sector employment rate in columns (8) and (10) is positive but not significant at the 5% level.

In conclusion, the robustness estimations support the results of the baseline specifications stating that increased competition in the product market results in falling employment and increasing unemployment. The direct effects of regulation on employment outcomes are also fairly robust. What is more, the impact of labour market institutions is very similar across alternative specifications. Finally, it is important to highlight that country and year dummies are to be included to the model and that the effect of competition is not significantly changed even if control variables are dropped from the specifications.

Table 14. Three alternative specifications for the impact of competition on employment outcomes using FI indicators

Dependent variable:	Unemployment rate (Mark-up using varying capital costs)				Unemployment rate (using 1986[1] collective bargaining coverage)		Log of employment			
	(1) OLS Linear	(2) IV Linear	(3) OLS Interaction	(4) IV Interaction	(5) OLS Interaction	(6) IV Interaction	(7) OLS Linear	(8) IV Linear	(9) OLS Interaction	(10) IV Interaction
Competition variables (FI)										
Mark-up	-1.730*** [0.576]	-7.078*** [2.212]	-2.059 [1.488]	-6.043 [3.986]	1.306 [3.054]	-16.413*** [5.851]	10.931*** [2.604]	20.649*** [5.581]	13.590 [8.391]	0.384 [15.307]
Mark-up x bargaining coverage			0.005 [0.020]	0.093** [0.039]	-0.026 [0.043]	0.209*** [0.079]			-0.040 [0.125]	0.169 [0.248]
Government investment		-0.193*** [0.059]		-0.395*** [0.068]		-0.399*** [0.077]		-0.068 [0.172]		0.189 [0.239]
Average tariff rate		-0.697** [0.341]		-1.951*** [0.280]		-2.147*** [0.276]		3.681*** [0.791]		6.553*** [0.760]
Non-tariff trade barriers		-0.649*** [0.200]						0.625 [0.473]		
Foreign own. restrictions				-1.503*** [0.322]		-1.993*** [0.381]				3.027** [1.326]
Capital controls				-0.503*** [0.162]		-0.472*** [0.153]				2.510*** [0.576]
Starting a business				-1.075*** [0.408]		-1.926*** [0.434]				1.843 [1.749]
Foreign own. restrictions x bargaining coverage				0.022*** [0.004]		0.025*** [0.004]				-0.025* [0.014]
Capital controls x bargaining coverage				0.008*** [0.002]		0.008*** [0.002]				-0.044*** [0.007]
Starting a business x bargaining coverage				0.015*** [0.003]		0.024*** [0.004]				-0.025* [0.013]

Table 14 *(Continued)*

Dependent variable:	Unemployment rate (Mark-up using varying capital costs)				Unemployment rate (1986[1] collective bargaining coverage)		Log of employment			
	(1) OLS Linear	(2) IV Linear	(3) OLS Interaction	(4) IV Interaction	(5) OLS Interaction	(6) IV Interaction	(7) OLS Linear	(8) IV Linear	(9) OLS Interaction	(10) IV Interaction
Labour market & other controls										
Tax wedge	0.128***	0.174***	0.126***	0.181***	0.137***	0.174***	-0.671***	-0.677***	-0.664***	-0.752***
	[0.025]	[0.032]	[0.026]	[0.026]	[0.025]	[0.024]	[0.088]	[0.105]	[0.093]	[0.102]
Benefit replacement ratio	0.031**	0.027*	0.030**	0.028**	0.034***	0.026**	-0.187***	-0.166***	-0.184***	-0.154***
	[0.012]	[0.015]	[0.012]	[0.012]	[0.013]	[0.012]	[0.051]	[0.051]	[0.052]	[0.049]
Coordination	-0.572***	-0.222	-0.570***	-0.633***	-0.659***	-0.611***	0.239	-0.097	0.232	0.164
	[0.168]	[0.196]	[0.169]	[0.156]	[0.161]	[0.121]	[0.553]	[0.554]	[0.553]	[0.427]
EPL - regular contracts	-0.918*	-0.461	-0.898	-0.836	-1.125**	-0.411	-4.373**	-5.177***	-4.510**	-3.864***
	[0.557]	[0.521]	[0.563]	[0.534]	[0.551]	[0.460]	[1.749]	[1.539]	[1.873]	[1.403]
EPL - temporary contracts	-0.770***	-0.643***	-0.763***	-0.846***	-0.832***	-0.765***	2.743***	2.426***	2.706***	3.288***
	[0.109]	[0.125]	[0.117]	[0.112]	[0.116]	[0.120]	[0.427]	[0.439]	[0.452]	[0.556]
Extension clauses	-0.218	-0.635***	-0.223	-1.086***	-0.205	-1.100***	0.572	1.615***	0.621	1.983***
	[0.215]	[0.230]	[0.215]	[0.257]	[0.219]	[0.245]	[0.521]	[0.558]	[0.541]	[0.723]
Home ownership rate	0.031	-0.022	0.029	-0.046*	0.031	-0.049**	-0.629***	-0.491***	-0.624***	-0.430***
	[0.025]	[0.030]	[0.028]	[0.027]	[0.025]	[0.024]	[0.078]	[0.085]	[0.080]	[0.074]
Output gap	-0.511***	-0.438***	-0.510***	-0.448***	-0.522***	-0.454***	1.023***	0.927***	1.023***	0.816***
	[0.037]	[0.038]	[0.037]	[0.031]	[0.037]	[0.030]	[0.104]	[0.105]	[0.104]	[0.089]
Change in inflation	0.038	0.146**	0.039	0.004	0.009	0.018	-0.166	-0.160	-0.167	-0.095
	[0.056]	[0.068]	[0.056]	[0.075]	[0.057]	[0.049]	[0.226]	[0.205]	[0.227]	[0.175]
Real exchange rate	-0.029***	-0.025***	-0.029***	-0.006	-0.027***	-0.014**	0.248***	0.237***	0.248***	0.201***
	[0.008]	[0.009]	[0.008]	[0.007]	[0.008]	[0.007]	[0.028]	[0.027]	[0.027]	[0.029]
Public sector employment rate	-0.076	-0.279***	-0.077	-0.147*	-0.068	-0.064	-0.006	0.035	-0.005	0.060*
	[0.068]	[0.087]	[0.067]	[0.083]	[0.071]	[0.077]	[0.031]	[0.029]	[0.031]	[0.031]
Civilian labour force (millions of persons)							0.387***	0.459***	0.382***	0.568***
							[0.091]	[0.098]	[0.092]	[0.116]

