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Key Words: Unemployment, Openness, Labor Markets, Panel Estimation
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1 Introduction

It is widely accepted today that the labor market and its ability to absorb shocks can play an important role for the economic performance of an economy. The post-70s experience in many European countries contrasts sharply to the comparatively low unemployment rates in the United States and Japan. The extent to which the labor market is decisive in determining the level of unemployment or more recently the extent to which different labor market structures have varying abilities to absorb macroeconomic shocks has received great attention in the field of labor economics. Is there something like an ideal labor market structure that should be implemented to reduce unemployment rates, or do labor markets have only marginal effects? Does one scheme fit all countries, or is it the overall design that matters? Various articles have been investigating these questions. A central paper in this discussion that focused on the wage bargaining system is the article by Calmfors and Driffill (1988) that proposed a hump-shaped relationship between the level of bargaining and the unemployment performance. The argument has been criticized on theoretical as well as empirical ground, and it has been argued that with an increase in openness to trade the relationship gets blurred and the level of wage bargaining does essentially not influence the unemployment performance anymore. This paper adds to this discussion by reinterpreting the Calmfors-Driffill hypothesis in an open economy context with traded and non traded good sector.

The goal of the paper is to evaluate, whether different labor markets perform better in terms of employment even if openness to trade has increased. More precisely, I provide a theoretical argument that, controlling for other variables, the hump-shape is unlikely to disappear, despite increased openness. Within this framework, the potential effects of increased openness under different labor market constellations are then analyzed.

In the initial chapter, I revise briefly the body of theoretical literature that has coined the discussion on the macroeconomic performance of economies with different wage setting structures. Based on the findings of this literature and allowing for different wage-employment trade-offs for unions in the traded and non traded sector, an adjusted version of the theoretical framework is proposed in Chapter 3. The theoretical implications of the model are formulated in Chapter 4 and tested in an empirical exercise. Chapter 5 concludes and formulates possible policy implications.

From a theoretical point of view, the main contribution of this paper may hence be seen in the explicit consideration of the non traded good sector in a multilevel bargaining set up to allow for a more encompassing picture in order to analyze the implications of different labor market structures in an open economy on the unemployment level. Furthermore, I am not aware of an empirical paper that investigated the effect of openness to trade interacted with different labor market structures.

2 Literature Review

The major part of the theoretical literature has focused on analyzing union behavior in an integrated labor market (i.e. assumed free movement of labor between sectors), while a smaller amount of literature builds on the dual labor market approach in which skill differences are the primary motive for different wages that can be maintained in an economy (See Layard et. al. 2003 or Dixon, Thustrup Hansen and Jacobsen Kleven 1999). For the purpose of this paper it is essential to filter the different arguments in the literature and to provide a motivation for the possible outcomes of different labor market structures. As a complete literature review on the subject is well above the scope of this paper, I will focus on the part of the literature which is essential for the analysis of this paper.[1]

Although the literature on corporatism and union behavior dates further back, the main reference papers on the issue of wage bargaining at different levels of centralization is the paper by Calmfors and Driffill. Calmfors and Driffill (1988) proposed in their article the well cited hump-shaped relation between centralization of wage bargaining and macroeconomic performance in a closed economy. According to the paper countries with highly decentralized or very centralized union wage setting should experience a lower real wage increase and have lower unemployment rates than countries that are characterized by industry level bargaining. The argument is based on the optimization behavior of trade unions, which will lead in the case of decentralization to lower wage demands due to increased market competition. Moving towards more centralized wage bargaining increases the market power of the unions and the scope for higher wage demands, but also entails a partly offsetting effect through the increased price level associated with higher wages. At the most centralized level, unions will again demand lower wages due to the incorporation of the externalities that one sector's wage increase poses to the other sectors' real wage via the higher price level which offsets the market power consideration (Calmfors and Driffill 1988, p.34). Despite the paper's contribution to the academic discussion on labor market structures and their macroeconomic implications, it has one major drawback: open economy aspects were not taken into account even though the country sample analyzed consisted of various open economies.

The open economy issue has been addressed at a later stage by Driffill and van der Ploeg (1993) as well as Danthine and Hunt (1992). The paper by Driffill and van der Ploeg looks at an open economy whose consumption basket consists of home and foreign goods. Wage setting either takes place at a decentralized level in each of the competitive firms that produce a homogenous good, at a national level or at an international level. This gives rise to an international version of the hump-shaped relationship, which implies that wage bargaining at the national level results in higher unemployment and higher real wages. The result is analogous to the Calmfors-Driffill argument only that here, at the national bargaining level, the negative effect on the foreign CPI is not taken

[1] For a more detailed analysis of labor market structures and their macroeconomic implications see Layard et. al. (2003) and Flanagan (1999).

into account, an externality that is internalized under wage setting at an international level (Driffill van der Ploeg 1993, p.382). Danthine and Hunt (1994) instead maintain the set up of Calmfors and Driffill, but split the goods' production into Home and Foreign. Consumption follows the Dixit-Stiglitz approach, with Home goods and Foreign goods being the least substitutable baskets. The more disaggregated the consumption basket becomes the closer the goods are to each other. This set up allows analyzing the outcomes of different levels of wage bargaining in the respective countries.[2] Danthine and Hunt find that if bargaining in both countries is at the same level of aggregation the intermediate level performs the worst in terms of unemployment rates. Furthermore, countries with more centralized wage setting structures seem to perform less well in terms of employment when having a trading partner that tends towards a more decentralized structure (Danthine and Hunt 1992, p.21). For both cases, Danthine and Hunt find that the more integrated the economies become the less pronounced the hump-shape will be.

