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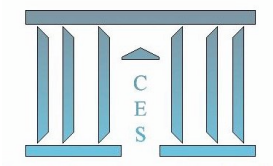

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Résumé

De nombreuses recherches ont souligné que les institutions du marché d'un pays constituent des déterminants importants de son taux de chômage. Cette étude généralise l'idée de Davis (1998) selon laquelle les instituions des partenaires commerciaux influencent aussi le taux de chômage d'un pays parce qu'elles sont à la source d'avantages comparatifs. L'investigation empirique confirme que les interactions entre le commerce bilatéral et les réglementations relatives du marché du travail affectent le taux de chômage d'équilibre. Compte tenu des limites relatives aux données dans ce domaine, l'ambition de ce papier est simplement d'attirer l'attention sur la pertinence de ces interactions comme facteurs complémentaires aux autres explications du chômage. Un autre résultat intéressant est qu'un pays relativement peu réglementé comme le Canada peut être affecté négativement parce que son principal partenaire est encore moins réglementé, alors qu'un pays hautement réglementé comme l'Allemagne est relativement protégé car ses partenaires le sont tout autant.

Mots clés: Chômage, Commerce international, Institutions du marché du travail

Abstract

There is ample evidence that a country's labour market institutions are important determinants of unemployment. This study generalises Davis' (1998) idea according to which the institutions of the trade partners matter also for a country's equilibrium unemployment rate as they generate comparative advantages. Moreover, the empirical investigation provides some evidence that the interactions between bilateral trade and relative labour market regulations affect the equilibrium unemployment rate. Given data limitations in this area, the ambition of this paper is merely to draw the attention to the general relevance of these interactions as complementing factors to other explanations of unemployment. Another interesting finding is that a fairly low regulated country like Canada can be negatively affected because its main trading partner is even less regulated, while a high regulated country like Germany appears rather sheltered because its trading partners are also highly regulated.

Keywords: Unemployment, Trade, Labour Market Institutions

JEL Classification: F16, J50, F10, F41

"A more subtle – but by this more important – reason for considering a global approach is that the consequences even of purely local institutions and shocks often depend crucially on the links to the global market"

Donald Davis

1. Introduction

The impact of labour market institutions on unemployment is generally assessed in empirical studies without taking into account the consequences of the increasing integration between countries. This is surprising given the prominent attention placed on the employment consequences of globalisation in the public and political debate. Theoretically, Brecher (1974) shows how labour market rigidities generated by a binding minimum wage are magnified by international trade, and Davis (1998) builds on Brecher's idea and draws attention to the key interactions between labour market institutions designed at the country level and global goods markets.[1] In a stylized trade model between flexible wage "America" and minimum wage "Europe", Davis shows that trade ties up factor prices between countries and leads to an increase in unemployment in "Europe". Davis' main intuition lies in the fact that "even when factor markets are strictly national, with idiosyncratic institutional features, they cannot be considered in isolation when goods markets are global".

The current paper takes this assertion seriously and brings two main contributions. Firstly, it extends Davis' framework using Pissarides (2000) matching model. This theoretical exercise shows the extent to which Davis' main idea could be generalised to a broader type of labour market institutions than the simple minimum wage context. The main mechanism through which institutions of trading partners could influence unemployment is straightforward. To the extent that labour market institutions matter for unemployment, they affect the cost of labour and, therefore, relative factor prices. It follows that labour market regulation contributes to comparative advantages in an open economy. "Rigid" countries that have relative high labour costs tend to specialise in capital intensive goods and face higher unemployment. Conversely, and this is the main difference with Davis, "flexible" economies benefit in terms of employment from trade with "rigid" countries, which increases demand for labour intensive

[1] In a different context, Krugman (1995) emphasises that the impact of trade with developing countries on wages and employment depends on the functioning of the labour market: trade effects are likely to be mostly reflected by changes in wages in flexible economies and in employment levels in rigid ones.

goods. Through trade and induced changes in factor prices, comparative advantages in labour market institutions enable “flexible” economies to transfer some of the regulation costs to “rigid” economies.

Secondly, this study provides the first empirical investigation of the impact of interactions between relative labour market institutions and bilateral trade on unemployment. In this research area relying on macro panel data, caution is required concerning the interpretation of empirical results because of data limitations. Nevertheless, the idea that these interactions influence unemployment receives some support, potentially contributing to the unemployment rate by several half-percentage points in some countries. Belgium, Finland and Sweden seem to be the countries that suffer the most from the trade-regulation interactions, while Portugal and Switzerland are estimated to be the main beneficiaries, although the advantages have decreased for the latter country. In addition, the Netherlands and the United Kingdom might have benefited the most from the *changes* in these interactions since the early 80s. Another interesting finding is that a low regulated country like Canada can be negatively affected because its main trading partner is even less regulated, while a large high regulated country like Germany appears rather sheltered because its trading partners highly regulate also.

This paper is part of the rapidly expanding literature highlighting that labour market institutions generate comparative advantages (see e.g. Davidson, Martin and Matusz, 1999; Moore and Ranjan, 2005; Cuñat and Melitz, 2007; Helpman and Itskhoki, 2007). Its focus is also closely related to the issue of interactions between shocks and labour market institutions, which has received prominent attention following the seminal paper by Blanchard and Wolfers (2000), BW hereafter. BW highlight that, even though labour market institutions could explain much of the differences in unemployment across countries either in the eighties or the nineties, changes in institutions through time were too small to account for the changes in unemployment rates. This position is also defended by Ball (1999), but is controversial, and section 2 discusses the empirical evidence related to this debate. As a result, BW turn their attention to the hypothesis that labour market institutions might affect the sensitivity of unemployment to shocks. The rationale is, firstly, that rigidities can prevent the adjustment of wages in the advent of negative shocks, which might generate unemployment, and, secondly, that differences in rigidities are related to differences in institutions. BW find evidence that the mostly common shocks that affected developed countries had differentiated impacts based on differences in labour market

institutions. However, Blanchard (2006) concludes that these explanations are only partly satisfactory and encourages researchers to search for other shocks and other interactions.

There is a major difference between BW's hypothesis and the channel implied by the Davis-type mechanism. The former seems implicitly optimistic in that the effects of labour market institutions, albeit persistent, are not a long term phenomenon, either because the "shocks" will revert / vanish over time or because bad institutions only slow the necessary adjustments. However, although trade expansion can be treated as a "shock" in the empirical analysis, this "shock" is permanent and the interactions between trade and labour market institutions affect the unemployment rate in the long run. Besides, this effect is clearly distinct from the temporary rise in unemployment caused by imports, which lasts until employment reallocates across firms and sectors, and fully adjusts to the new competitive environment.

The rest of the paper is organised as follows. The next section reviews briefly the empirical evidence on the role of institutions in explaining unemployment. Section 3 presents the theoretical framework on which the empirical investigation in Section 4 is based. Finally, Section 5 concludes.

2. Stylized facts and related literature

Searching for determinants of unemployment among the shock / institution interactions has been motivated by the assessment that the explanations relying solely on labour market institutions had three major shortcomings. Firstly, it could not account for the fact that in the 50s and 60s the flexible labour market economies recorded higher unemployment than the already more regulated European economies.[2] Secondly, the empirical evidence was considered not to be terribly robust. Thirdly, the changes in regulations seemed too small to account for the extent of the changes in the unemployment rates.

Aggregating data, which is described in section 4, across 20 OECD countries provides the broad picture represented in Figure 1. The non-weighted average unemployment rate started to increase

[2] This stylized fact is a major theoretical challenge. To my knowledge, only the calibrated model of Ljungqvist and Sargent (2005) can reproduce it.

sharply in the mid-seventies reaching a peak at a level that was 5.5 percentage points higher a decade later. The following decade was U-shaped with a trough in 1990 and a new record peak at 9.2% in 1993. Then, the average unemployment rate receded and, since the end of the nineties, it has stabilised between 6.5% and 7.5% a level comparable to those reached in the eighties.

Turning to the institution variables, there has been a clear upward trend in both the average benefit replacement rate and tax wedge, with an increase of 24 and 18 percentage points over 1960-1998, respectively (Figure 1a). The pattern of the replacement rate seems to fit that of the unemployment rate closely, at least until the end of the eighties, while the pace of the increase in the average tax wedge appears rather disconnected from the unemployment rate trend. Neither of these two institution variables is able to match the waves in the unemployment rate from the mid-eighties. Figure 1b shows that the evolution in bargaining coordination, employment protection (both a 0-2 index) and union density has been hump-shaped. Average coordination increased slightly until the mid-seventies and then decreased significantly until the mid-eighties. Employment protection increased until the mid-eighties, especially between the mid-sixties and mid-seventies, and has decreased slightly since then. Average union density evolved in a tight range between 38% and 46% over the whole period. Finally, the evolution of the average import ratio matches that of the unemployment rate reasonably well until 1990, but the peaks and trough seem to have been disconnected since then. These are only descriptive average statistics and only the empirical analysis might disentangle the various effects.

The aim here is not to produce one more review of the empirical literature about the impact of institutions, but simply to synthesise the debate. Very good surveys can be found in Nickell, Nunziata and Ochiel (2005), and in both Baker, Glyn, Howell and Schmitt (2005) and Baccaro and Rei (2005) for a sceptical view on the evidence produced up to now. Saint-Paul (2004) argues that changes in institutions have been significant in the last decades and can explain the magnitude of the trends in unemployment rates. The most comprehensive effort to match the changes in unemployment with those in institutions is probably that of Nickell et al. They find support for the regulatory view of unemployment and assess that the shock interactions à la Blanchard and Wolfers are not robust, when added to their thorough specification. However, based on absolute numbers and comparison across studies, Baker and al. note that some of the parameters reported by Nickell et al. do not seem

realistic. Following a rigorous empirical strategy, Bassanini and Duval (2006) reach more moderate conclusions as for the role of institutions, either directly or through the interactions with shocks.

Rather than taking a determined position on this debate, this paper focuses on another interaction related to another "shock", which has been surprisingly discarded so far and might complement other explanations of the unemployment patterns. The amount of empirical work accumulated to date on the institutional determinants of unemployment induces any researcher to modesty regarding the conclusions that can be drawn from time-series cross-section macro data.[3] Multi-collinearity plagues the data, which weakens the confidence one might place in the significance of a specific parameter. Nevertheless, as a starting point, three inferences look particularly robust across studies. Firstly, there is certainly no evidence that, since the seventies, regulating the labour market is good, with one caveat leading to the second inference. A robust finding across studies is that bargaining coordination is employment friendly. Thirdly, taking the data at face value, regulation seemed beneficial in the sixties and detrimental in the nineties. The last point is illustrated in Figure 2. Based on yearly data covering the twenty countries under study, each graph plots the linear correlation coefficient per decade between the unemployment rate and a given institution variable. Very similar patterns are obtained whether these correlations are computed from annual data or 10-year averages. Concerning the replacement rate, the correlation was negative in the sixties and turned positive afterwards. With benefit duration, the correlation was negative in the first two decades and positive in the last two. With employment protection and bargaining coordination, the correlation is negative, except in the nineties. There is a similar pattern for the tax wedge, although the positive correlation in the nineties is higher. These bivariate correlations are consistent with the view that the impact of labour market institutions on unemployment has varied over time.