Table 14 *(Continued)*

Dependent variable:	Unemployment rate (Mark-up using varying capital costs)				Unemployment rate (1986[1] collective bargaining coverage)		Log of employment			
	(1) OLS Linear	(2) IV Linear	(3) OLS Interaction	(4) IV Interaction	(5) OLS Interaction	(6) IV Interaction	(7) OLS Linear	(8) IV Linear	(9) OLS Interaction	(10) IV Interaction
Constant	7.029***	31.288***	10.600***	54.483***	9.715**	75.733***	1598.48***	1770.05***	1580.70***	1704.85***
	[2.506]	[5.686]	[3.632]	[10.534]	[4.004]	[12.252]	[16.129]	[26.644]	[16.818]	[50.337]
1st stage F statistic:										
linear		12.12***		2.69**		10.72***		23.48***		6.02***
interaction		-		8.43***		11.23***		-		5.66***
1st stage partial R^2:										
linear		0.07		0.04		0.10		0.14		0.07
interaction		-		0.07		0.09		-		0.05
No. of overid. restrictions		3		3		3		3		3
Hansen test p-value		0.223		0.145		0.006		0.000		0.004
Underid. test p-value		0.000		0.016		0.000		0.000		0.000
Weak id. F statistic		12.12		2.43		11.02		23.48		5.22
R-squared	0.876	0.867	0.876	0.902	0.875	0.902	0.999	0.999	0.999	0.999
Observations	586	586	586	586	586	586	586	586	586	586

Notes: Robust standard errors are in brackets. All regressions include country and year dummies. [1]The collective bargaining coverage rate takes the 1995 value for Greece, 1989 for New Zealand and 1990 for Switzerland. */**/*** indicates significance at 10%/5%/1% level. The 1st stage F statistic is for testing the joint significance of the excluded economic freedom indicators. The 1st stage Partial R^2 is for the excluded economic freedom indicators. The underidentification test verifies that the instruments together are relevant, whereas the weak identification statistic reports the Kleibergen-Paap Wald rk F statistic for testing whether the excluded instruments are only weakly correlated with the mark-up. The critical values provided by Stock and Yogo (2002) are in annexes 6 and 7. Columns (1)–(4) are equivalent specifications to columns (2), (4), (5) and (7) in Table 10 except for the mark-up being calculated with a time-varying cost of capital. Columns (5) and (6) are based on the specifications of columns (5) and (7) in Table 10 but the collective bargaining coverage takes the 1986 value instead of country averages over the sample period. Columns from (7) to (10) show the impact of competition on employment where the specifications are as in columns (2), (4), (5) and (7) of Table 10, except for the civilian labour force being an additional control variable. In order to ease the presentation, the public sector employment rate is in logarithms in columns (7)–(10) and it is multiplied by 100 as is the log of employment.

6. Conclusion

Many developed countries have experienced persistently higher unemployment rates compared to the era of economic prosperity in the aftermath of the Second World War. Governments and experts continuously strive to find solutions in order to fight against unemployment because it includes considerable humanly and societal costs. Traditionally, research has focused on investigating the role of labour market institutions in explaining the causes of unemployment but during the last decades there has been a growing interest in how product market regulation (PMR) enters the picture.

Theory postulates that regulation affects the level of rents in the economy since it determines how easy it is for new firms to enter a market. In other words, the size of economic rents describes the extent of competition in a particular industry. High regulation allows the incumbent to appropriate a mark-up over marginal costs as it can set prices higher and restrict output compared to a situation of perfect competition. Deregulation leads to new players entering the market, which decreases the mark-up and increases competition. The pressure from competition forces the incumbent to decrease the price and produce more, which is why it needs to hire more people. What is more, workers see their real wages increasing as the price level decreases. The majority of earlier empirical work confirms these findings but there still remain specific questions to be answered that lack robustness. The impact of union bargaining power and its interaction with regulation is one of the most debated areas in this regard.

On the other hand, increased competition forces inefficient firms to exit the market and improves the productive efficiency by reducing slack in the workplace, which may entail an increase in unemployment. Similarly, privatisation might lead to a reduction in the previously overmanned (state-owned) enterprises. These considerations mean that aggregate employment may fall. This is supported by some empirical studies discussed in section 3.

This thesis explores the impact of product market regulation and labour market institutions on unemployment and real wages for 21 OECD countries over 1985–2013 using an instrumental variables approach. The article of Griffith et al. (2007) serves as a benchmark for the empirical strategy although there are important differences between the study and this thesis regarding the sample, data definitions and variables used. Regulation in the product market is assumed to influence unemployment and real wages through the degree of economic rents, which is why in the first stage the mark-up is explained by product market regulation indicators as well as labour

market and control variables. The second stage shows the impact of competition on unemployment and real hourly labour costs (being a proxy for real wages).