Besides the more detailed nature of the Danthine and Hunt paper, both papers hint at the better performance of decentralized systems compared to alternative levels of bargaining (in the national context). The main caveat of both papers is that the non traded good sector is not modeled explicitly, preventing the possibility to take into account the fact that traded good sector workers do face a different trade-off between employment and real wages than the sheltered non traded good sector does. Hence, the way that Danthine and Hunt model stronger integration - via an increase in substitutability between all domestic and foreign goods - may appear inappropriate as primarily the traded good sector will be affected by the integration process in terms of a more pronounced trade-off between unemployment and real wages.[3]

The different trade-off faced by unions in traded and non traded good sector is taken account of in Rasmussen's paper (1992). Taking the world price for traded goods as given, he finds that an increase in the wage in the traded good sector leads to less employment in the sector and lower overall income, which reduces demand for non traded goods lowering the price for non traded goods. This tends to decrease employment and increase real wages in the non traded good sector. According to Rasmussen the negative employment effect tends to outweigh the wage effect, which will induce wage setters in the non traded good sector to demand a lower wage (Rasmussen 1992, p.569). For economies that tend to be less open, Rasmussen finds that under non cooperative wage setting real wages in the traded good sector will tend to be lower than real wages in the non traded good sector. Furthermore he proposes the concept of "centralized bargaining cooperation", in which the two unions determine both wages jointly. He concludes that in such a centralized set up, wage differentials tend to be less pronounced and the outcome to be a pareto improvement to the

[2] Beissinger and Büsse (2002) present in a similar model international spillover effects, which allow the trading partner to affect the unemployment rate of the home country.

[3] The argument that unions in the traded good sector face a more severe trade-off is very prevalent in the literature but hardly found in the theoretical models. See for example Calmfors (1993), Rasmussen (1992) or Abdersen et al (2000).

decentralized wage bargaining.[4] However, Rasmussen's predictions with respect to employment performance and real wages are less precise and the modeling approach does not allow for bargaining at different levels as shown in Calmfors and Driffill.

Summarizing the above it may be stated that the literature on wage bargaining that introduced bargaining at different levels either disregarded the open economy aspect (like the initial paper by Calmfors and Driffill 1988), or did not model this explicitly. While Danthine and Hunt (1994) introduce increased integration over a higher elasticity of substitution at the level of aggregation between Foreign and Home goods, the paper does not take account of the fact that unions in the traded good sector and unions in the non traded good sector do face different trade offs due to the competition from abroad that gives less room for maneuver when deciding the wage (price) level. Rasmussen (1992) takes account of this fact, however models bargaining solely in the whole traded good sector and non traded good sector acting independently or, in the cooperative scenario, for the overall economy, which does not permit him to look at a more detailed set up as in Calmfors and Driffill.

The model presented in the next paragraph tries to overcome these shortcomings, by extending the open economy framework by Danthine and Hunt through explicitly modelling the existence of traded and non traded goods sector and introducing different wage-employment trade-offs in traded and non traded goods sector. Furthermore, the general structure of the Calmfors and Driffill framework is maintained in order to allow for the wage setting to take place at different levels of centralization.

3 The Theoretical Framework

The set up of the (static) model follows essentially the idea laid out by Calmfors and Driffill (1988) and later Danthine and Hunt (1992). However, the approach includes an essential adjustment. The existence of non traded and traded good sector is taken into account in order to allow for the different wage employment trade-off faced by non traded and traded goods sector, where the later faces the foreign competition and therefore a higher elasticity of substitution for similar brands. This will essentially result in a set-up which incorporates the traditional Calmfors-Driffill argument at one extreme and the Danthine and Hunt version at the other extreme. The model is not solved explicitly but given in a general form.[5]

[4] However, "simple" centralized bargaining in this set up tends to be unstable as one union stands to loose from co-operation compared to the decentralized wage setting outcome (Rasmussen 1993, p. 574).

[5] The derivations follow Danthine and Hunt (1994), but are adjusted wherever the non-traded good sector comes into play. For more details on the underlying model see Calmfors and Driffill (1988) or Danthine and Hunt (1994). See Appendix IV for the derivations.

3.1 The Baseline Model

I will present a simple model (based on Danthine and Hunt 1992) in which the traded good sector faces stronger competition, i.e. home goods and foreign goods are close substitutes. This represents the case where the wage employment trade off in the traded good sector is more severe than in the non traded good sector, such that a wage increase leads to higher unemployment in the traded good sector compared to an equivalent increase of the wage in the non traded good sector.[6] For simplicity, labor is immobile between sectors, which will essentially lead to different wage settlements in traded and non traded good sector.[7]

Production

Both sectors are characterized by a large number of competitive firms, which produce according to the following production function:

$$Y_{NTG,i}^{\rho} = AK^{\rho} + (1-A)L_{NTG,i}^{\rho} \tag{1}$$

$$Y_{T,i}^{\rho} = AK^{\rho} + (1-A)L_{T,i}^{\rho} \tag{2}$$

$1/1-\rho$ represents the constant elasticity of substitution between capital (K) and labor (L). A is a constant parameter. The number of firms in the overall economy is held constant. Following Danthine and Hunt, I set the capital stock equal to one in each of the firms.[8] The labor demand and the (inverse) output supply can be derived from the firm's maximization problem taking the wage rate and prices as given:

$$L_i = \left[\frac{1}{A}\left(\frac{1}{1-A}\frac{w_i}{P_i}\right)^{\frac{\rho}{1-\rho}} - \frac{1-A}{A}\right]^{\frac{-1}{\rho}} \tag{3}$$

$$P_i = (1-A)^{\frac{-1}{\rho}} w_i (1 - A y_i^{-\rho})^{\frac{1-\rho}{\rho}} \tag{4}$$