[3] As noted by Blanchard (2006), "it is clear however that the number of potential shocks, institutions, and interactions is sufficiently large that the ability of such panel data regressions to tell us what exact combination matters is limited. Such regressions allow us to check for simple and partial correlations; they are unlikely to tell us about which combination of shocks and institutions is responsible for unemployment".

3. Theory

The proposed theoretical model embeds the large-firm version of the matching model of Pissarides (2000, chapter 3) into a Heckscher-Ohlin trade framework with two factors of production, capital K and labour L. The two factors could alternatively be thought of as being skilled and low skilled labour, as in Davis, with rigidities affecting mainly low skilled labour. Sub-section 3.1 summarises the insights of Pissarides model that are relevant for the impact of labour market institutions on unemployment, and Appendix 1 gives all the analytical details. Sub-section 3.2 integrates Davis' (1998) rationale into the matching framework.

3.1. The regulation view

The equilibrium unemployment rate is negatively related to labour market tightness θ, defined as the ratio of vacancy positions to the number of unemployed people, according to:

$$u = \frac{\lambda}{\lambda + \theta\, m(\theta)} \qquad (1)$$

where $m(.)$ is the matching function which decreases with θ such that $\theta\, m(\theta)$ increases with θ, and λ is the exogenous separation rate. Equation (1) implies that the unemployment rate is negatively related to and unequivocally determined by labour market tightness. In this sub-section, the user cost of capital, c_K, is supposed to be given, whereas it is determined by factor endowments and preferences in the following sub-section. In the presence of adjustment costs of labour, represented by the cost, h, of a vacant position, profit maximization entails that the marginal product of labour is equal to the sum of the gross wages, w, and the expected capitalised value of the firm's hiring costs:

$$marginal\ product\ of\ labour = w + h\,(\lambda + r)\,/\,m(\theta) \qquad (2)$$

where r denotes the discount rate.

The Factor Price Frontier defines a negative relationship between the marginal product of labour and the user cost of capital:

$$FPF: \qquad marginal\ product\ of\ labour = g(c_K) \quad , \quad g' < 0 \qquad (3)$$

The combination of equations (2) and (3) leads to the price-setting or labour demand curve:

$$price\ setting: \qquad h\,(\lambda + r)\,/\,m(\theta) = g(c_K) - w \quad , \quad g' < 0 \qquad (4)$$

Given c_K, the wage-setting curve represents the positively-sloped relation between tightness and bargained wages, w :

$$\textit{wage setting:} \qquad w = (1-\gamma)\,\rho\, z + \gamma\left[h\,\theta + g(c_K)\right] \tag{5}$$

where z represents the unemployment benefits, ρ the tax wedge between gross and net of labour tax wages, γ the workers' bargaining power. The labour market equilibrium is represented by *(E0)* in Figure 3a. By eliminating w in (4) and (5), the equilibrium tightness, and therefore the unemployment rate, is implicitly and uniquely determined by:

$$\textit{labour market eq.:} \quad \gamma\,\theta + \frac{\lambda + r}{m(\theta)} = \frac{1-\gamma}{h}\left[g(c_K) - \rho\, z\right] \quad \Rightarrow \quad \frac{\partial u}{\partial \gamma} > 0, \frac{\partial u}{\partial z} > 0, \frac{\partial u}{\partial \rho} > 0, \frac{\partial u}{\partial h} > 0, \frac{\partial u}{\partial \lambda} > 0 \tag{6}$$

Equation (6) captures the main features of the regulation view. Workers' bargaining power, and therefore, union density, is positively related to the unemployment rate, because an increase in γ tends to push up wages, which reduces labour demand. An increase in the unemployment benefits leads to an increase in the unemployment rate, as it improves the outside option of workers in the bargaining process and therefore boosts wages. For the same reason, unemployment is positively related to the tax wedge, but only to the extent that an increase in the tax wedge, which drives down net wages, is not offset by lower unemployment benefits, i.e. to the extent that the wedge between net wages and benefits is reduced. Employment protection can be seen both as increasing the vacancy costs h and as decreasing the separation rate λ. The former has a positive impact on the unemployment rate, while the latter has a negative one. Therefore, employment protection has an ambiguous effect overall. Finally, if coordination / centralization internalizes the negative externalities of too high wages and separation rates, it is associated with a lower γ and λ, *ceteris paribus*. Therefore, coordination / centralization could be expected to reduce unemployment and considered a "good" institution in this framework.

The cost of capital affects both the price-setting and wage-setting schedules. An increase in the cost of capital entails a decrease in the capital-labour ratio such that the marginal product of labour decreases to match the rise in c_K along the factor price frontier (equation 3). This decrease in the marginal product of labour is achieved by a decrease in both tightness, hence a rise in unemployment,

and wages. Indeed, an increase in the user cost reduces labour demand, which tends to drive unemployment to higher levels as seen from (4). On the other hand, it deteriorates profits and exerts a negative pressure on bargained wages. Maintaining wages constant requires an increase in labour tightness, which tends to diminish unemployment as seen from (5). However, the net effect captured by (6) is unambiguous, as represented by the shift from *(E0)* to *(E1)* in Figure 3b: an increase in the user cost leads to both lower wages and higher unemployment.[4] This channel plays a key role in the impact of trade because of the induced factor price changes.

3.2. The magnification effect of trade

The mechanism highlighted by Davis, who treats the case of trade between a minimum wage and a flexible wage economy, is now extended to the labour market framework presented above. There are two sectors in the economy and p is the price of good *1* in terms of good *2*, which is chosen as the numeraire. Good *1* is assumed to be capital intensive relative to good *2* at any factor prices. Let us focus on the link between the user cost of capital and the unemployment rate.

Based on the above analysis, the labour market equilibrium defines a positive relation between the user cost of capital and the unemployment rate, which is represented by the positively-sloped *RR* curve in Figure 4, where *R* stands for regulation. Equation (6) implies that an increase in (bad) regulation shifts the *RR* curve to the upper left. Obviously, the cost of capital is not exogenous, and, according to the Heckscher-Ohlin theorem, there is a negative relation between the price of the capital intensive good and the effective capital-labor endowment:

$$p = \zeta\left(\frac{\overline{K}}{\overline{N}(1-u)}\right) \quad , \quad \zeta' < 0 \qquad (7)$$

where $\overline{K}$ is the country's capital stock and $\overline{N}$ is total labour force. As long as the country produces both goods, the Stolper-Samuelson relation implies a positive relation between c_K and p:

$$c_K = \psi(p) \quad , \quad \psi' > 0 \qquad (8)$$

[4] The reason why the total effect on employment is unambiguous is the following. For a given level of tightness, the decrease in the marginal product of labour, that is induced by an increase in the user cost, affects wages one to one as a result of the labour demand shift (eq. 4). However, it affects wages to a factor $\gamma < 1$ as a result of the wage curve shift (eq. 5). Hence, the effect of the labour demand shift dominates and employment decreases.

It follows from (7) and (8) that product market equilibrium implies a negative relationship between the unemployment rate and the cost of capital: an increase in the unemployment rate, by reducing the effective labour available to the economy, makes the labour intensive good relatively more expensive, hence a decrease in c_K :[5]

$$\textit{product market equilibrium:} \quad c_K = \varphi(u) \quad , \quad \varphi' < 0 \qquad (9)$$

Importantly, this decreasing function only depends on the technical parameters of the production functions, on the relative factor endowment $\overline{K} / \overline{N}$ and on preferences. This means that labor market regulation does not affect this relation, which is labeled as the *BD* locus in Figure 5, where *BD* stands for Brecher-Davis. Therefore, equations (6) and (9) define the equilibrium unemployment rate and cost of capital at the intersection of the *BD* and *RR* schedules.

The low regulation equilibrium is represented at point *A**. Stricter regulation moves the equilibrium along the *BD* locus to a point like *A*. An increase in regulation triggers an increase in unemployment, a decrease in the user cost of capital, as well as in the price p of the capital-intensive good. Consequently, because regulation affects relative prices, it creates comparative advantages even if factor endowments are identical.

Suppose that two countries having the same relative factor endowments and preferences open up to trade. In that case, both countries share the same *BD* locus in the closed economy, which is also the *BD* relation in the integrated equilibrium. If both countries have the same level of regulation, then in this extended Heckscher-Ohlin framework, there is no trade and all prices and unemployment remain at their autarky level. Suppose now that the domestic country highly regulates its labour market as compared to the foreign country. The autarkic equilibrium are at point *A* and *A** respectively in Figure 5, where an asterisk superscript represents the foreign country. The integrated equilibrium takes place at the world unemployment rate u^W and price p^T, which lies somewhere between p and $p*$ based on the relative size of the two countries. At the price p^T, equilibrium in each country moves along the respective *RR* locus at points *C* and *C**. Because the domestic country specializes in the capital-

[5] It should be noted that the framework is a static one. Taking the dynamics of capital accumulation into account would amplify these mechanisms because of the substitution of capital to labour.

intensive good, the *BD* locus shifts rightwards for the domestic country and leftwards for the foreign country.[6] In the domestic country, trade induces a joint increase in the user cost of capital and in the unemployment rate along the high regulation schedule *RR*, while the converse applies to the foreign country, leading to the aggregated unemployment rate u^W. Therefore, the model highlights a testable positive relation between the unemployment rate of a given country and the interaction of trade with the difference between the regulation level of the country and that of its trading partner.

Thus, the result obtained by Davis in the case where regulation is limited to minimum wages is extended to a more general regulation context, with one noticeable difference. In Davis, the low regulation country has flexible wages and therefore no unemployment in autarky, as well as in the trade equilibrium. Here, the low regulation country benefits in terms of employment from trade with a high regulation country, through a decrease in the user cost of capital, which boosts labour demand and tightens the labour market.

When countries differ in their relative factor endowments, these interactions between trade and labour market regulations contribute to the establishment of comparative advantages. In the case of trade between a capital intensive developed country and a labour intensive developing one, relatively high regulation in the developed country would amplify the natural comparative advantages, whereas the latter would be somewhat attenuated if the developing is relatively highly regulated. However, regulation indicators are typically unavailable for developing countries, which makes this effect difficult to test in practice. Besides, institutional differences are likely to be secondary in this context.

[6] Factors are supposed to be immobile internationally in the Heckscher-Ohlin context. This can be problematic if *K* is explicitly thought of as physical capital. However, in such a case, low return to capital in the "rigid" economy would lead to capital outflows that would shift the *BD* schedule upwards. This would produce similar results to the case of trade without capital mobility, because factor mobility is a substitute for trade in this model.

4. Empirical analysis

4.1. Data

The dataset used in this study is standard in this literature. It covers 20 countries over 1960-1998. The shock and time-invariant labour market institution variables used in BW are available through Justin Wolfers' homepage.[7] The time-varying institution variables were assembled by Nickell and Nunziata (2001) and are described in the appendix of Nickell et al.[8] Although, the respective time-invariant and time-varying variables are not strictly the same, the linear correlation coefficient between the averages through time of the respective measures is of around 80% across countries. The bargaining coordination variable is a 2 to 6 index in BW, whereas it lies between 1 and 3 in the time-varying alternative. To make them comparable, the BW coordination variable is first divided by two. Then, the minimum value, i.e. 1, is subtracted from both variables, such that 'no regulation' is associated with zero, as with all the other institution variables. The benefit duration variable has no time-varying equivalent and therefore, the BW measure is kept as such.[9] In BW, the employment protection is just a ranking of the countries. The measure of this institution has been refined since then, and the 0 to 2 index from Nunziata was preferred. The reader is referred to section 1 of Nickell et al. for a description of the main changes in the institution variables over the period. Finally, bilateral trade data comes from the CHELEM database built by the CEPII. Descriptive statistics are provided in Table A1.