The estimations are run for two sets of regulation indicators from two different sources. The results suggest that increased competition in the product market leads to an increase in unemployment and a decrease in real wages. Robustness checks support these conclusions. Interestingly, these findings are compatible with the minority of previous empirical work which remains indecisive especially with regard to the impact of competition on wages and the role of workers' bargaining power. What is more, this study makes use of regulation indicators encompassing the whole economy, whereas previous empirical work has mainly concentrated on using indicators describing the regulatory stance of network sectors (such as telecommunications and energy).

Furthermore, the results indicate that the type of regulation matters since the impact of different regulation indicators varies substantially both in regard to the sign and significance of the coefficients. What is more, certain types of regulation exert a direct effect on unemployment and wages. For instance, decreasing tariffs and reducing burdens to creating new businesses result in falling unemployment. Hence, deregulation has direct beneficial impacts on employment. However, the cumulative impact of these kinds of regulatory reforms may increase unemployment when union bargaining power is taken into consideration. Lastly, the effects of labour market institutions on unemployment and real wages are fairly similar to previous empirical findings.

At the end of the day, there is still scope for further understanding how regulation affects employment outcomes and wages and how the impacts depend on regulation in the labour market. Countries differ in many aspects and a regulatory reform which boosts employment in one country may not have any effect at all in another country. An interesting future study project would be to use the data of this thesis to explore the effects of regulation in a specific country or group of countries, for example the Eurozone.

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Annexes

Annexes 1–3 include Tables 2, 3 and 5 from Griffith et al. (2007) and the corresponding estimations by me, using the same sample countries and period. The aim of this exercise was to collect the same dataset as far as possible and see if I will get the same kind of results as in the benchmark study before extending the sample size and using a different set and definition of the variables. The tables below show that the results are quite different in regard to the unemployment and labour cost regressions. This is probably due to a different calculation of the mark-up[17], especially regarding the capital cost component: Griffith et al. (2007) use a time-varying capital cost (10-year US government bond yield) and the capital stocks are calculated using the perpetual inventory method. By contrast, I apply a constant 7% capital cost for all the countries during the sample period and use existing net capital stock data from the OECD STAN database and other data sources when necessary. In addition, the real hourly labour costs as well as some control variables have a slightly different definition, mainly due to data revisions conducted by the OECD (which is the main source).

Annex 1. Table 2 from Griffith et al. (2007) and my estimation results

Table 2

The Impact of Product Market Reforms on Competition

Dependent variable:	Profitability (μ_{it})			Profitability (μ_{it}) $\times$ Bargaining Coverage in 1986
	(1)	(2)	(3)	(4)
Single Market Programme	−0.00066	−0.00048	−0.00060	−0.01364
	(0.00026)	(0.00031)	(0.00032)	(0.02778)
Average Tariff Rate		−0.02813	−0.02064	−10.50267
		(0.01601)	(0.05146)	(4.10911)
Government Bureaucracy		−0.00387	−0.09118	−5.23088
		(0.00822)	(0.06655)	(5.29911)
Non-Tariff Barriers		0.02075	0.01997	1.28659
		(0.01435)	(0.01516)	(1.31458)
Average Tariff Rate × Bargaining Coverage 1986			−0.00017	0.09813
			(0.00058)	(0.04713)
Government Bureaucracy × Bargaining Coverage 1986			0.00103	0.05005
			(0.00079)	(0.06331)
Tax Wedge × Bargaining Coverage 1986			0.00010	0.00935
			(0.00007)	(0.00651)
Labour market controls: Tax wedge, employment protection, benefits, coordination	Yes	Yes	Yes	Yes
Other controls: output gap, change in inflation, real exchange rate, public sector employment rate, country and year dummies	Yes	Yes	Yes	Yes

Notes. The regressions include 206 observations on 14 countries over the period 1986–2000. Robust standard errors are in parentheses. See Table 3 for tests of the joint significance and partial R^2 of the four product market reform variables.

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[17]Annex 5 documents in detail how I have calculated the mark-up.

Table 2. The impact of product market reforms on competition (my estimations)

Dependent variable:	Profitability			Profitability x Bargaining Coverage in 1986
	(1)	(2)	(3)	(4)
Single Market Programme	-0.00015	-0.00002	-0.00029	-0.01534
	[0.000]	[0.000]	[0.000]	[0.029]
Average Tariff Rate		0.00710	0.11551**	-0.10491
		[0.022]	[0.050]	[4.050]
Government Bureaucracy		-0.01143	-0.23662***	-14.36659***
		[0.010]	[0.068]	[5.027]
Non-Tariff Barriers		0.01754	0.01771	1.54382
		[0.018]	[0.018]	[1.483]
Average Tariff Rate x Bargaining Coverage 1986			-0.00150**	0.00064
			[0.001]	[0.048]
Government Bureaucracy x Bargaining Coverage 1986			0.00269***	0.16300***
			[0.001]	[0.059]
Tax Wedge x Bargaining Coverage 1986			0.00014	0.01464**
			[0.000]	[0.007]
Labour market controls: tax wedge, employment protection, benefits, coordination	Yes	Yes	Yes	Yes
Other controls: output gap, change in inflation, real exchange rate, public sector employment rate, country and year dummies	Yes	Yes	Yes	Yes

Notes: Robust standard errors are in brackets. */**/*** indicates significance at 10%/5%/1% level. Otherwise same notes as in Table 2 of Griffith et al. (2007) above.