[6] This may be justified as "in tradable sectors with strong foreign competition, the differences in terms of wage outcomes may be small between bargaining at industry and firm level. Industry bargaining is more likely to lead to higher wages than firm-level bargaining in the private non-tradable sectors." (Calmfors 1993, P.169). The differential treatment of traded and non traded good sector may also provide an implicit argument for the decline in national bargaining systems which has been observed in the Scandinavian countries (See Driffill 2005, p. 8)

[7] This is certainly a strong assumption and limits the predictive power of the model to a rather short run description of the economy. However, in an extension (part 3.2) I show that the main conclusion remains unchanged when changing the assumptions such that there is a unified wage within the country.

[8] As the following analysis focuses on the effects of different labor markets, considerations with respect to capital are above the scope of this essay.

Consumption

Consumers in the respective country derive utility from the consumption of traded and non traded goods:

$$U = C + h(W_R) \tag{5}$$

, with $C = C_T^a \cdot C_N^{1-a}$ and $h(W_R)$ being the utility derived from the benefits received when being unemployed.[9] Preferences are of Dixit-Stiglitz type with three levels of aggregation (See Appendix 1 for a graphical illustration of the consumer preferences and resulting production structure for the case of a=1/2).[10] More precisely, goods are imperfect substitutes, with the elasticity of substitution between the consumption baskets decreasing with higher levels of aggregation. Aggregate income is given by the sum of the value of the domestically produced goods:

$$I = \sum_{i=1}^{n} P_{T,i,j,k} Y_{T,i} + \sum_{i=1}^{m} P_{N,i,j} Y_{NTG,i} \tag{6}$$

When looking at this level of aggregation we find from utility maximization the demand for traded goods and non traded goods:[11]

$$C_T = a \cdot \frac{I}{P_T} \text{ and } C_{NTG} = (1-a) \cdot \frac{I}{P_N} \tag{7}$$

The corresponding CPI is given by:

$$P = \frac{P_T^a \cdot P_N^{1-a}}{a^a (1-a)^{1-a}} \tag{8}$$

, where the nominal exchange rate has been set equal to unity. Demands for the next level of aggregation in the traded good sector are given by

$$C_{T,i} = \left(\frac{P_{T,i}}{P_T}\right)^{-\theta_X} \cdot C_T = a \cdot \left(\frac{P_{T,i}}{P_T}\right)^{-\theta_X} \cdot \frac{I}{P_T} \quad \text{for i=1,2} \tag{9}$$

and for the non traded goods sector by:

$$C_{N,i} = \left(\frac{P_{N,i}}{P_N}\right)^{-\theta_1} \cdot C_{NTG} = (1-a) \cdot \left(\frac{P_{N,i}}{P_N}\right)^{-\theta_1} \cdot \frac{I}{P_N} \quad \text{for i=1,2} \tag{10}$$

[9] The benefits are assumed to be financed through lump sum transfers paid by the workers in each firm such that the benefits drop out of the budget constraint.

[10] The minimum number of levels of aggregation to generate a hump-shaped structure is three. Although, Danthine and Hunt work with more sublevels (i.e. 5), this analysis limits itself to the minimum number in order to keep the notation as simple as possible. Clearly the analysis can easily be extended to more levels of aggregation as well as more branches at each level of aggregation (e.g. instead of two branches, Danthine and Hunt employ 4 branches at each nod).

[11] The respective consumption baskets at the different levels of aggregation are given in Appendix IV.

$P_{T,i}$ and $P_{N,i}$ refer to the respective price indices of the consumption baskets and θ_X is the elasticity of substitution between the home and the foreign traded goods consumption basket, while θ_1 refers to the elasticity of substitution between the two sub-baskets of the non traded goods. The idea that goods are imperfect substitutes is captured by $\theta_X > 1$ and $\theta_1 > 1$. Furthermore, the assumption that traded goods face stronger competition (due to the competition from abroad) than non traded goods is captured by $\theta_X > \theta_1$. The fact that $\theta_X > \theta_1$ will lead firms in the traded good sector to increase prices less than in the non traded goods sector, as the loss of demand to foreign producers is stronger in the traded good sector than the loss of demand to other domestic producers in the non traded goods sector. In general the elasticities of substitution within a sector are increasing with a higher degree of disaggregation, such that: $1 < \theta_1 < \theta_X < \theta_Y < \theta_2 \leq \theta_Z$.[12] The intuition behind the increasing elasticity of substitution at lower levels of aggregation is that the goods become closer substitutes.[13]

The price index at the respective level of aggregation is given by:

$$P_T = \left(P_{T,1}^{1-\theta_X} + P_{T,2}^{1-\theta_X}\right)^{\frac{1}{1-\theta_X}} \tag{11}$$

$$P_N = \left(P_{N,1}^{1-\theta_1} + P_{N,2}^{1-\theta_1}\right)^{\frac{1}{1-\theta_1}} \tag{12}$$

Moving down one stage in the aggregation ladder, gives the demands for those subgroups:

$$C_{T,i,j} = a \cdot \left(\frac{P_{T,i,j}}{P_{T,i}}\right)^{-\theta_Y} \left(\frac{P_{T,i}}{P_T}\right)^{-\theta_X} \cdot \frac{I}{P_T} \tag{13}$$

$$C_{N,i,j} = (1-a)\left(\frac{P_{N,i,j}}{P_{N,i}}\right)^{-\theta_2} \left(\frac{P_{N,i}}{P_N}\right)^{-\theta_1} \cdot \frac{I}{P_N} \quad \text{for i,j=1,2} \tag{14}$$