4.2. First glance / Direct look at the interaction

In order to get a first impression of the relevance of the interaction between trade and labour market regulation to explain unemployment, the unemployment rate is regressed on regulation indicators, LMR, and the interactions with the import ratio, $LMR * IMPORT$. Country and time fixed effects are included to control for country specificities and common time trend. In addition, the interaction term is itself interacted with the size of each country, measured by the log of the average population over the

[7] http://bpp.wharton.upenn.edu/jwolfers/data.shtml

[8] Data is available at http://cep.lse.ac.uk/pubs/number.asp?number=502.

[9] The benefit duration variable *BD* in Nickell and Nunziata is a duration-weighted average of benefits paid during five years. It is substantially different form *Ben* in BW. For example, according to *Ben*, benefits in Spain are paid during three and a half years, which places Spain on the very generous side. On the contrary, according to *BD*, Spain is at the opposite of the scale with an index of 0 until 1980 and 0.30 afterwards. This helps tp understand why results are not robust when replacing *Ben* by *BD.*

period, in order to account for the fact that small countries are both more open and specialized. As the effect highlighted in the model holds up to the point of complete specialization, the $LMR*IMPORT$ effect might be lower for small countries.

Table 1 presents the results treating each indicator separately, i.e. each row is associated with one regression within each panel of the table. The left panel is based on yearly data. As it is well known, the high persistence in the unemployment rate series induces a strong autocorrelation with yearly data. Regulation indicators have a low frequency and BW favour using 5-year averages in order to capture long-term effects, which leads to the results reported in the right panel. $SIZE$ is defined as the difference between the population (log) of the country and the average over all countries. It ranges from -1.6 for New Zealand to 2.7 for the USA (see Table A1). Therefore, the $LMR*IMPORT$ parameter indicates the interaction effect for the average size country, whereas the LMR parameter would correspond to the regulation effect of a closed average size economy.

These illustrative estimates are broadly consistent across the two panels, despite the issue raised by autocorrelation with yearly data, and three general results stand out. Firstly, the non-interacted regulation indicators (closed economy) are never positively significant except for union density. In most cases, the results taken at face value would imply that employment protection, bargaining coordination and high replacement rate are favourable to employment in a closed economy. Secondly, the import interaction term is positive and highly significant: for an average size country, the sensitivity of unemployment to regulation increases with the level of openness and, reciprocally, imports have a detrimental impact on unemployment the more stringent the regulation level. Finally, the size effect is significant and for the smaller countries, the total interaction parameter is small, often close to zero. Overall, these first estimates provide some indications that the trade-regulation interaction might play some role.

4.3. Appropriate interaction variables

The model presented in section 3 highlights that the impact of trade in a high-regulation country depends on the regulation level of the trade partners. Therefore, the interaction term should be

defined as the product of the trade flows and the difference between the regulation levels of the trade partners. For each country i, time t and regulation indicator LMR_k,

$$LMRTRADE_{ikt} = \sum_j TRADE_{ijt} * (LMR_{ikt} - LMR_{jkt}) \qquad (10)$$

where $TRADE_{ijt}$ is the average of bilateral imports and exports between countries i and j, as a ratio of country i GDP, and j covers all the countries in the sample.

Compared to either the institution indicator LMR or the direct $LMR * IMPORT$ used in the preceding sub-section, the refined variable $LMRTRADE$ can make a substantial difference.[10] This point is illustrated by comparing the case of Canada and Germany. Canada is generally perceived as a low labour market regulation country, while Germany lies in the high regulation group, but the respective trade partners are also very different. Because Canada trades mostly with the United States, which regulates much less, trade might have a detrimental impact on Canadian unemployment based on the model above, whereas when Germany trades, for instance, with such high regulation countries as France, Belgium or Italy, German unemployment might not be affected.

Let us focus on benefit replacement rate (BRR) and union density (UD) represented in Figure 6. For both Canada and Germany, the benefit replacement rate evolved around 0.40 between 1968 and 1998. However, the $BRRTRADE$ variable fell sharply in Germany, while for Canada, the levels at the beginning and end of the period are very similar. Two thirds of the changes in the German variable are explained by the increase in the benefit replacement rate over the period in Italy, Switzerland and Sweden of 0.36, 0.67 and 0.55 respectively. For union density, the impact on $UDTRADE$ of the steady increase in unionization in Canada has been magnified by deunionisation in the USA leading to the contrasted patterns between Canada and Germany.

The trade-regulation interactions are tested in various specifications. As shown in section 2, the impact of labour market institutions on unemployment seems to have evolved over time. This provides support for the shock-institution interaction hypothesis. Sub-sections 4.4 and 4.5 focus on common unobservable and specific shocks respectively, while sub-section 4.6 is devoted to the direct impact of

[10] Using imports rather than the average of imports and exports as the *TRADE* variable does not make noticeable differences.

labour market institutions. Because, as discussed above, the 5-year period is more adapted to the low frequency of the institution variables and the persistence of the unemployment series, the reminder of this study focuses on 5-year averages.

4.4. Common unobservable shocks

This sub-section starts by replicating BW results obtained with time-invariant institution variables from the following specification:

$$u_{it} = c_i + d_t \left(1 + \sum_k a_k \left(LMR_{ik} - \overline{LMR}_k \right) \right) + e_{it} \qquad (11)$$

where i is a country index, k an institution index and t a 5-year period index. c_i and d_t are country and time effects respectively. The impact of a common shock on unemployment depends on labour market institutions, LMR_k, and a_k are the parameters associated with these interactions. Column 1 of Table 2 captures the main insights of BW.[11] Based on these estimates, a country with the average levels of regulation would have experienced an increase of 6 points in the unemployment rate over the full period due to adverse shocks. Regulation magnifies the impact of a negative shock, except for bargaining coordination, which is a "good" institution moderating detrimental effects on employment.

Let us now turn to the time-varying measures of institutions. As BW themselves note, the significance of some coefficients does not survive the use of these alternative measures. As seen from the results in columns 2 and 3, the tax wedge and union density variables are no longer significant with time-varying measures of institutions. One additional difference compared to the first column lies in the time dummies. With time-invariant institutions, time dummies are determined up to a constant. However, with time-varying measures, one degree of freedom is gained. In so doing, a very robust finding emerges as regards the time-dummies distribution: although the difference between the first and last period dummies is still of around 6 points, the dummies are negative in the first periods and positive in the last ones. Using the shocks terminology, this would mean that shocks were positive in the sixties

[11] BW use two other institution variables, union coverage and active labour market policies. The former has no time-varying equivalent; the latter raises problematic endogeneity issues as active policies have been put in place following the rise in unemployment and the variable is available from 1985 only. In any case, these two variables have never appeared significant in the regressions herein, and have therefore been dropped.

while turning negative in the second part of the seventies. Taken literally, data indicates that regulations were *both* detrimental from the eighties *and* beneficial in the sixties. However, the main inference that a negative shock is magnified by some regulations continues to hold notwithstanding.

The specification in equation (11) is now supplemented with the inclusion of the trade interaction variables $LMRTRADE$:

$$u_{it} = c_i + d_t \left(1 + \sum_k a_k (LMR_{ikt} - \overline{LMR_k}) \right) + \sum_k b_k LMRTRADE_{ikt} + e_{it} \qquad (12)$$

Results reported in columns 4 to 7 provide some support to the idea that trade with countries having a lower (higher) level of regulation is detrimental (beneficial) in terms of employment. Replacement rate, benefit duration, tax wedge and union density show up as significant once interacted with trade in the way described in 4.3, although collinearity prevents discriminating the effects of benefit duration and union density. Moreover, the a_k parameters are very little affected by the addition of the trade related variables, which implies that the trade interaction effect acts on top of the impacts highlighted by BW. Also, adding either $IMPORT$ or $TRADE$ to equation (12) does not alter the estimates significantly as the added parameter is not significantly different from zero, confirming that the effects of trade channel through labour market institutions. Sub-section 4.2 suggested that size might affect these trade regulation interactions. Unfortunately, given that there are six interaction variables, this size effect cannot easily be included herein. In an attempt to do so, the effect of country size is extracted from import and export ratios, i.e. only the residuals of the regression of the trade ratios on size are considered. Column 8 reports the estimates of (12) when $LMRTRADE$ variables are computed with the size-corrected trade variables. In addition to replacement rate and tax wedge, union density is significant once interacted with trade, whereas benefit duration is not.

4.5. Specific shocks

As in BW, we study the impact of three specific shocks that have been mostly common to the developed economies and related to the changes in real interest rate ($RIRS$), productivity growth ($TFPS$) and labour demand (LDS). The shock variables are directly taken from the BW database. The full specification with these specific shocks is:

$$u_{it} = c_i + \left(\sum_l s_l SHOCK_{ilt} \right) \left(1 + \sum_k a_k (LMR_{ikt} - \overline{L}\,\overline{MR}_k) \right) + \sum_k b_k LMRTRADE_{ikt} + e_{it} \qquad (13)$$

Table 3 is built according to the same rationale used for Table 2. In the first column, BW specification with time-invariant institutions is replicated. The three shocks show up significantly and regulations magnify the impact of these negative shocks, except employment protection, which is not significant (with the same negative coefficient for coordination as in the preceding sub-section). When the time-varying measures are introduced in column 2, the slowdown in productivity growth stops playing a role, and only replacement rate, benefit duration and tax wedge are significant. Finally, when the trade-regulation interactions are added in column 3, the explanatory power is greatly increased and the trade variables interacted with the two dimensions of the unemployment insurance system, replacement rate and unemployment benefit, and with union density are positively significant. This applies to the direct trade ratios (column 3) or those that are corrected for the size effect (unreported). The interaction with employment protection is negatively signed but, as explained in the theoretical section, the expected effect is ambiguous. Overall, the results concerning the trade-regulation variables are broadly consistent with those obtained with common unobservable shocks.

4.6. Direct impact of labour market institutions

Nickell et al. argue that the direct effects of institutions on unemployment dominate those obtained with shock interactions. In order to test whether the trade-regulation interactions are robust when the direct effects are introduced, the following specification is tested, with results reported in Table 4:

$$u_{it} = c_i + d_t + \sum_k a_k LMR_{ikt} + \sum_k b_k LMRTRADE_{ikt} + e_{it} \qquad (14)$$

The first two columns omit the trade-regulation interactions. Column (1) includes time-dummies and column (2) adds country-specific time trends, as advocated by Nickell et al. Indeed, without the shock interactions, these specific trends are necessary to control for the contrasted evolution of the unemployment rate across countries. The evidence in favour of the “regulation view” is mixed at best. The third column adds trade-regulation interactions. All the interaction parameters are positive, although only replacement rate and employment protection are significant (tax wedge almost is).