Table 3

The Impact of Competition on the Unemployment Rate

Dependent variable: Unemployment Rate	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) IV	(6) OLS	(7) IV
Competition Variables							
Profitability		6.857	17.102	−17.858	−0.272	−13.361	1.700
		(2.402)	(8.612)	(5.705)	(12.975)	(3.855)	(7.538)
Profitability × Bargaining coverage in 1986				0.300	0.375		
				(0.062)	(0.134)		
Profitability × Union density in 1986						0.297	0.157
						(0.049)	(0.078)
Labour Market Controls							
Tax wedge	0.109	0.118	0.131	0.079	0.099	0.039	0.083
	(0.047)	(0.047)	(0.048)	(0.047)	(0.060)	(0.044)	(0.046)
Employment protection legislation	−0.271	−0.225	−0.157	−0.035	0.172	0.193	0.033
	(0.289)	(0.279)	(0.268)	(0.266)	(0.328)	(0.270)	(0.281)
Benefits replacement ratio	10.72	9.591	7.905	6.943	2.360	8.810	8.268
	(2.984)	(3.055)	(3.149)	(2.948)	(3.844)	(2.455)	(2.525)
Coordination index	−1.328	−1.446	−1.622	−1.172	−1.513	−0.885	−1.245
	(0.364)	(0.367)	(0.384)	(0.391)	(0.485)	(0.327)	(0.363)
Other Controls							
Output gap	−0.515	−0.563	−0.635	−0.566	−0.733	−0.545	−0.592
	(0.044)	(0.047)	(0.075)	(0.046)	(0.074)	(0.046)	(0.058)
Change in inflation	−1.454	0.246	2.786	−0.231	5.549	−1.259	0.822
	(5.830)	(5.740)	(6.325)	(5.555)	(8.278)	(4.999)	(5.007)
Real exchange rate	−0.070	−0.057	−0.037	−0.062	−0.018	−0.063	−0.049
	(0.012)	(0.013)	(0.022)	(0.012)	(0.023)	(0.012)	(0.016)
Public sector employment rate	−0.546	−0.537	−0.523	−0.396	−0.329	−0.491	−0.505
	(0.122)	(-.0109)	(0.093)	(0.107)	(0.119)	(0.102)	(0.091)
Constant	4.783	−4.778	−19.061	35.951	−29.396	35.451	−8.651
	(2.829)	(4.248)	(12.780)	(8.513)	(12.346)	(7.079)	(8.436)
1st Stage p-value:							
linear			0.0053		0.0016		0.0001
interaction			–		0.0003		0.0000
1st Stage Partial R^2:							
linear			0.06		0.09		0.15
interaction			–		0.11		0.26
p-value for Hansen test of over-identifying restrictions			0.20		0.27		0.08

Notes. The regressions include 206 observations on 14 countries over the period 1986–2000. Robust standard errors are in parentheses. All specifications include country and year dummies. The 1st Stage p-value is for a test of the joint significance of the excluded product market reforms, and the 1st Stage Partial R^2 is for the excluded product market reforms. In column (3) they are based on the estimates in column (2) of Table 2, in column (5) they are based on the estimates in columns (3) and (4) of Table 2, and in column (7) they are based on the equivalent specification to columns (3) and (4) in Table 2 but with bargaining coverage replaced by union density.

Table 3. The impact of competition on the unemployment rate (my estimations)

Dependent variable: Unemployment Rate	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) IV	(6) OLS	(7) IV
Competition variables							
Profitability		1.142	-30.849**	-36.721***	-37.885***	-12.943***	-1.608
		[2.086]	[14.625]	[7.839]	[11.125]	[4.165]	[6.181]
Profitability x Bargaining Coverage in 1986				0.496***	0.350***		
				[0.097]	[0.119]		
Profitability x Union Density in 1986						0.258***	-0.075
						[0.063]	[0.102]
Labour market controls							
Tax wedge	0.113***	0.120***	-0.090	0.095***	0.021	0.112***	0.078**
	[0.038]	[0.039]	[0.115]	[0.035]	[0.050]	[0.037]	[0.039]
Employment protection legislation	-0.212	-0.207	-0.332	0.457*	0.212	-0.127	-0.257
	[0.295]	[0.298]	[0.434]	[0.257]	[0.291]	[0.288]	[0.285]
Benefit replacement ratio	13.368***	12.868***	26.878***	5.893*	13.367***	11.143***	16.369***
	[2.990]	[3.162]	[7.182]	[3.052]	[3.834]	[2.662]	[3.159]
Coordination index	-0.371	-0.383	-0.053	0.299	0.225	0.194	-0.480
	[0.303]	[0.297]	[0.710]	[0.342]	[0.455]	[0.319]	[0.371]
Other controls							
Output gap	-0.533***	-0.538***	-0.383***	-0.523***	-0.468***	-0.520***	-0.510***
	[0.042]	[0.043]	[0.104]	[0.040]	[0.052]	[0.043]	[0.046]
Change in inflation	-2.959	-2.535	-14.418	-4.391	-8.432	-4.099	-4.623
	[4.951]	[5.131]	[9.346]	[4.976]	[5.604]	[5.227]	[5.162]
Real exchange rate	-0.055***	-0.050***	-0.176***	-0.056***	-0.103***	-0.050***	-0.077***
	[0.011]	[0.014]	[0.062]	[0.013]	[0.026]	[0.015]	[0.017]
Public sector employment rate	-0.449***	-0.427***	-1.052***	-0.237**	-0.535***	-0.151	-0.641***
	[0.092]	[0.093]	[0.341]	[0.106]	[0.162]	[0.114]	[0.163]
Constant	8.015***	6.110	92.727**	51.026***	70.532***	-6.926	28.583***
	[2.771]	[4.336]	[36.844]	[8.864]	[17.728]	[6.873]	[8.934]
1st Stage p-value:							
linear			0.2788		0.0036		0.0000
interaction			-		0.0001		0.0000
1st Stage partial R^2:							
linear			0.03		0.08		0.20
interaction			-		0.10		0.20
Hansen test p-value			0.485		0.109		0.001

Notes: Robust standard errors are in brackets. */**/*** indicates significance at 10%/5%/1% level. Otherwise same notes as in Table 3 of Griffith et al. (2007) above.