Resulting in the price index for the sub-branches:

$$P_{T,i} = \left(P_{T,i,1}^{1-\theta_Y} + P_{T,i,2}^{1-\theta_Y}\right)^{\frac{1}{1-\theta_Y}} \tag{15}$$

$$P_{N,i} = \left(P_{N,i,1}^{1-\theta_2} + P_{N,i,2}^{1-\theta_2}\right)^{\frac{1}{1-\theta_2}} \quad \text{for i=1,2} \tag{16}$$

[12] In order to generate the different wage-employment trade off in traded and non traded good sector it is only necessary to have $1 < \theta_1 < \theta_X$.

[13] One may think of the choice a consumer makes at the highest aggregation level of traded goods between durables (e.g. automobiles) and non durables (food), two baskets which have a low elasticity of substitution (θ_X). At the next level of aggregation the consumer will choose between, say, an SUV and a normal passenger car (for the automobiles) and vegetables and meat (for the food). At the lowest level of aggregation the choice would then be between the brands (say Peugeot and Volkswagen). One can see from this idea that the elasticities are increasing with an increasing level of dis-aggregation, which is captured by: $\theta_X < \theta_Y < \theta_Z$ in the traded good sector.

And at the most disaggregated level for the traded good sector:

$$C_{T,i,j,k} = a \cdot \left(\frac{P_{T,i,j,k}}{P_{T,i,j}}\right)^{-\theta_Z} \left(\frac{P_{T,i,j}}{P_{T,i}}\right)^{-\theta_Y} \left(\frac{P_{T,i}}{P_T}\right)^{-\theta_X} \cdot \frac{I}{P_T} \quad \text{for i,j,k=1,2} \quad (17)$$

This will give the following price index:

$$P_{T,i,j} = \left(P_{T,i,j,1}^{1-\theta_Z} + P_{T,i,j,2}^{1-\theta_Z}\right)^{\frac{1}{1-\theta_Z}} \quad \text{for i,,j=1,2} \quad (18)$$

In equilibrium consumption of non traded goods must equal production: $C_{NTG} = Y_{NTG}$. This allows pinning down the equilibrium conditions. Note that this also implies that the traded and non traded good sector can basically be treated separately as each sector's nominal consumption must equal its value of production. More precisely, the Cobb-Douglas structure will result in the fact that a change in the price of non traded goods will be exactly offset by a corresponding change in the quantity of non traded goods such that the value of $\sum P_{N,i,j} Y_{NTG,i}$ remains unchanged. Furthermore, as $C_{NTG} = Y_{NTG}$ and the consumption of non traded goods is $C_{NTG} = (1-a) \cdot I/P_{NTG}$ there is no effect on the demand for traded goods or the wage setting in the traded good sector stemming form wage changes in the non traded good sector.

The monopoly union approach to wage determination

In this simple approach to wage setting, unions are able to decide the wage and firms are left to determine employment. When each union maximizes independently it takes the other unions' wage as given.[14] Given that (a) determines the division of demand between non traded goods and traded goods, a=1 would imply that there will be no demand for the non traded good sector. If the production structure would not adjust to such a change in a, this would result in complete unemployment for all the labor formerly employed in the non traded good sector. Therefore, the way in which firms allocate themselves between traded and non traded good sector will depend on (a). More precisely, in terms of the graph in Appendix 1, when a=1 all firms constitute part of the traded good sector, and we have the case of the Danthine and Hunt open economy. On the other hand, if a=0 all firms will produce for the non traded good sector and we are in the original Calmfors and Driffill framework. The labor that can potentially be employed in a firm, whether non traded good sector or traded

[14] Although a wage bargaining approach, where the firm and the union set the wage by jointly maximizing their utilities with the respective weights to union utility and firm utility representing the respective bargaining power, is a more realistic set-up, I make use of the monopoly union approach as Calmfors and Driffill (1988) have shown that the outcome would not be altered significantly. Nevertheless, I will make use of the concept of relative bargaining strength in the empirical part of the paper. The intuition of this concept is straight forward: If the trade union does have a stronger bargaining position (either due to a high level of union coverage or a favorable legal framework) the wage tends to be higher.

good sector will hence always be identical and equal to M_i, the union members, independent of (a). Furthermore, the demand facing a single firm in the non traded good sector for its variety in the case of a=1/2, will be the same as in the case of a=0, while the demand facing a single firm in the traded good sector will be the same under a=1/2 and a=1.[15] For simplicity, I will only contrast the cases of a=0, a=1/2 and, a=1 as these cases are essentially contrasting the three different scenarios.[16]

The case of decentralized wage setting

Given that workers contribute to the production of either non traded or traded goods, a union at the firm level will maximize the utility deriving from the wage that maximizes the following function taking, respectively, the labor demand in non traded good sector or traded good sector into account (a similar function holds for unions in the traded goods sector):

$$U = L_{i,NTG} \cdot v\left(\frac{W_i}{P}\right) + (M_i - L_{i,NTG})\bar{V} \tag{19}$$

The first term is the utility (v) derived from the real wage paid to those members of the union that will remain employed and the second term reflects the members that will not be employed anymore ($M_i - L_{i,NTG}$) and derive utility $\bar{V}$, with $\bar{V}$ being defined as: $\bar{V} = h(W_R)$