4.7. Quantification of the impact of trade-regulation interactions

Obviously as in BW, the specification in (12) does a good job in fitting the different evolutions of unemployment across countries. The specific interest here is on the contribution of the trade-regulation interactions and Figure 7 plots the actual unemployment rate in bold and the estimated rate from equation (12) (column 4 in Table 2) in grey. The dotted line corresponds to the fitted unemployment rate once the trade-regulation effect has been subtracted. In other words, the contribution of the interactions between trade and labour market institutions is read from the difference between the grey and the dotted lines. It represents the impact of bilateral trade on unemployment given the differences in regulation between trading partners, or reciprocally, the impact of differences in regulations given the level of trade.

The countries that would suffer the most from these interactions are Belgium, Finland and Sweden (France and Canada to a lesser extent) while the main beneficiaries would be Portugal and Switzerland, based on the estimated effect for the most recent period (Table 5). The comparison between the adjusted R^2 of the third and fourth columns in Table 2 seems to indicate that the trade-regulation interactions carries a low explanatory power. This assessment is misleading because the other explanatory variables in the third column, including the country and time fixed effects, partly compensate for omitting the trade interactions. In fact, the trade-regulation interactions contribute to 21% of the total unemployment rate variance, when using column (4) for example, and account for several percentage points of unemployment rate for some countries. However, the interpretation of the impact in levels should be taken cautiously since country size might not be controlled for satisfactorily.

Therefore, another instructive way to look at this contribution consists in looking at changes through periods, as country dummies must be included in the empirical model. Table 6 reports, for each country, the changes in the unemployment rate and in the trade-regulation component over the total period, over the first half during which the increase in unemployment has been widespread and, finally, over the second half where the performances have been contrasted across countries with some of them succeeding to reduce unemployment.[12]

[12] 1960/65 has some missing data, hence the choice of 1965/1970 for the first period providing more reliable correlation parameters, but there is no major differences between the two.

Five main results stand out. First, the changes in trade-regulation interactions seem to play no role in the deterioration of employment in the first half, whereas they are significantly correlated to the contrasted evolutions in the second half, as indicated by the cross-country correlation that is reported in the last row. Second, the Netherlands and the United Kingdom benefited the most, by 2.3 and 1.1 points respectively, from the changes in trade and regulation comparative advantages during the second period. Third, Belgium, Finland and Sweden consistently lost in the two half periods from changes in the trade-regulation interactions, although that contribution is much lower for Sweden in the second half. This is also the case for Canada and Switzerland to a lesser extent. Fourth, some countries were negatively affected during the first half, but managed to improve the situation in the second period. Ireland, Denmark, Norway and New Zealand are in this situation, whereas the opposite applies to Italy. Finally, the largest countries in Continental Europe, Germany and France, appear mostly insulated from the changes in the interactions.

5. Conclusion

There is ample evidence that a country's labour market institutions are important determinants of unemployment, either directly or through the propagation of shocks. This paper imbeds the rationale of Davis (1998) into the labour market search framework of Pissarides (2000). The main argument is that the institutions of the trade partners matter also for a country's equilibrium unemployment rate. Because institutions affect relative prices, they contribute to comparative advantages and boost or weaken demand for labour intensive goods depending on relative labour market regulations. Consequently, trade might magnify the consequences of either a bad or a good institutional setting.

The empirical investigation provides some evidence that the interactions between bilateral trade and relative labour market regulations affect the unemployment rate. Given data limitations in this area, the ambition of this paper is merely to draw the attention to the general relevance of these interactions as complementing the other explanations of persistent unemployment. More efforts should be placed in trying to identify such mechanisms in country case studies. In particular, how country size influences the nature and magnitude of these effects via greater specialisation remains a challenging issue.

Confirmation of these results could have important political implications. Although an overall welfare analysis is missing, for those would endorse the "regulation view" of unemployment, these results are good news as they seem to imply that economic integration fosters labour market deregulation. Even for some others who consider that optimal regulation is the outcome of a trade-off, they would suggest that the terms of the trade-off change with the opening of the economy. Incentives to non-cooperatively deregulate the labour market might be reinforced with integration, and desire to preserve the so-called "social models" might create resistance to open up to low regulation economies. In that case, deregulating the labour market could generate a negative externality for trading partners, raising the possibility that cooperation in setting labour market policies enables to reach a better equilibrium.

Appendix: Search model

There are two sectors in the economy and sector *1* produces the capital intensive good of price p in terms of good *2*, which is chosen as the numeraire. The labor market framework is the large-firm version of the matching model of Pissarides (2000, chapter 3). Let K_i and L_i be the capital and employment of firm i, and let $F_j(K_i, L_i)$ be the constant returns-to-scale production function of all firms in sector j. Each firm is large enough so that there is no uncertainty about its flow of labour. Wages are bargained at the individual level and firms choose the number of jobs by taking wages as given, that is firms have the "right-to-manage". During a small interval dt, a vacant job is matched to an unemployed worker with probability $m(\theta)dt$, where m is the matching function and θ labour market tightness, defined as the ratio of vacancy to unemployment rates. Usual properties of the matching function, discussed at greater length in Pissarides (2000) are supposed to hold:

$$m'(\theta) < 0 \quad , \quad \left|\theta\, m'(\theta)\right| < m(\theta) \qquad \textit{(A1)}$$

We assume that labour market tightness is exogenous to the firm's control and that each firm loses workers at the rate λ. Each vacancy costs the firm h in recruitment costs and returns a worker at the rate $m(\theta)$. Therefore, denoting V_i the vacancies at firm i, the law of motion of job is:

$$\dot{L}_i = -\lambda L_i + m(\theta) V_i \qquad \textit{(A2)}$$

Aggregating across all firms gives the steady-state unemployment rate:

$$u = \frac{\lambda}{\lambda + \theta\, m(\theta)} \qquad \textit{(A3)}$$

Unambiguously, given (A3), the unemployment rate is negatively related to labour market tightness. I representing the investment of price p_K, δ the depreciation rate of capital stock, w the gross wage and r the discount rate, firm i in sector j maximizes the present-discounted value of expected profits:

$$\underset{V_i, I_i}{Max} \quad \Pi_i = \int_0^{\infty} e^{-rt}\left[p_j F_j(K_i, L_i) - w_i L_i - hV_i - p_K I_i\right]dt \quad \text{with} \quad p_1 = p \ \text{and} \ p_2 = 1 \qquad \textit{(A4)}$$

$$\text{s.c.} \quad \dot{K}_i = I_i - \delta K_i \quad , \quad \dot{L}_i = -\lambda L_i + m(\theta).V_i$$

Let $k_i = K_i / L_i$ be the capital per unit of labour and $f_j(k_i) = F_j(K_i, L_i) / L_i$, first-order conditions write as, for $j = 1, 2$:

$$p_j F_{jK}(K_i, L_i) = p_j f_j^{'}(k_i) = p_K\,(r + \delta) \equiv c_K \qquad \textit{(A5a)}$$

$$p_j F_{jL}(K_i, L_i) = p_j\left[f_j(k_i) - k_i\ f_j^{'}(k_i)\right] = w_i + \frac{h\,(\lambda + r)}{m(\theta)} \qquad \textit{(A5b)}$$

Equation (A5a) implies that the capital-labour ratio in the numeraire good *2* is negatively related to the user cost of capital $c_K \equiv p_K\,(r + \delta)$ and is the same for each firm in a given sector. Combining this with (A5b) leads to the Factor Price Frontier, where $g_2(.)$ depends on the characteristics of the numeraire good, hence the subscript index, *2*:

$$w + \frac{h\,(\lambda + r)}{m(\theta)} = g_2(c_K) \quad , \quad g_2{'} < 0 \qquad \textit{(A6)}$$

(the positive relation between the relative price p of the capital intensive good and the user cost of capital is implicitly given by $g_2(c_K) = p\, g_1(c_K / p)$ where g_1 is the counterpart of g_2 for good *1*. This leads to equation 8 in the main text). The expression of the Factor Price Frontier in equation (A6) illustrates that the adjustment cost of labour, represented by h, creates a wedge between the marginal product of labour and the gross wage. Let J_o and J_v be the present-discounted values of expected profit from an occupied and vacant job respectively. Bellman equations lead to:

$$rJ_v = -h + m(\theta)\,(J_o - J_v) \qquad \textit{(A7a)}$$

$$rJ_o = p_j f_j(k) - w - p_K\,(r + \delta)\,k - \lambda\,(J_o - J_v) \qquad \textit{(A7b)}$$

In equilibrium, profit opportunities drive rents from vacant jobs to zero, i.e. $J_v = 0$, implying:

$$J_o = \frac{h}{m(\theta)} = \frac{p_j F_{jL} - w}{\lambda + r} = \frac{g_2(c_K) - w}{\lambda + r} \qquad \textit{(A8)}$$

This downward-sloping relationship between wages and labour market tightness is similar to labour demand and referred to as the job creation condition. Conversely, let W_e and W_u denote the present-discounted value of the expected income stream of an employed and unemployed worker respectively. Denoting z the unemployment benefits and ρ the tax wedge between gross and net of labor tax wage:

$$rW_u = z + \theta\, m(\theta)\,(W_e - W_u) \qquad \textit{(A9a)}$$

$$rW_e = w/\rho - \lambda\,(W_e - W_u) \qquad \textit{(A9b)}$$

Equations (A9a-b) are solved as follows:

$$r\,W_u = \frac{(\lambda + r)z + \theta\, m(\theta) w/\rho}{\lambda + r + \theta\, m(\theta)} \qquad r\,W_e = \frac{\lambda z + (r + \theta\, m(\theta)) w/\rho}{\lambda + r + \theta\, m(\theta)} \qquad \textit{(A10)}$$

The negotiated wage is the outcome of the Nash bargaining which boils down to maximizing the weighted product of the worker's and the firm's surpluses from the match, the weight γ representing workers' bargaining power:

$$w = \arg\max\,(W_e - W_u)^{\gamma}\,(J_o - J_v)^{1-\gamma} \qquad \textit{(A11)}$$

Using (A8) and (A10), the first-order condition with respect to wages leads to:

$$w = \rho\, z + (p_j F_{jL} - \rho\, z)\frac{\gamma(\lambda + r + \theta\, m(\theta))}{\lambda + r + \gamma\,\theta\, m(\theta)} \quad \Leftrightarrow \quad w = (1-\gamma)\,\rho\, z + \gamma\left[h\,\theta + g_2(c_K)\right] \qquad \textit{(A12)}$$

This positive relation between tightness and wages is the wage-setting curve. Combining the wage-setting curve and the Factor Price Frontier leads to the unique equilibrium determining labour market tightness as a function of the cost of capital:

$$\gamma\,\theta + \frac{\lambda + r}{m(\theta)} = \frac{1-\gamma}{h}\left[g_2(c_K) - \rho\, z\right] \qquad \textit{(A13)}$$

which ensures that the following sensitivities are satisfied:

$$\frac{\partial\theta}{\partial\gamma} < 0, \frac{\partial\theta}{\partial z} < 0, \frac{\partial\theta}{\partial\rho} < 0, \frac{\partial\theta}{\partial r} < 0, \frac{\partial\theta}{\partial c_K} < 0, \frac{\partial\theta}{\partial h} < 0, \frac{\partial\theta}{\partial\lambda} < 0 \qquad \textit{(A14)}$$

or equivalently,

$$\frac{\partial u}{\partial\gamma} > 0, \frac{\partial u}{\partial z} > 0, \frac{\partial u}{\partial\rho} > 0, \frac{\partial u}{\partial r} > 0, \frac{\partial u}{\partial c_K} > 0, \frac{\partial u}{\partial h} > 0, \frac{\partial u}{\partial\lambda} > 0 \qquad \textit{(A15)}$$

Clearly, if the unemployment benefits are indexed to net wages, i.e. if $z = b\,w/\rho$, b being a constant, the tax wedge disappears from the wage-setting function and has therefore no impact on the equilibrium unemployment rate. This illustrates that, within this framework, the impact of the tax wedge channels exclusively through the ratio of gross wages to unemployment benefits.