Annex 3. Table 5 from Griffith et al. (2007) and my estimation results

Table 5
The Impact of Competition on Labour Costs

Dependent variable: Log Real Labour Costs per Hour	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) IV
Competition Variables					
Profitability		−21.025	−114.644	−124.116	−176.422
		(10.336)	(56.607)	(28.126)	(61.486)
Profitability × Bargaining				1.245	1.803
coverage in 1986				(0.313)	(0.569)
Labour Market Controls					
Tax wedge	0.593	0.568	0.459	0.368	0.272
	(0.163)	(0.160)	(0.197)	(0.161)	(0.167)
Employment protection legislation	−2.028	−2.189	−2.909	−0.945	−0.436
	(1.072)	(1.037)	(1.359)	(1.040)	(1.055)
Benefit replacement ratio	24.208	27.759	43.571	14.893	10.175
	(8.814)	(8.750)	(13.152)	(8.350)	(9.550)
Coordination index	−3.225	−2.847	−1.163	−2.035	−1.561
	(1.894)	(1.850)	(1.946)	(1.899)	(1.824)
Other Controls					
Output gap	0.109	0.255	0.908	0.261	0.307
	(0.150)	(0.146)	(0.421)	(0.148)	(0.314)
Change in inflation	14.657	9.349	−14.284	9.295	7.714
	(32.625)	(29.936)	(32.477)	(31.640)	(32.918)
Real exchange rate	0.218	0.177	−0.004	0.160	0.141
	(0.051)	(0.054)	(0.128)	(0.052)	(0.087)
Constant	136.958	166.248	296.666	416.462	217.467
	(11.394)	(17.923)	(80.801)	(33.395)	(56.449)
1st Stage p-value:					
linear			0.0227		0.0329
interaction					0.0013
1st Stage partial R^2:					
linear			0.05		0.06
interaction					0.10
p-value for Hansen test of over-identifying restrictions			0.61		0.08

Notes. The regressions include 206 observations on 14 countries over the period 1986–2000. Robust standard errors appear in parentheses. Country and year dummies are included throughout. The 1st Stage p-value is for a test of the joint significance of the excluded product market reforms, and the 1st Stage Partial R^2 is for the excluded product market reforms. In column (3) they are based on estimates similar to those shown in column (2) of Table 2 but with non-tariff barriers excluded, in column (5) they are based on equivalent specifications to columns (3) and (4) in Table 2 but with non-tariff barriers excluded. The dependent variable has been multiplied by 100, to aid presentation.

Table 5. The impact of competition on labour costs (my estimations)

Dependent variable: Log Real Labour Costs per Hour	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) IV
Competition variables					
Profitability		54.854**	56.292	95.084	272.000***
		[21.830]	[55.778]	[61.677]	[85.551]
Profitability x Bargaining				-0.514	-2.917***
Coverage in 1986				[0.654]	[1.006]
Labour market controls					
Tax wedge	-0.383	-0.119	-0.112	-0.071	0.103
	[0.383]	[0.373]	[0.376]	[0.374]	[0.392]
Employment protection legislation	-4.620*	-3.217	-3.180	-4.098*	-8.493**
	[2.369]	[2.170]	[2.456]	[2.325]	[3.592]
Benefit replacement ratio	54.351**	33.470	32.923	39.750*	73.260**
	[22.520]	[20.397]	[26.774]	[21.055]	[31.897]
Coordination index	7.574	6.889	6.871	6.192	3.074
	[5.013]	[4.727]	[4.413]	[5.070]	[4.840]
Other controls					
Output gap	-1.578***	-1.743***	-1.748***	-1.780***	-1.918***
	[0.415]	[0.432]	[0.410]	[0.449]	[0.439]
Change in inflation	-55.239	-36.149	-35.649	-33.648	-25.784
	[60.629]	[59.924]	[55.957]	[60.809]	[61.621]
Real exchange rate	0.574***	0.809***	0.815***	0.816***	0.798***
	[0.165]	[0.152]	[0.235]	[0.151]	[0.239]
Constant	183.341***	79.256**	112.581	69.433	-123.737
	[27.662]	[39.481]	[102.933]	[76.595]	[124.593]
1st Stage p-value:					
linear			0.0132		0.0485
interaction			-		0.0109
1st Stage partial R^2:					
linear			0.05		0.05
interaction			-		0.06
Hansen test p-value			0.003		0.010

Notes: Robust standard errors are in brackets. */**/*** indicates significance at 10%/5%/1% level. Otherwise same notes as in Table 5 of Griffith et al. (2007) above.

Annex 4. Sample composition and average of the mark-up by country

Country	Period	Average of the mark-up	Standard deviation of the mark-up
Australia	1985–2013	1.4078	0.1659
Austria	1986–2013	1.4104	0.0953
Belgium	1985–2013	1.3320	0.0779
Canada	1985–2013	1.2758	0.0866
Denmark	1985–2013	1.2629	0.0510
Finland	1985–2013	1.3890	0.1503
France	1985–2013	1.3862	0.0228
Germany	1985–2013	1.3875	0.0468
Greece	1995–2013	1.3236	0.0471
Ireland	1986–2013	1.4523	0.0780
Italy	1985–2013	1.4811	0.1742
Japan	1985–2013	1.4115	0.0986
Netherlands	1985–2013	1.4189	0.0960
New Zealand	1989–2012	1.5895	0.1166
Norway	1985–2013	1.5382	0.2698
Portugal	1986–2013	1.0339	0.0350
Spain	1985–2013	1.1994	0.1459
Sweden	1985–2013	1.2167	0.1328
Switzerland	1990–2013	1.2157	0.0194
United Kingdom	1985–2013	1.3292	0.1127
United States	1985–2013	1.4344	0.0308
Total observations	**586**	**1.3570**	**0.1674**