The first order condition is given by:

$$0 = \frac{\partial L_{i,NTG}}{\partial W_i}\left(v - \bar{V}\right) + \frac{\partial v_i}{\partial W_i} L_{i,NTG} \tag{20}$$

From the labor demand function, the output supply function as well as the demand for each single variety one can derive the wage chosen by the union in the non traded good sector:

$$W_{i,NTG} = h(W_R) \cdot \left(1 + f(\epsilon_{NTG}, a_{NTG,ii}, \sum_{k=1}^{m} s_{NTG,k} a_{NTG,ki})\right), \tag{21}$$

$$\text{with} \quad f(\epsilon_{NTG}, a_{ii}, \sum_{k=1}^{m} s_{NTG,k} a_{NTG,ki}) > 0$$

[15] This is quite intuitive, as the income being spent on non traded goods is twice as big as the income spent on non traded goods under a=1/2, but also the number of firms in the non traded good sector has doubled. A similar reasoning applies to the case of a=1. Appendix II and III illustrate the consumption and production structure for the case of a=1 and a=0. For a formal derivation of the equality of demands see Appendix IV.

[16] For any value $0 < a < 1$, the analysis is conducted identical to the framework set out in this paper, but would require more branches at the upper nods. E.g.: if there were three branches at the nod C_N and three branches at the nod $C_{T,2}$, $a = 1/3$ would result in a production structure, in which two branches would be at the nod of $C_{T,2}$ and 4 bracnhes at the nod of C_N.

and in the traded good sector:

$$W_{i,T} = h(W_R) \cdot \left(1 + f(\epsilon_T, a_{T,ii}, \sum_{k=1}^{n} s_{T,k} a_{T,ki})\right), \tag{22}$$
$$\text{with} \quad f(\epsilon_T, a_{T,ii}, \sum_{k=1}^{n} s_{T,k} a_{T,ki}) > 0$$

Essentially the wage is a mark-up over the utility derived from leisure which depends on the unemployment benefits W_R. Higher unemployment benefits tend to raise wage demands. ϵ_{NTG} and ϵ_T are the elasticity of labor demand with respect to the real product wage in non traded and traded good sector, respectively. Clearly, a higher elasticity tends to decrease the wage demands as it would imply a strong loss of employment in response to a small increase in the wage. $s_{NTG,k}$ is the share of income spent on non traded goods that goes to the single good k.[17] Of particular interest are a_{ii} and a_{ki}, which represent the respective elasticity of the price of product k and product i with respect to a wage increase in firm i.[18] These elasticities depend on all the elasticities of substitution between the goods, i.e. from the lowest to the highest level of aggregation in the non traded good for (21) and all the elasticities in the traded good sector for (22). Hence, one may rewrite the relationships as:

$$f(\epsilon_{NTG}, a_{NTG,ii}, \sum_{k=1}^{m} s_{NTG,k} a_{NTG,ki}) = f(\epsilon_{NTG}, \vec{\theta}_{NTG}) \tag{23}$$

$$f(\epsilon_T, a_{T,ii}, \sum_{k=1}^{n} s_{T,k} a_{T,ki}) = f(\epsilon_T, \vec{\theta}_T) \tag{24}$$

It is possible to show that if the elasticity of substitution between the final goods (in the underlying framework) increases, wage demands decrease, which is a quite intuitive result. A higher degree of substitution between products will lead to a stronger loss in employment, as consumers will react to the price increase of product i that follows the wage increase in firm i, by substituting into consumption of the other product that is the closest substitute. Hence, the closer varieties are to each other, the lower will the wage demand be.

Moving Towards Centralized Wage Bargaining Levels

The analysis of the wage bargaining at higher levels of aggregation (i.e. for more centralized bargaining levels) proceeds identical to Calmfors and Driffill.

[17] With the symmetry assumption and in equilibrium every union setteling for the same wage rate the share will be the same for all non traded good producers.

[18] Both can be obtained by deriving the respective output supply equation for industry k with respect to the wage rate in industry i while taking into account the demand for the single product k.

At the intermediate level of bargaining, unions cooperate and set jointly the wage rate. I follow Calmfors and Driffill (1988) and regard union cooperation as the maximization of the sum of the union's utility functions that cooperate. Hence, at the second lowest level of aggregation, there are always two unions that cooperate in a group and there are four groups in each country (two in the traded good sector and two in the non traded good sector). The maximization problem may hence be rewritten for this level (for a single group in the non traded good sector) according to:

$$\begin{aligned} U_i &= (L_{i,NTG}) \cdot v_i \left(\frac{W_i}{P}\right) + (M_i - L_{i,NTG}) \cdot \bar{V} \\ &\quad + (L_{j,NTG}) \cdot v_j \left(\frac{W_j}{P}\right) + (M_j - L_{j,NTG}) \cdot \bar{V} \end{aligned} \tag{25}$$

An identical condition holds for the other union. This utility function implies that, when setting the wage, union i takes into account the effect that the wage change has on the members of union j. The first order condition for union i is given by (with a similar condition holding for union j):

$$\begin{aligned} \phi_i &= \frac{\partial U_i}{\partial W_i} + \frac{\partial U_j}{\partial W_i} \\ &= \frac{\partial L_{i,NTG}}{\partial W_i}\left(v - \bar{V}\right) + \frac{\partial v_i}{\partial W_i} \cdot L_{i,NTG} \\ &+ \frac{\partial L_{j,NTG}}{\partial W_i}\left(v - \bar{V}\right) + \frac{\partial v_j}{\partial W_i} \cdot L_{j,NTG} = 0 \end{aligned} \tag{26}$$