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Table A1 : Descriptive statistics

Average institution variables (LMR) and size

	replace-ment rate	benefit duration	employment protection	tax wedge	union density	bargaining coordination	size
aus	0.22	3.50	0.50	0.38	0.37	1.01	-0.09
aut	0.27	2.50	0.99	0.56	0.43	1.46	-0.76
bel	0.47	3.50	1.31	0.45	0.39	1.13	-0.50
can	0.41	0.25	0.30	0.42	0.25	0.13	0.42
dnk	0.52	2.00	0.98	0.52	0.62	1.72	-1.16
fin	0.34	2.50	1.18	0.54	0.52	0.99	-1.21
fra	0.56	2.88	1.08	0.62	0.08	0.96	1.20
ger	0.40	3.50	1.33	0.48	0.24	1.50	1.58
irl	0.37	3.50	0.37	0.34	0.43	1.49	-1.58
ita	0.12	0.00	1.92	0.59	0.30	0.91	1.23
jpn	0.32	0.00	1.40	0.30	0.20	1.50	1.95
nld	0.64	2.50	1.33	0.51	0.24	1.62	-0.14
nor	0.38	1.00	1.52	0.60	0.44	1.86	-1.38
nzl	0.30	3.50	0.80	0.28	0.26	1.09	-1.63
por	0.50	0.15	1.88	0.30	0.38	0.91	-0.53
spa	0.59	3.00	1.90	0.32	0.03	1.51	0.81
swe	0.50	0.70	1.09	0.66	0.67	1.61	-0.67
swi	0.32	0.50	0.55	0.34	0.20	0.88	-0.92
uk	0.29	3.50	0.29	0.45	0.38	0.38	1.25
usa	0.27	0.00	0.10	0.42	0.13	0.00	2.66

Average trade-institution interaction variables ($LMRTRADE$)

Trade interacted with	replacement rate	benefit duration	employment protection	tax wedge	union density	bargaining coordination
aus	-0.010	0.263	-0.032	-0.001	0.018	0.025
aut	-0.018	0.038	-0.047	0.018	0.043	0.049
bel	0.011	0.509	0.095	-0.032	0.087	0.002
can	0.028	-0.032	0.001	0.002	0.022	-0.023
dnk	0.042	-0.026	-0.039	0.008	0.080	0.125
fin	-0.010	0.096	0.026	0.007	0.036	-0.024
fra	0.027	0.096	-0.003	0.021	-0.031	-0.014
ger	-0.009	0.301	0.070	-0.004	-0.009	0.091
irl	0.014	0.378	-0.121	-0.057	0.051	0.394
ita	-0.040	-0.331	0.109	0.013	0.011	-0.018
jpn	0.000	-0.055	0.044	-0.007	-0.001	0.047
nld	0.106	-0.035	0.093	0.010	-0.022	0.231
nor	-0.004	-0.352	0.173	0.022	0.026	0.217
nzl	-0.001	0.325	0.028	-0.025	-0.003	0.046
por	0.018	-0.622	0.154	-0.047	0.029	-0.042
spa	0.026	0.112	0.090	-0.018	-0.023	0.053
swe	0.038	-0.328	0.036	0.046	0.089	0.098
swi	0.005	-0.411	-0.148	-0.040	-0.017	-0.054
uk	-0.021	0.292	-0.117	-0.004	0.020	-0.120
usa	-0.006	-0.065	-0.036	0.000	-0.007	-0.039

Notes

The size variable is the difference between the log of the population and that of the average across countries. The trade-interaction variables are defined for each institution *k* by eq.(10): $LMRTRADE_{ikt} = \sum_j TRADE_{ijt} * (LMR_{ikt} - LMR_{jkt})$

where $TRADE_{ijt}$ is the average of imports and exports between countries i and j, as a ratio of country i GDP, and j covers all the countries in the sample.

Table 1

Trade-regulation interactions, each labour market institution separately

For each institution LMR_k separately, the following specification is estimated:

$$u_{it} = a_k LMR_{ikt} + b_k LMR_{ikt} * IMPORT_{it} + c_k LMR_{ikt} * IMPORT_{it} * SIZE_i + e_i + e_t + v_{it}$$

	Panel A Yearly data			**Panel B** Five-year periods		
Regulation variable	*LMR*	*LMR * IMPORT*	*LMR * IMPORT * SIZE*	*LMR*	*LMR * IMPORT*	*LMR * IMPORT * SIZE*
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Replacement rate	-0.044*** (0.010)	0.113*** (0.032)	0.133*** (0.013)	-0.028 (0.022)	0.068 (0.076)	0.138*** (0.026)
Benefit duration	na	0.048*** (0.005)	0.023*** (0.005)	na	0.058*** (0.010)	0.029*** (0.011)
Employment protection	-0.037*** (0.004)	0.094*** (0.011)	0.021*** (0.008)	-0.042*** (0.009)	0.133*** (0.023)	0.028* (0.015)
Tax wedge	0.012 (0.016)	0.171*** (0.033)	0.136*** (0.018)	0.028 (0.028)	0.189*** (0.067)	0.114*** (0.039)
Union density	0.088*** (0.015)	-0.014 (0.038)	-0.023 (0.024)	0.102*** (0.031)	-0.088 (0.086)	-0.050 (0.053)
Coordination	-0.019*** (0.004)	0.052*** (0.010)	0.015** (0.006)	-0.023*** (0.008)	0.056*** (0.010)	0.018 (0.012)
Country effects	yes			yes		
Time effects	yes			yes		
Nb obs	between 730 and 748			between 155 and 159		

Note

In each panel, each row corresponds to a separate estimation. Estimates are produced from an iterated GLS estimator taking into account heteroscedasticity across countries. The benefit duration variable is time-invariant. $IMPORT$ is the import penetration rate, while $SIZE$ is defined as the difference of the log of the population of a given country and the average over all countries. Therefore, the $LMR * IMPORT$ parameter indicates the interaction effect for the average size country, whereas the LMR parameter would correspond to the regulation effect of a closed economy.

Table 2

Institutions interacted with trade and common unobservable shocks

$$u_{it} = c_i + d_t \left(1 + \sum_k a_k (LMR_{ikt} - \overline{L}\overline{MR}_k) \right) + \sum_k b_k LMRTRADE_{ikt} + v_{it}$$

	Time-invariant institutions *(1)*	Time-varying institutions *(2)*	Time-varying Institutions *(3)*	Time-varying institutions *(4)*	Time-varying institutions *(5)*	Time-varying institutions *(6)*	Time-varying institutions *(7)*	Time-varying institutions *(8)*
Regulation variables (LMR)								
Replacement rate	0.800*** (0.234)	1.186*** (0.319)	1.123*** (0.294)	1.081*** (0.266)	1.173*** (0.289)	1.152*** (0.288)	1.143*** (0.274)	1.261*** (0.289)
Benefit duration	0.269*** (0.026)	0.282*** (0.033)	0.290*** (0.034)	0.305*** (0.037)	0.316*** (0.040)	0.303*** (0.039)	0.342*** (0.034)	0.334*** (0.034)
Employment protection	0.522*** (0.082)	0.481*** (0.125)	0.435*** (0.118)	0.570*** (0.130)	0.607*** (0.126)	0.613*** (0.125)	0.521*** (0.115)	0.455*** (0.120)
Tax wedge	1.616*** (0.421)	-0.376 (0.464)						
Union density	0.528* (0.289)	0.289 (0.367)						
Coordination	-0.330*** (0.040)	-0.428*** (0.114)	-0.400*** (0.105)	-0.489*** (0.122)	-0.557*** (0.111)	-0.571*** (0.112)	-0.485** (0.106)	-0.476*** (0.115)
Regulation-Trade interaction variables (LMRTRADE)								
Replacement rate				0.204** (0.087)	0.171*** (0.062)	0.183*** (0.063)	0.156*** (0.065)	0.208** (0.099)
Benefit duration				0.052 (0.034)	0.046 (0.035)	0.062* (0.033)		0.040 (0.034)
Employment protection				0.010 (0.030)				-0.024 (0.029)
Tax wedge				0.294*** (0.111)	0.296*** (0.110)	0.357*** (0.116)	0.269*** (0.113)	0.298*** (0.102)
Union density				0.094 (0.076)	0.089 (0.073)		0.132** (0.067)	0.187** (0.086)
Coordination				-0.017 (0.021)				-0.019 (0.025)
First period dummy	x	-0.032*** (0.009)	-0.030*** (0.008)	-0.047*** (0.016)	-0.039*** (0.009)	-0.039*** (0.009)	-0.045** (0.010)	-0.042*** (0.016)
Last period dummy	x+0.060*** (0.005)	0.034*** (0.006)	0.034*** (0.005)	0.016 (0.012)	0.022*** (0.006)	0.023*** (0.006)	0.018** (0.007)	0.017 (0.012)
Country effects	yes	yes	yes	yes	yes	yes	yes	yes
Adj R^2	0.861	0.843	0.845	0.856	0.858	0.857	0.857	0.865
Nb obs	160	155	157	154	154	154	154	154

Note

Data are based on five-year periods. Estimates are produced from non-linear least squares with heteroscedasticity-consistent standard-errors. In column (8), the trade variable that is used to compute the trade-regulation interactions discounts the effect of country size.

Table 3

Institutions interacted with trade and specific shocks

$$u_{it} = c_i + \left(\sum_l s_l SHOCK_{ilt} \right) \left(1 + \sum_k a_k (LMR_{ikt} - \overline{L}\,\overline{MR}_k) \right) + \sum_k b_k LMRTRADE_{ikt} + v_{it}$$

	Time-invariant institutions *(1)*	Time-varying institutions *(2)*	Time-varying institutions *(3)*
Specific shocks			
Real interest rate	0.434***	0.449***	0.368***
	(0.076)	(0.068)	(0.061)
TFP	0.458***	-0.039	0.140
	(0.117)	(0.087)	(0.089)
Labour demand	0.161**	0.080*	0.017
	(0.071)	(0.043)	(0.033)
Regulation variables (LMR)			
Replacement rate	1.268**	1.881**	1.216
	(0.506)	(0.877)	(0.947)
Benefit duration	0.235***	0.455***	0.324**
	(0.055)	(0.125)	(0.130)
Employment protection	0.051	0.183	0.992**
	(0.187)	(0.300)	(0.417)
Tax wedge	4.924***	4.218***	2.462*
	(0.926)	(1.537)	(1.504)
Union density	1.849***	-0.587	-1.956
	(0.667)	(0.911)	(1.331)
Coordination	-0.366***	-0.383	-0.584
	(0.120)	(0.259)	(0.470)
Regulation-Trade interaction variables (LMRTRADE)			
Replacement rate			0.221***
			(0.078)
Benefit duration			0.162***
			(0.044)
Employment protection			-0.095***
			(0.034)
Tax wedge			0.035
			(0.164)
Union density			0.335**
			(0.151)
Coordination			-0.018
			(0.024)
Country effects	yes	yes	yes
Adj R^2	0.636	0.629	0.716
Nb obs	131	129	129

Note
Data are based on five-year periods. Estimates are produced from non-linear least squares with heteroscedasticity-consistent standard-errors.