Annex 5. Data definitions and sources

Variable	Definition and source	Mean	Std.
Unemployment rate	Harmonised (seasonally-adjusted) unemployment rate. Numbers of unemployed persons of working age as a percentage of the civilian labour force (total number of unemployed plus persons in civilian employment). The unemployed comprises persons who are out of work, available for work and seek for employment. OECD Main Economic Indicators and OECD Economic Outlook No 99 - June 2016.	7.565	3.840
Employment (millions of persons)	Total employment in millions of persons (aged 15 and over). OECD Economic Outlook No 99 - June 2016 and OECD STAN database.	18.851	29.590
Real hourly labour costs	Wages and salaries plus supplements, such as contributions to social security, private pensions, health insurance and life insurance per hour worked. Deflated by the Consumer Price Index (2010=100) and expressed in US dollars (2010 exchange rate). Own calculations based on various OECD statistics: OECD Economic Outlook No 99 - June 2016; OECD STAN database; OECD Unit Labour Costs - Annual Indicators; OECD Employment and Labour Market Statistics and OECD Main Economic Indicators.	21.354	11.747
Mark-up	$$\mu_{it} = \frac{Value\ added\ (current\ prices)_{it}}{Labour\ Costs\ (current\ prices)_{it}\ +\ 7\%\ x\ Net\ Capital\ Stock\ Volume\ (in\ 2000\ or\ 2005\ prices)_{it}}$$ - Value added at basic prices plus taxes, less subsidies on production, excluding imports and VAT. At factor costs for Canada and producer's prices for the United States. - Labour costs include wages and salaries plus supplements, such as contributions to social security, private pensions, health insurance and life insurance. - The yield demand for net capital stock is assumed to be constant at 7% over the period for each country. - The volume of net capital stock is the value of all vintages of assets to owners where valuation reflects market prices for new and used assets. It is also referred to as Wealth Capital Stock as it reflects current monetary values of capital goods rather than continuing utility. The mark-up includes the following sectors per country: - Non-agriculture business sector excluding real estate: Austria, Denmark, Finland, France, Germany, Netherlands, Norway, United States. - Non-agriculture business sector: Australia, Belgium, Italy, New Zealand, Spain, Sweden, United Kingdom. - Total economy: Canada, Greece, Ireland, Japan, Portugal, Switzerland. Own calculations based mainly on OECD STAN database; OECD System of Unit Labour Cost and Related Indicators; Eurostat; AMECO_08: Capital Stock data from the European Commission; Kamps (2004) and Feenstra, Inklaar and Timmer (2015).	1.357	0.167

Variable	Definition and source	Mean	Std.
OECD product market regulation indicators *(scale from 0 to 6 from least to most restrictive, sources:* OECD Product Market Regulation database and Koske et al., 2015*)*			
Public ownership	Incorporates the following: 1)-(2) scope and governance of state-owned enterprises, 3) government involvement in network sectors and 4) direct control over enterprises.	2.747	0.897
State involvement in business operations	Consists of two measures. The first one includes price controls in 8 sectors. The second indicates whether the government applies incentive-based or coercive regulation.	2.339	0.938
Administrative burdens on start-ups	Includes three sub-components: 1) burdens for corporations, 2) burdens for sole proprietors and 3) barriers in professional services, freight transport services and retail distribution. 1) and 2) are compiled by information regarding the number of procedures and working days required to register a company and the total costs of the registration.	2.240	0.808
Legal barriers to entry	Share of sectors in which there are explicit legal limitations on the number of competitors. Takes into account 30 sectors.	1.495	0.696
Communication and simplification of rules and procedures	Government's communication strategy and efforts to reduce and simplify the administrative burden of interacting with the government.	1.398	0.709
Barriers in network sectors	Entry barriers in 8 network sectors (e.g. gas, telecommunications and rail transport) and degree of vertical separation in 3 network sectors (gas, electricity and rail transport).	3.545	0.953
Tariff barriers	Cross-product average of effectively applied tariffs.	0.150	0.361
Other barriers to trade and investment	Consists of two sub-components:1) discrimination of foreign firms in terms of taxes, subsidies, entry regulation etc. 2) barriers to trade facilitation which consists of recognition of foreign standards etc.	0.971	0.616
Fraser Institute's economic freedom indicators *(scale from 0 to 10 from most to least restrictive, sources:* Fraser Institute's 2016 Economic Freedom dataset and Gwartney et al., 2016*)*			
Government enterprises and investment	Government investment as a share of total investment. A country is assigned to 0 when government investment exceeds 50%. A rating of 10 is given to a country when the rate is less than 15%.	7.731	2.158
Average tariff rate	Unweighted mean of tariff rates. A rating of 10 is assigned to countries that do not impose tariffs. Countries receive lower ratings if the mean tariff rate rises.	8.931	0.475
Non-tariff trade barriers	Based on the answer to the following question: "In your country, tariff and non-tariff barriers significantly reduce the ability of imported goods to compete in the domestic market. 1–7 (best)". The question's wording has varied slightly over the years. The indicator considers tariff and non-tariff barriers.	7.553	1.223