If $\partial U_j/\partial W_i > 0$ (and then also due to symmetry $\partial U_j/\partial W_i = \partial U_i/\partial W_j > 0$) at the wage rate found for the decentralized setting of the former paragraph then it follows that $\phi_i = \phi_j > 0$. Therefore, compared to the decentralized case, the wage needs to increase in order to satisfy the first order condition that maximizes the unions' objective function. Whether $\partial U_j/\partial W_i$ is positive or negative depends on the relative size of the two effects that are essential to the analysis: the "cross-employment effect" and the "real income effect". While on the one hand, a higher wage in firm i leads to an increase in the demand for product j and hence an increase in the demand for labor such that a higher wage can be realized which increases the utility of union j. On the other hand the increase in wage i leads to an increase in the general price level which tends to decrease the real wage and reduces union j's utility.

The first effect, represented by $\partial L_{j,NTG}/\partial W_i \cdot (v - \bar{V})$ is higher the easier the two goods are substitutable. The idea here is that, if unions from firms that produce close substitutes cooperate and set commonly a wage rate, prices for the two goods will be the same. This results only in substitution effects towards products that are less close substitutes, but there will be no substitution between

the two products. Given the tree structure of consumption with decreasing elasticities of substitution between products at a higher level of aggregation, the cooperating unions face a lower elasticity of demand for labor with respect to the nominal wage increase. At any higher level of aggregation the elasticity of demand for labor gets even lower as substitution between products decreases, pushing cooperating unions to set higher wages (Calmfors and Driffill 1988, p.33). The second effect, "the real income effect" (represented by $\partial v_j/\partial W_i \cdot L_{j,NTG}$ in the FOC) leads instead to the opposite effect. The bigger the share of unions that cooperate, the bigger the share of their aggregate production in the overall price index. This tends to decrease the wage demands at higher levels of aggregation as the effect on the real wage tends to offset the gains due to increased market power. The combination of these two offsetting effects gives rise to the hump-shaped form of wage demands when moving from a system of decentralized bargaining to a system of centralized bargaining in the non traded good sector.[19] It is worth pointing out that the highest level (i.e. the national level) of wage bargaining is where wage bargaining takes place at the aggregate level of traded goods and non traded goods, respectively. Although unions of both sectors could theoretically cooperate, there will be no scope for wage changes as the Cobb-Douglas structure impedes any further gains from wage cooperation.

Hence, wage bargaining is decentralized if wages are set at the most disaggregated, i.e. the firm level, where each union cares only about its own members. The intermediate level of bargaining in this framework is then represented by the case in which the two unions of the products which are closest substitutes cooperate by taking the effect of the own wage setting on the other unions' members into account (e.g. in terms of the graph in Appendix I, the union in firm $C_{N,2,1}$ annd $C_{N,2,2}$ cooperate and the unions in firm $C_{N,1,1}$ annd $C_{N,1,2}$ cooperate). Centralized wage bargaining is then achieved when four unions co-operate, i.e. firms $C_{N,2,1}$, $C_{N,2,2}$, $C_{N,1,1}$,and $C_{N,1,2}$.

Increase in Openness

An increase in openness to trade can be captured via two channels. Firtsly, an increase in the share of consumption being spent on traded goods (a) clearly leads to an increase in openness. Secondly, following the idea of Danthine and Hunt (1994) an increase in openness may be modelled via a stronger competition from abroad which would be reflected by a higher elasticity of substitution between the traded home and foreign goods (θ_X).[20] It is worth noting that the case of $a = 0$ corresponds essentially to the original closed economy version by Calmfors and Driffill and the case of $a = 1$ corresponds to the open economy version of Danthine and Hunt.[21] When modeling openness as an increase in

[19] For given parameters, this was proven in Calmfors and Driffill (1988) and Danthine and Hunt (1994).

[20] Holding the other elasticities of substitution constant.

[21] Note that a=0 applies due to symmetry to the home and the foreign economy such that there will be neither a demand from home nor from foreign for traded goods. For a graphical illustration of production and consumption structure under a=0 see Appendix II and for a=1 see Appendix III.

the size of the traded good sector, the hump-shape will not disappear, but will be closer to the less pronounced hump-shape in the traded good sector (as represented in Figure 1). This is not only a result of the fact that I do not model the increase in trade through an increase in the elasticity of substitution between home and foreign goods (as Danthine and Hunt did), but through an increase in the size of the traded good sector. It is much more a result of the fact that the non traded good sector does not face any foreign competition.

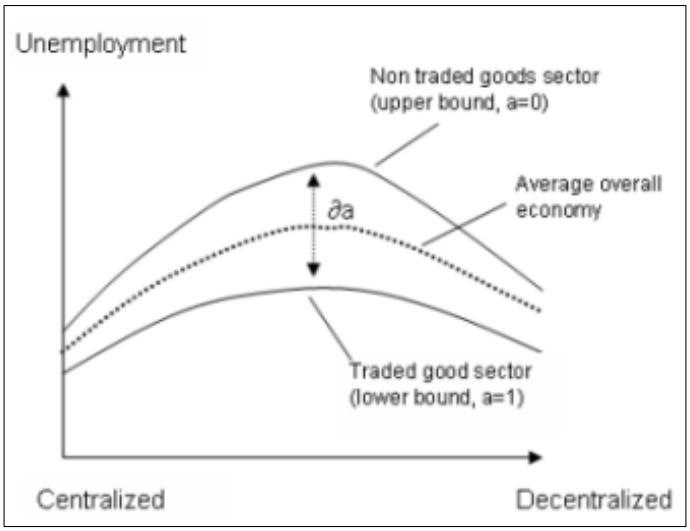


Figure 1: Unemployment in an Open Economy with Identical Trading Partner with Increasing Size of the Traded Good Sector