Table 4

Direct impact of institutions and trade-regulation interactions

$$u_{it} = c_i + d_t + \sum_k a_k LMR_{ikt} + \sum_k b_k LMRTRADE_{ikt} + v_{it}$$

	Time-invariant institutions *(1)*	Time-varying institutions *(2)*	Time-varying institutions *(3)*
Direct effect of regulation variable (LMR)			
Replacement rate	-0.028**	0.040**	-0.049
	(0.012)	(0.020)	(0.049)
Benefit duration	na	na	na
Employment protection	-0.013*	-0.022***	-0.056***
	(0.007)	(0.006)	(0.013)
Tax wedge	0.075**	-0.043	-0.037
	(0.035)	(0.039)	(0.068)
Union density	0.078***	0.056	0.020
	(0.023)	(0.039)	(0.068)
Coordination	-0.005	-0.008*	-0.018
	(0.005)	(0.005)	(0.012)
Regulation-Trade interaction variable (LMRTRADE)			
Replacement rate			0.402**
			(0.158)
Benefit duration			0.037
			(0.036)
Employment protection			0.163***
			(0.056)
Tax wedge			0.380
			(0.247)
Union density			0.243
			(0.264)
Coordination			0.026
			(0.041)
Country effects	yes	yes	yes
Time dummies	yes	yes	yes
Country specific time trend	no	yes	yes
Adj R^2	0.780	0.875	0.884
Nb obs	155	155	152

Note
Data are based on five-year periods. Standard-errors are robust to heteroscedasticity.

Table 5

Impact of the trade-institution interactions

on the unemployment rate, late 1990s

	Impact on the unemployment rate, percent
Belgium	1.5 < x
Sweden	1.5 < x
Finland	1.5 < x
Canada	1.5 < x
France	1.5 < x
Australia	0.5 < x < 1.5
Denmark	0.5 < x < 1.5
Germany	0.5 < x < 1.5
Ireland (Rep.)	0.5 < x < 1.5
Spain	0.5 < x < 1.5
New Zealand	-0.5 < x < 0.5
United Kingdom	-0.5 < x < 0.5
Austria	-0.5 < x < 0.5
Netherlands	-0.5 < x < 0.5
Norway	-0.5 < x < 0.5
Japan	-0.5 < x < 0.5
United States	-1.5 < x < -0.5
Italy	-1.5 < x < -0.5
Switzerland	< -1.5
Portugal	< -1.5

Note
The total effect of the interactions is computed for the 1995 + period based on the estimated parameters reported in table 2, column 4. Hierarchy is not sensitive to the choice of specification.

Table 6

Changes in the unemployment rate and in the trade-regulation interaction effects

Period	65+ to 95+		65+ to 80+		***80+ to 95+***	
	Observed changes in the unempl. rate	Changes in the trade-regulation interaction effects	Observed changes in the unempl. rate	Changes in the trade-regulation interaction effects	***Observed changes in the unempl. rate***	***Changes in the trade-regulation interaction effects***
Netherlands	4.4	-2.7	6.3	-0.4	***-1.9***	***-2.3***
United Kingdom	5.9	-1.1	8.5	0.0	***-2.6***	***-1.1***
Denmark	4.7	1.4	6.3	2.1	***-1.6***	***-0.7***
New Zealand	6.3	0.8	3.7	1.2	***2.7***	***-0.4***
Austria	3.9	0.1	1.0	0.5	***3.0***	***-0.4***
Ireland (Rep.)	5.4	2.0	7.2	2.4	***-1.8***	***-0.4***
United States	1.3	-0.4	4.5	-0.1	***-3.2***	***-0.3***
Portugal	-0.4	0.0	1.3	0.1	***-1.7***	***-0.1***
Germany	7.2	0.0	3.8	0.0	***3.4***	***0.0***
France	9.7	0.8	6.1	0.8	***3.6***	***0.0***
Norway	2.7	1.8	1.0	1.8	***1.6***	***0.0***
Spain	14.7	0.8	10.8	0.6	***3.9***	***0.1***
Japan	2.3	-0.1	1.2	-0.3	***1.1***	***0.2***
Australia	6.4	0.8	5.8	0.4	***0.7***	***0.4***
Sweden	5.7	4.3	1.0	3.3	***4.7***	***1.0***
Switzerland	3.6	1.7	0.5	0.5	***3.1***	***1.2***
Canada	5.1	1.6	5.9	0.3	***-0.8***	***1.3***
Italy	7.3	0.0	2.9	-1.4	***4.4***	***1.4***
Belgium	7.9	2.3	7.8	0.7	***0.1***	***1.6***
Finland	11.7	2.4	2.6	0.5	***9.0***	***1.9***
linear correlation	0.23		-0.01		***0.58 ******	

Notes
An *x*+ period denotes a five-year period starting in year *x*. The changes in the unemployment rates are those observed over the corresponding periods. The changes in the effects of trade-regulation interactions are obtained from the estimating equation (12) (Table 2, column 4). Countries are ranked in ascending order of the changes in the interaction effect over the second half of the total period (last column). *** denotes significance at 1% level.

Figure 1: Average variables across countries

Figure 1a

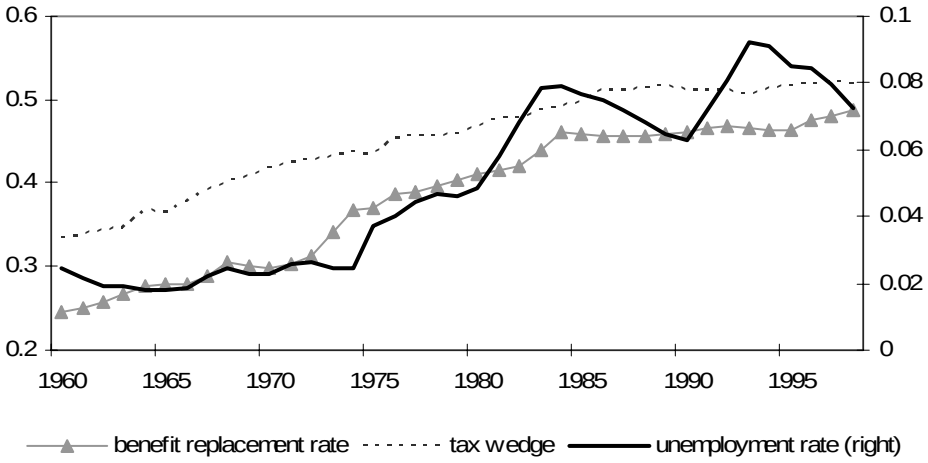


Figure 1b

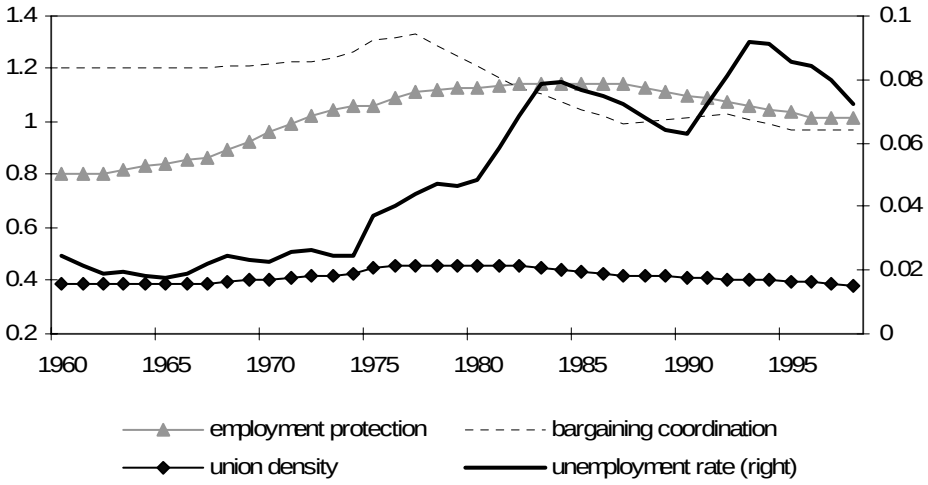


Figure 1c

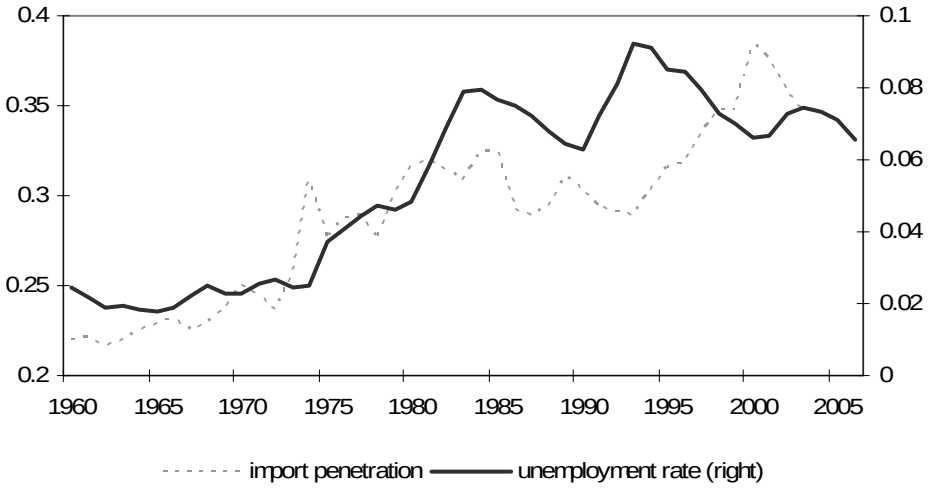
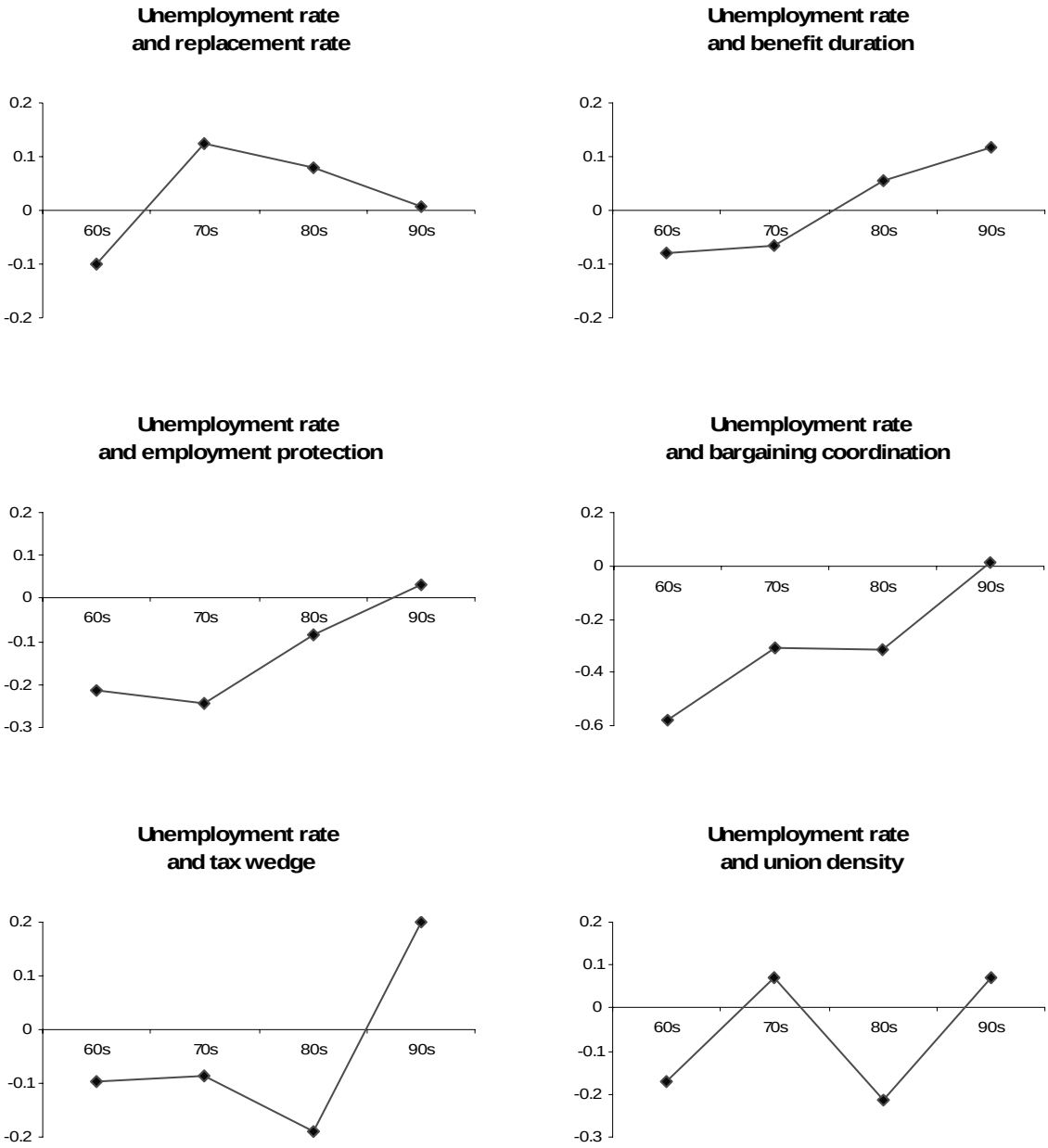