Variable	Definition and source	Mean	Std.
Foreign ownership/investment restrictions	Based on the following two questions: (1) "How prevalent is foreign ownership of companies in your country? 1 = Very rare, 7 = Highly prevalent"; (2) "How restrictive are regulations in your country relating to international capital flows? 1 = Highly restrictive, 7 = Not restrictive at all".	8.200	1.109
Capital controls	The indicator takes into account 13 types of international capital controls. The rating is the percentage of capital controls not levied as a share of the total number of capital controls listed.	6.793	2.186
Private sector credit	Government borrowing relative to borrowing by the private sector. Greater government borrowing indicates more central planning and results in lower ratings. If available, the score is calculated as the government fiscal deficit as a share of gross saving. Otherwise it is calculated by the share of private credit to total credit extended in the banking sector.	8.420	1.506
Starting a business	This indicator includes three variables measuring the extent of time and money needed for creating a limited liability business.	7.580	2.016
Labour market variables			
Tax wedge	Income tax and employee and employer contributions less cash benefits as % of labour costs. Average of a single worker (at 100% of average earnings) in two family situations: one-earner family with two children and single persons without children. OECD (2004); OECD Taxing Wages 2003; OECD Taxing Wages 2016: Comparative tables. OECD Tax Statistics database.	33.739	9.714
Gross unemployment benefit replacement ratio	Percentage of previous gross earnings of average (production) worker for two earnings levels (67% and 100% of the average wage), three family situations (single, one-earner couple, two-earner couple) and three durations of unemployment. Consists of unemployment insurance and unemployment assistance benefits. Social assistance benefits are not generally included unless there is a general entitlement. Replacement rates in first year are weighted more heavily. Sources: mainly OECD (1994); Martin (1996) and OECD Benefits and Wages Statistics.	29.475	12.679
Adjusted collective bargaining coverage	Proportion of all wage earners with right to bargain, i.e., workers whose contract is regulated by the collective agreements signed by unions. Visser, J. ICTWSS Data base. version 5.1. (September 2016). Amsterdam: Amsterdam Institute for Advanced Labour Studies (AIAS), University of Amsterdam.	66.169	26.389
Union density	Ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. The measure is calculated using survey data wherever possible, and administrative data adjusted for non-active and self-employed members otherwise. OECD Labour Force Statistics.	35.919	20.343

Variable	Definition and source	Mean	Std.
Employment protection legislation - regular contracts	Strictness of employment protection for regular contracts. The measure includes regulation on individual dismissals and ranges between 0 (no restrictions) and 6 (full restrictions). OECD Employment Protection database.	2.112	0.914
Employment protection legislation - temporary contracts	Strictness of employment protection for temporary contracts. The measure includes regulation on the use of fixed-term and temporary work agency contracts and ranges between 0 (no restrictions) and 6 (full restrictions). OECD Employment Protection database.	1.808	1.332
Extent of coordination	Coordination of wage-setting. The indicator ranges from 1 to 5 where 5 means high coordination (centralised bargaining). Visser, J. ICTWSS Data base. version 5.1. (September 2016). Amsterdam: Amsterdam Institute for Advanced Labour Studies (AIAS), University of Amsterdam.	3.061	1.367
Extension clauses	Mandatory extension of collective agreements to non-organised employers. The indicator ranges from 0 to 3 where 3 means virtually automatic use of extension. Visser, J. ICTWSS Data base. version 5.1. (September 2016). Amsterdam: Amsterdam Institute for Advanced Labour Studies (AIAS), University of Amsterdam.	1.399	1.250
Home ownership rate	Home ownership rate as a percentage from population. Eurostat; US. Bureau of the Census; Doling & Horsewood (2011); Luxembourg Income Study (LIS); GSOEP; American Housing Survey; Statistics Bureau of Japan; Australian Bureau of Statistics and OECD (2015).	64.492	11.281
Control variables			
Output gap	Difference between the actual and potential gross domestic product (GDP) as a per cent of potential GDP. OECD Economic Outlook No 99 - June 2016 and International Monetary Fund (IMF) World Economic Outlook database.	-0.246	2.926
Change in inflation	Change in growth of consumer price index (2010=100) for all goods, from previous year. OECD Main Economic Indicators.	-0.195	1.395
Real exchange rate	Competitiveness-weighted relative consumer prices (2010=100) and unit labour costs for the overall economy measured in US dollars. Competitiveness weights take into account the structure of competition in both export and import markets of the goods sector of 49 countries. An increase in the index indicates a real effective appreciation and a corresponding deterioration of the competitive position. OECD Main Economic Indicators.	100.047	11.995
Public sector employment rate	General government employment rate. International Labour Organization (ILO) LABORSTA Labour Statistics Database; OECD Economic Outlook No 99 - June 2016 and OECD Annual Labour Force Statistics (ALFS) Summary tables.	13.069	4.936
Civilian labour force (millions of persons)	Total labour force excluding armed forces, in millions of persons. OECD Annual Labour Force Statistics (ALFS) database.	20.211	31.429

Annex 6. Critical values for the maximal IV relative bias

Table 1.
Critical Values for the Weak Instrument Test Based on TSLS Bias
Significance level is 5%