Even if the increase in openness is modeled exactly as in Danthine and Hunt, that is over the increase in the elasticity of substitution, it would only apply to the traded good sector, but the non traded good sector and its hump-shape would remain unaffected (as represented in Figure 2, where the overall economy hump moves with the traded good sector hump). Only a complete elimination of the non traded good sector (i.e. setting the expenditure share for non traded goods equal to zero: $a = 0$) and an increase in the elasticity of substitution (θ_X) would reveal the same conclusion as the one found by Danthine and Hunt. This however is an unlikely scenario, given the significant shares of income spent on non traded goods. Therefore, unaffected by how the increase in openness is modeled (i.e. either through an increase in the share of the traded good sector in consumption (a) or as in Danthine and Hunt via an increase in the substitutability between home and foreign goods), I find, as Danthine and Hunt, that the gains from stronger foreign competition in terms of employment are potentially highest in the intermediate case, where the hump is at its peak, but that the hump-shape should not disappear unless there is no more non traded goods sector and competition is close to perfect.

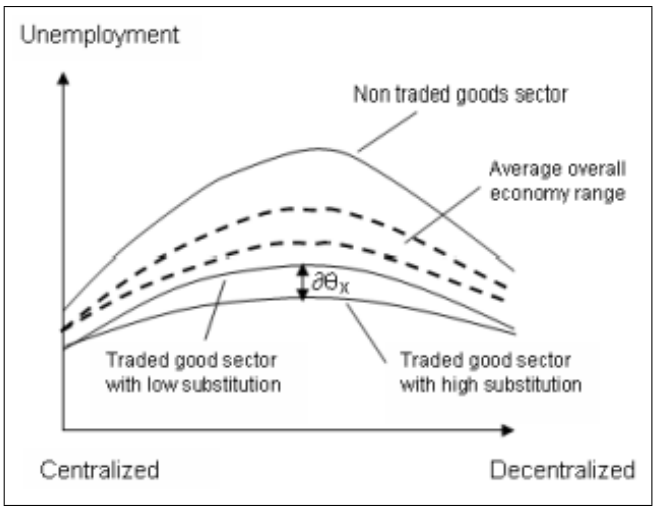


Figure 2: Unemployment in an Open Economy with Identical Trading Partner with Increasing Competition

3.2 Extension

The fact that unions were constituted along the lines of traded and non traded goods, as well as the fact that workers contribute either only to the production of non traded goods or only traded goods, is quite ad hoc and unlikely to reflect reality. Furthermore, a sustained wage differential is hard to defend in the long run. Therefore, some adjustments are necessary to overcome these shortcomings in the baseline model. I will sketch in the following an extension to the baseline model which will essentially leave the outcome unaltered but result in a more realistic setting.

The consumption pattern and the production function remain unchanged. The adjustment is made with respect to the mobility of labor and the way in which unions set wages. Labor is homogenous and may either be employed in the production of the non traded good or the traded good. Each firm is assumed to produce a fraction of total output as non traded good and another fraction of output as traded good.[22] This implies that each worker will potentially contribute a fraction of its work time to the production of the non traded good

[22] In terms of the graph in Appendix 1 this implies for the case of a=1/2 that a sinlge firm owns the production of one non traded good and one traded good (i.e. firm 1: $C_{N,1,1}$ and $C_{T,2,1,1}$; firm 2: $C_{N,1,2}$ and $C_{T,2,1,2}$, firm 3: $C_{N,2,1}$ and $C_{T,2,2,1}$, and firm 4: $C_{N,2,2}$ and $C_{T,2,2,2}$. For the case of a=1/3, each firm would own the production of two non traded goods and one traded good (See also footnote (16) for the case of a=1/3).

$(1-a) = M_{i,NTG}/(M_{i,NTG}+M_{i,T})$ and the rest of the time to the traded good production $a = M_{i,T}/(M_{i,NTG}+M_{i,T})$.[23]

The case of decentralized wage setting

Given that workers contribute to the production of non traded and traded goods the union at the firm level will maximize the weighted utility deriving from the wage that maximizes the following function:

$$\begin{aligned} U &= \frac{M_{i,NTG}}{M_{i,NTG}+M_{i,T}}\left[L_{i,NTG}\cdot v\left(\frac{W_i}{P}\right)+(M_{i,NTG}-L_{i,NTG})\bar{V}\right] \\ &+\frac{M_{i,T}}{M_{i,NTG}+M_{i,T}}\left[L_{i,T}\cdot v\left(\frac{W_i}{P}\right)+(M_{i,T}-L_{i,T})\bar{V}\right] \end{aligned} \tag{27}$$

The first line is the utility derived from the working time devoted to the production of the non traded good and the second line represents the utility derived from the working time devoted to the production of the traded goods. There will hence be only one wage rate within a firm and due to symmetry, in equilibrium within the overall economy. The first order condition is given by:

$$\begin{aligned} 0 &= \frac{M_{i,NTG}}{M_{i,NTG}+M_{i,T}}L_{i,NTG}\cdot\frac{\partial v_i}{\partial W_i}+\frac{M_{i,NTG}}{M_{i,NTG}+M_{i,T}}\left(v-\bar{V}\right)\frac{\partial L_{i,NTG}}{\partial W_i} \\ &+\frac{M_{i,T}}{M_{i,NTG}+M_{i,T}}L_{i,T}\cdot\frac{\partial v_i}{\partial W_i}+\frac{M_{i,T}}{M_{i,NTG}+M_{i,T}}\left(v-\bar{V}\right)\frac{\partial L_{i,T}}{\partial W_i} \\ &= \left[(1-a)\,L_{i,NTG}+aL_{i,T}\right]\frac{\partial v_i}{\partial W_i}+\left[(1-a)\,\frac{\partial L_{i,NTG}}{\partial W_i}+a\frac{\partial L_{i,T}}{\partial W_i}\right]\left(v-\bar{V}\right) \end{aligned} \tag{28}$$