Figure 2

Linear correlation coefficient between the unemployment rate and labour market institutions, per decade



Note
The correlation coefficients are computed from yearly panel data. Very similar patterns are obtained when the correlations are calculated in a country cross-section using 10-year averages.

Figure 3: Labour market equilibrium

Figure 3a

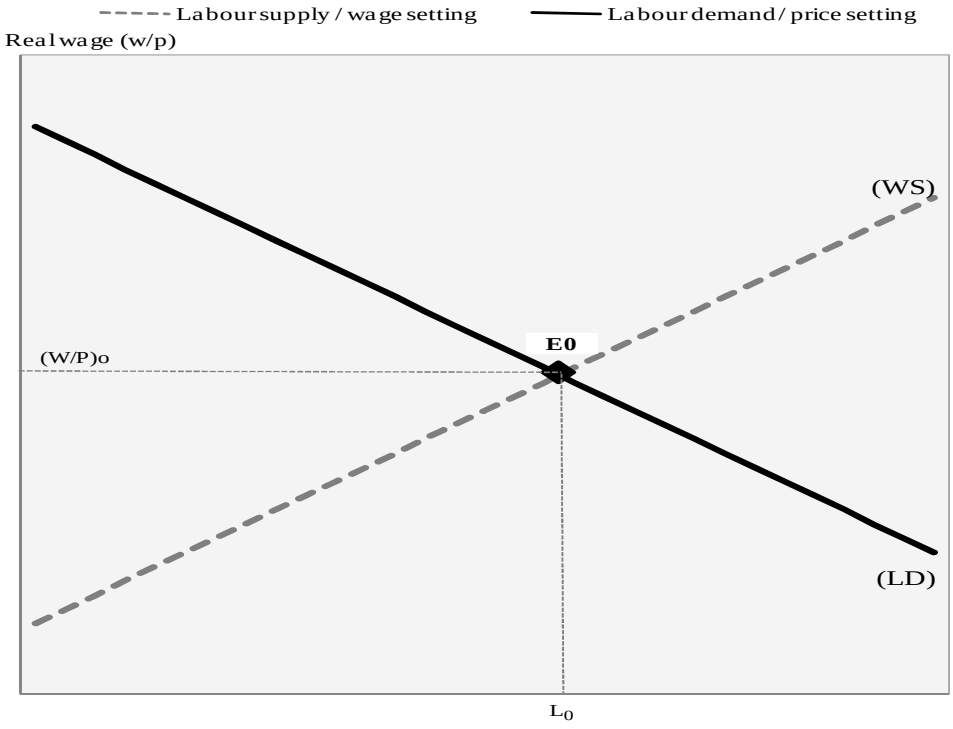


Figure 3b: Shifts due to an increase in the user cost of capital

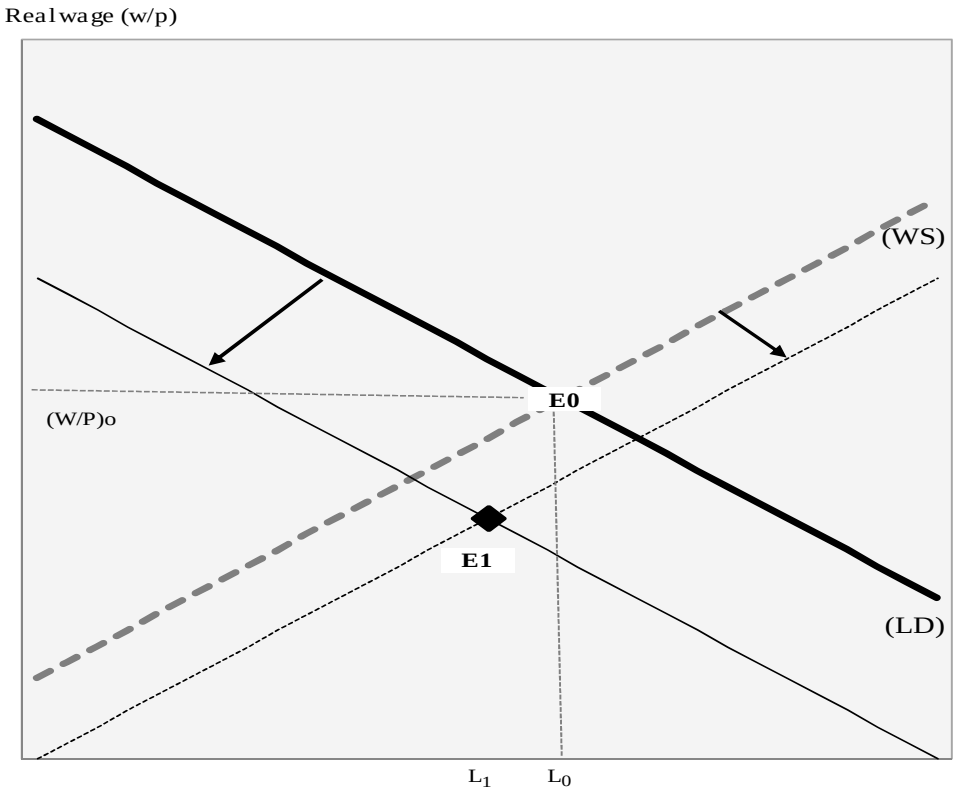


Figure 4

Regulation view in a two-sector model

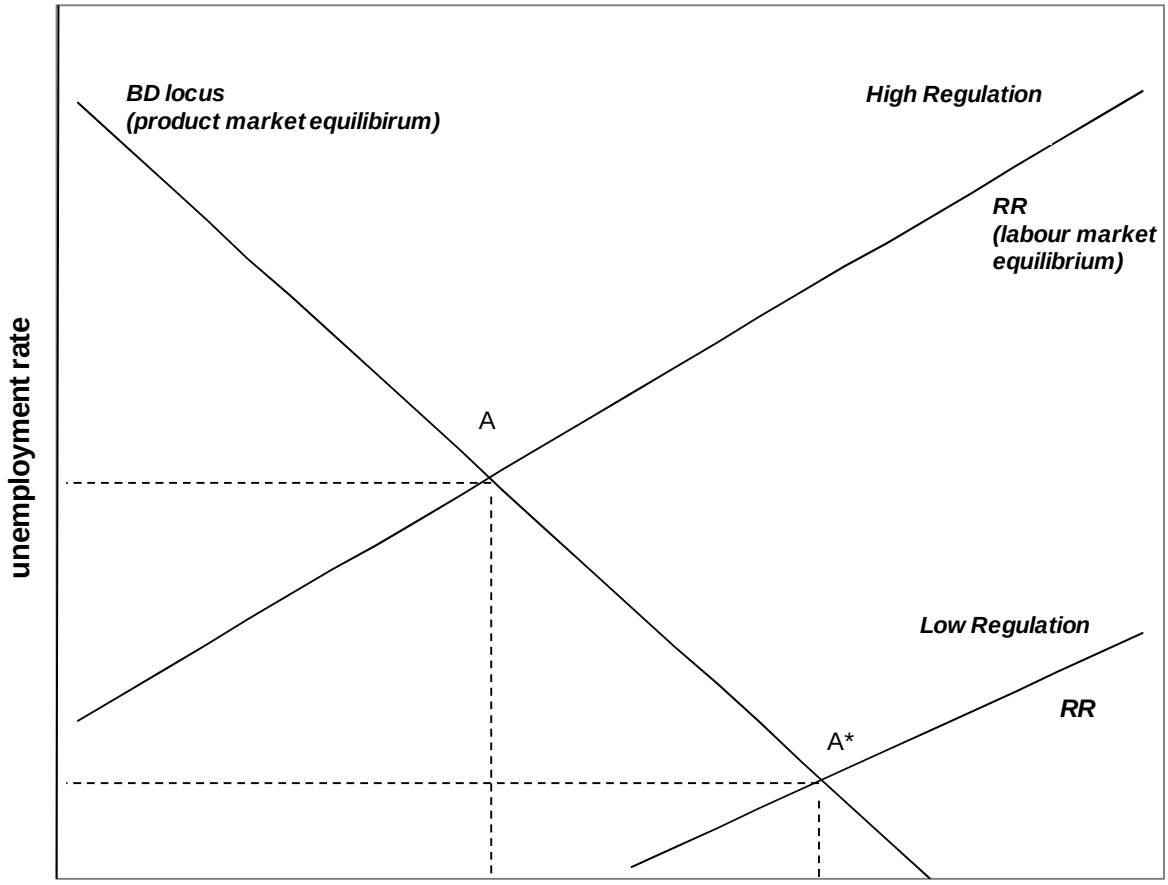
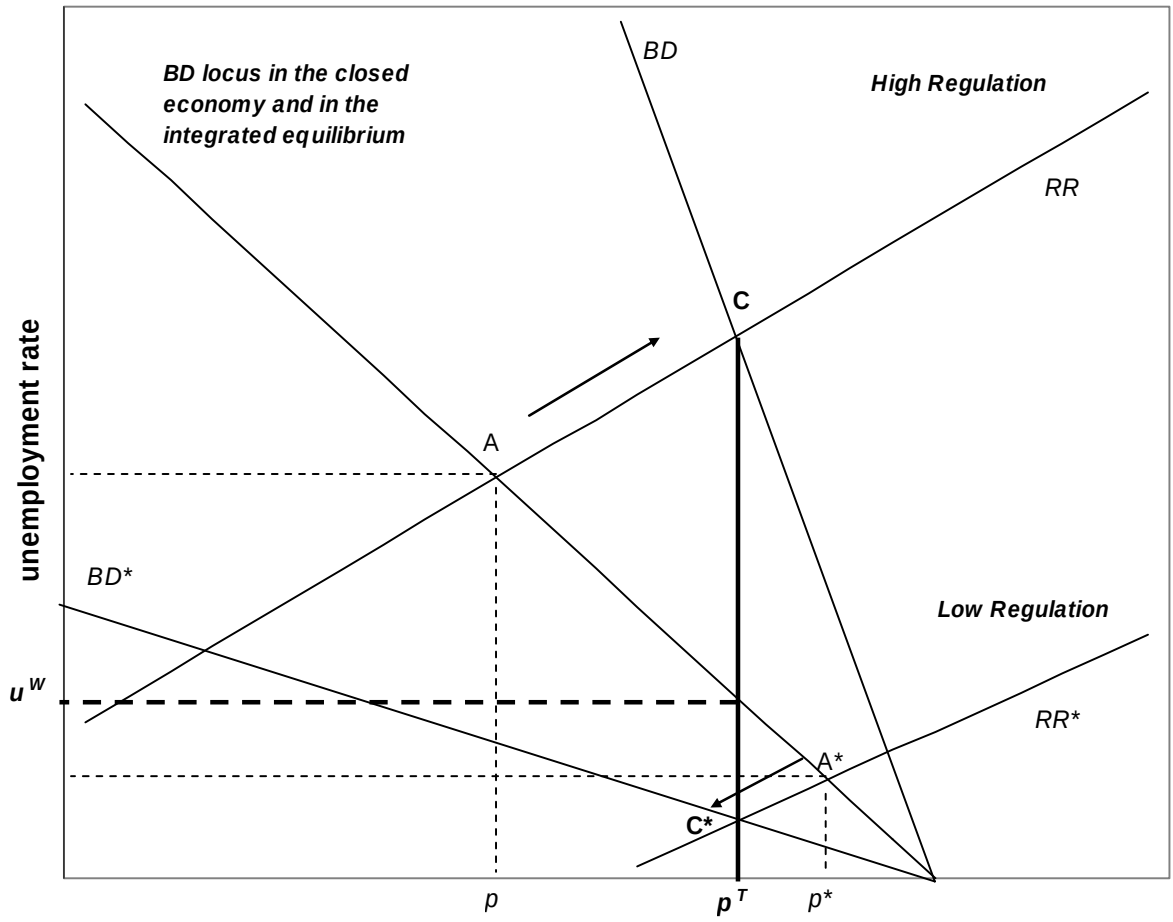