K_2	n = 1, b =				n = 2, b =				n = 3, b =			
	0.05	0.10	0.20	0.30	0.05	0.10	0.20	0.30	0.05	0.10	0.20	0.30
3	13.91	9.08	6.46	5.39	.	.	.	.				
4	16.85	10.27	6.71	5.34	11.04	7.56	5.57	4.73	.	.	.	.
5	18.37	10.83	6.77	5.25	13.97	8.78	5.91	4.79	9.53	6.61	4.99	4.30
6	19.28	11.12	6.76	5.15	15.72	9.48	6.08	4.78	12.20	7.77	5.35	4.40
7	19.86	11.29	6.73	5.07	16.88	9.92	6.16	4.76	13.95	8.50	5.56	4.44
8	20.25	11.39	6.69	4.99	17.70	10.22	6.20	4.73	15.18	9.01	5.69	4.46
9	20.53	11.46	6.65	4.92	18.30	10.43	6.22	4.69	16.10	9.37	5.78	4.46
10	20.74	11.49	6.61	4.86	18.76	10.58	6.23	4.66	16.80	9.64	5.83	4.45
11	20.90	11.51	6.56	4.80	19.12	10.69	6.23	4.62	17.35	9.85	5.87	4.44
12	21.01	11.52	6.53	4.75	19.40	10.78	6.22	4.59	17.80	10.01	5.90	4.42
13	21.10	11.52	6.49	4.71	19.64	10.84	6.21	4.56	18.17	10.14	5.92	4.41
14	21.18	11.52	6.45	4.67	19.83	10.89	6.20	4.53	18.47	10.25	5.93	4.39
15	21.23	11.51	6.42	4.63	19.98	10.93	6.19	4.50	18.73	10.33	5.94	4.37
16	21.28	11.50	6.39	4.59	20.12	10.96	6.17	4.48	18.94	10.41	5.94	4.36
17	21.31	11.49	6.36	4.56	20.23	10.99	6.16	4.45	19.13	10.47	5.94	4.34
18	21.34	11.48	6.33	4.53	20.33	11.00	6.14	4.43	19.29	10.52	5.94	4.32
19	21.36	11.46	6.31	4.51	20.41	11.02	6.13	4.41	19.44	10.56	5.94	4.31
20	21.38	11.45	6.28	4.48	20.48	11.03	6.11	4.39	19.56	10.60	5.93	4.29
21	21.39	11.44	6.26	4.46	20.54	11.04	6.10	4.37	19.67	10.63	5.93	4.28
22	21.40	11.42	6.24	4.43	20.60	11.05	6.08	4.35	19.77	10.65	5.92	4.27
23	21.41	11.41	6.22	4.41	20.65	11.05	6.07	4.33	19.86	10.68	5.92	4.25
24	21.41	11.40	6.20	4.39	20.69	11.05	6.06	4.32	19.94	10.70	5.91	4.24
25	21.42	11.38	6.18	4.37	20.73	11.06	6.05	4.30	20.01	10.71	5.90	4.23
26	21.42	11.37	6.16	4.35	20.76	11.06	6.03	4.29	20.07	10.73	5.90	4.21
27	21.42	11.36	6.14	4.34	20.79	11.06	6.02	4.27	20.13	10.74	5.89	4.20
28	21.42	11.34	6.13	4.32	20.82	11.05	6.01	4.26	20.18	10.75	5.88	4.19
29	21.42	11.33	6.11	4.31	20.84	11.05	6.00	4.24	20.23	10.76	5.88	4.18
30	21.42	11.32	6.09	4.29	20.86	11.05	5.99	4.23	20.27	10.77	5.87	4.17

Notes: The test rejects if g_{min} exceeds the critical value. The critical value is a function of the number of included endogenous regressors (n), the number of instrumental variables (K_2), and the desired maximal bias of the IV estimator relative to OLS (b).

Source: Table 1 from Stock and Yogo (2002, 58).

Annex 7. Critical values for the maximal IV size bias

Table 2.
Critical Values for the Weak Instrument Test Based on TSLS Size
Significance level is 5%

K_2	n = 1, r =				n = 2, r =			
	0.10	0.15	0.20	0.25	0.10	0.15	0.20	0.25
1	16.38	8.96	6.66	5.53	.	.	.	.
2	19.93	11.59	8.75	7.25	7.03	4.58	3.95	3.63
3	22.30	12.83	9.54	7.80	13.43	8.18	6.40	5.45
4	24.58	13.96	10.26	8.31	16.87	9.93	7.54	6.28
5	26.87	15.09	10.98	8.84	19.45	11.22	8.38	6.89
6	29.18	16.23	11.72	9.38	21.68	12.33	9.10	7.42
7	31.50	17.38	12.48	9.93	23.72	13.34	9.77	7.91
8	33.84	18.54	13.24	10.50	25.64	14.31	10.41	8.39
9	36.19	19.71	14.01	11.07	27.51	15.24	11.03	8.85
10	38.54	20.88	14.78	11.65	29.32	16.16	11.65	9.31
11	40.90	22.06	15.56	12.23	31.11	17.06	12.25	9.77
12	43.27	23.24	16.35	12.82	32.88	17.95	12.86	10.22
13	45.64	24.42	17.14	13.41	34.62	18.84	13.45	10.68
14	48.01	25.61	17.93	14.00	36.36	19.72	14.05	11.13
15	50.39	26.80	18.72	14.60	38.08	20.60	14.65	11.58
16	52.77	27.99	19.51	15.19	39.80	21.48	15.24	12.03
17	55.15	29.19	20.31	15.79	41.51	22.35	15.83	12.49
18	57.53	30.38	21.10	16.39	43.22	23.22	16.42	12.94
19	59.92	31.58	21.90	16.99	44.92	24.09	17.02	13.39
20	62.30	32.77	22.70	17.60	46.62	24.96	17.61	13.84
21	64.69	33.97	23.50	18.20	48.31	25.82	18.20	14.29
22	67.07	35.17	24.30	18.80	50.01	26.69	18.79	14.74
23	69.46	36.37	25.10	19.41	51.70	27.56	19.38	15.19
24	71.85	37.57	25.90	20.01	53.39	28.42	19.97	15.64
25	74.24	38.77	26.71	20.61	55.07	29.29	20.56	16.10
26	76.62	39.97	27.51	21.22	56.76	30.15	21.15	16.55
27	79.01	41.17	28.31	21.83	58.45	31.02	21.74	17.00
28	81.40	42.37	29.12	22.43	60.13	31.88	22.33	17.45
29	83.79	43.57	29.92	23.04	61.82	32.74	22.92	17.90
30	86.17	44.78	30.72	23.65	63.51	33.61	23.51	18.35

Notes: The test rejects if g_{min} exceeds the critical value. The critical value is a function of the number of included endogenous regressors (n), the number of instrumental variables (K_2), and the desired maximal size (r) of a 5% Wald test of $\boldsymbol{\beta} = \boldsymbol{\beta}_0$.

Source: Table 2 from Stock and Yogo (2002, 59).