Figure 5

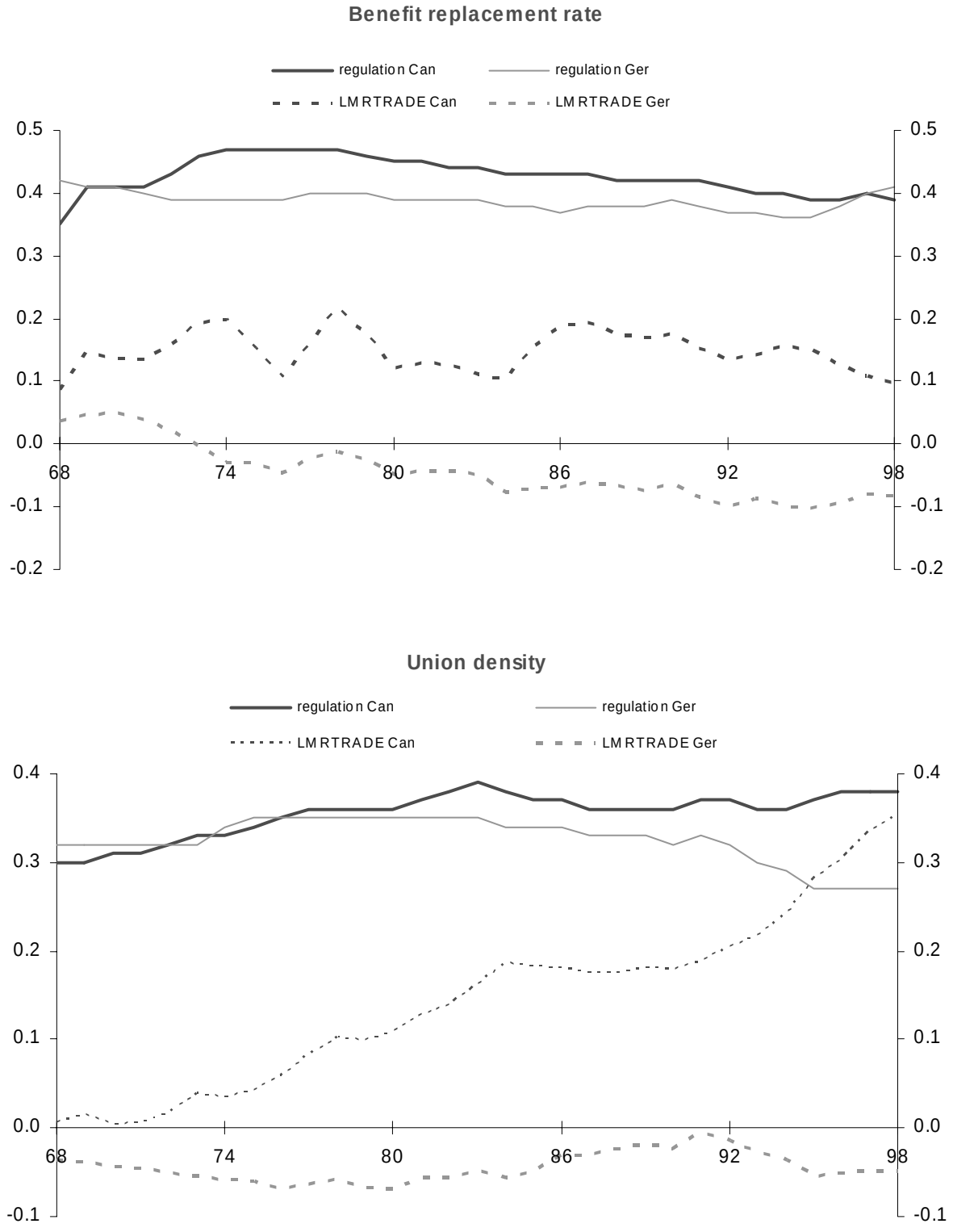
Trade between two countries having identical relative factor endowment



user cost of capital or relative price of the capital intensive good, p

Figure 6

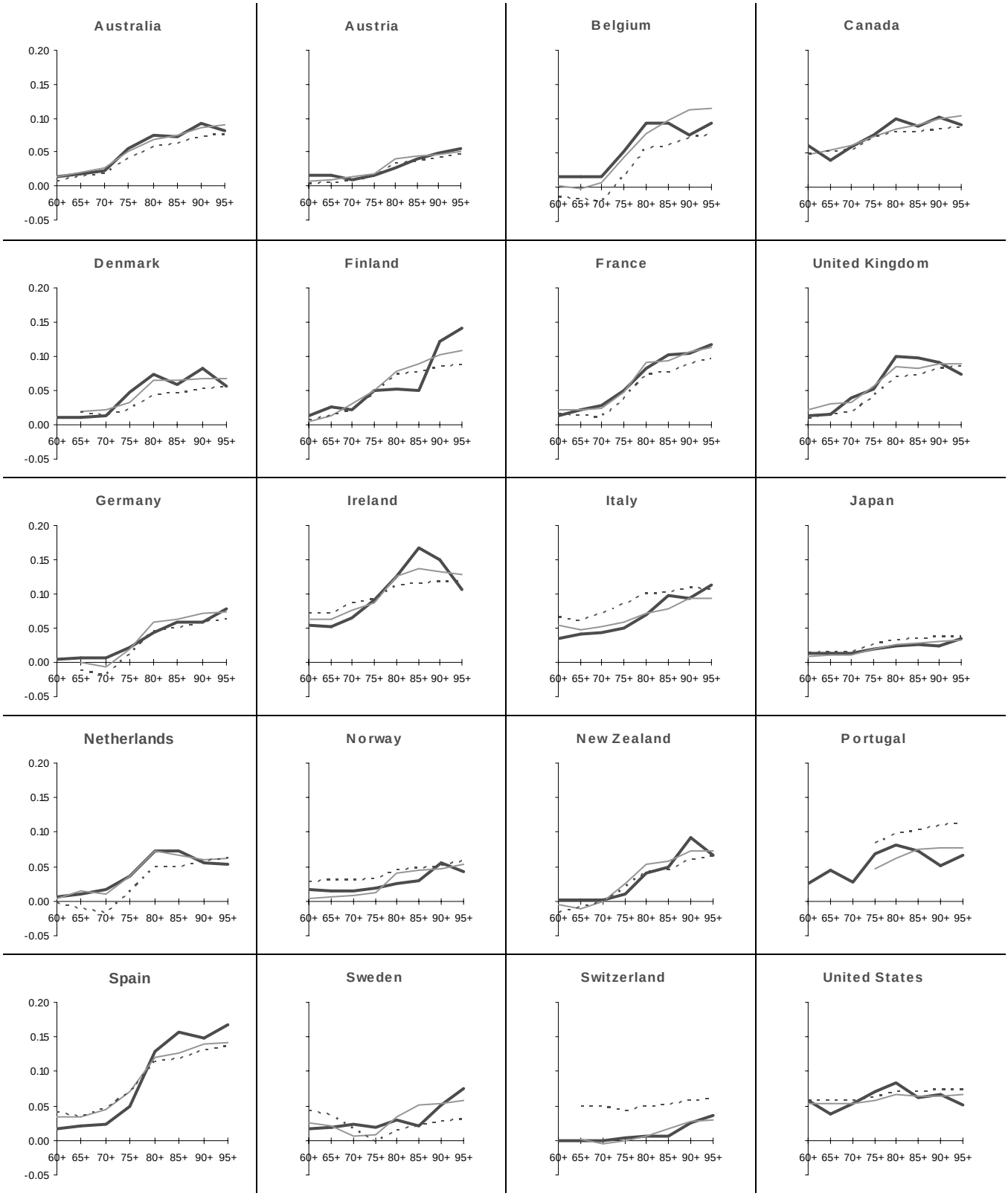
Comparison between Canada and Germany



Note. In order to facilitate the visual representation, values of the $LMRTRADE$ variables in this figure have been multiplied by 6.

Figure 7

Estimated unemployment rate and trade-regulation effects



___ actual unemployment rate ___ estimated unemployment rate (Table 2, column 4)
- - - estimated unemployment rate minus trade-regulation interaction variables (Table 2, column 4)