Looking at the extreme cases of open (a=1) and closed economy (a=0), it becomes clear that in the first case (28) simplifies to:[24]

$$0 = \frac{\partial L_{i,T}}{\partial W_i}\left(v-\bar{V}\right)+\frac{\partial v_i}{\partial W_i}L_{i,T} \tag{29}$$

and in the latter case to:

$$0 = \frac{\partial L_{i,NTG}}{\partial W_i}\left(v-\bar{V}\right)+\frac{\partial v_i}{\partial W_i}L_{i,NTG} \tag{30}$$

But (29) and (30) are nothing else then (20) for the traded good sector and the non traded good sector, respectively. Hence, for any value $0 < a < 1$ the

[23] That the fraction is set equal to the expenditure share on traded and non traded goods, respectively, is certainly somewhat restrictive, but allows for the tractability of the model. A more involved approach would be to set the fraction equal to the actual, instead of potential, working time devoted to the sector (i.e. $L_{i,T}/L$ and $L_{i,NTG}/L$).

[24] For a=0, it follows that there will be no demand for the traded goods neither from home nor from abroad. The production will alter such that the firms relocate from traded goods to non traded goods. Therefore a=0 implies that L_T=0 and L_{NTG}=L. For a=1, it follows that L_{NTG}=0 and L_T=L.

wage rate that applies to each worker in a firm that produces non traded goods and traded goods will be in between the two extreme wages when considering traded good sector and non traded good sector separately, as in the basic model. Whether the wage will be closer to the higher wage in the non traded good sector or closer to the lower wage in the traded good sector will be determined by the actual value of (a) and the magnitude of the elasticity of substitution between foreign and home goods, according to $\partial W_i/\partial a < 0$ and $\partial W_i/\partial \theta_X < 0$. With $0 < a < 1$, the wage in the economy will be above the wage in the traded good sector and below the wage rate in the non traded good sector, compared to the baseline model. Therefore, prices for non traded goods will be lower than in the baseline model and supply bigger while prices for traded goods will be higher than in the baseline model and supply will be lower.

The analysis with respect to union cooperation proceeds then analogous to the baseline model, where it can be shown again that the wage for $0 < a < 1$ will be in between the two extremes. Therefore, the basic outcome remains unaltered but the economy exhibits only one wage for each level of wage bargaining.

The model carries in its baseline as well as its extended version three testable hypothesis, of which two have already been formulated by either Calmfors and Driffill or Danthine and Hunt. Firstly, as noted by Calmfors and Driffill intermediate bargainers tend to exhibit a higher level of unemployment than centralized or decentralized bargainers. Secondly, as found by Danthine and Hunt, increased openness to trade should lead to lower levels of unemployment, where intermediate bargainers should benefit more in terms of lower unemployment from an increase in openness. And thirdly, as stated above, the hump-shaped relationship between the degree of centralization and the level of unemployment should persist for credible levels of openness, favouring centralized and decentralized wage setting systems over intermediate systems even in the open economy context.

4 Empirical Analysis

The model described in the previous chapter is completely static and does not give any predictions about dynamics (Driffill 2005, p.2). However, simply looking at the average unemployment rates and the level of bargaining structure is less likely to give an insightful picture as too many potential independent variables would be left out of consideration.[25] It appears hence logical to approach the analysis by looking at the performance of different countries in terms of unemployment over time including the wage bargaining level as a dummy variable.[26] Additionally, the wage setting structure (dummy) will be inter-acted

[25] See Flanagan (1999, p.1165) for a critique of this problem in former empirical analysis. However, in Appendix VI, this simple relationship is provided graphically.

[26] Similar approaches have bee taken by various authors, e.g. Layard et al (1991) and Blanchard and Wolfers (2000). An overview of models using changing institutional variables or fixed ones can be found in Nickell, Nunziata and Ochel (2005).

with a measure of openness in order to test whether "intermediate bargainers" tend to have lower unemployment rates when the competition from increased openness becomes stronger.

4.1 The Data[27]

The limited availability of data on labor market structures restricts the analysis essentially to 20 OECD countries over the period 1970-2000. Additionally, various variables are only recorded in two year intervals, or with even lower frequency. As the interest is in explaining the level of unemployment, the standardized unemployment rate as provided by the OECD is used as dependent variable. The outlined theoretical framework has provided indications with respect to the choice of the explanatory variables. Central to this analysis is the degree of wage centralization.[28] The indicator chosen here is based on two separate indicators: centralization of wage bargaining and coordination of wage bargaining.[29] The centralization variable is provided by the OECD on a five-year average basis and takes values from 1 to 5, increasing in the degree of centralization. The coordination indicator, which is taken from the dataset of Nickell et al (2001), takes values from 1 to 3, where higher values refer to a higher degree of coordination on union and employer side. I distinguish between three types of wage setting systems: centralized, intermediate and decentralized systems. A country is classified as centralized, if it either exhibits a centralized system of wage setting (i.e. the centralization indicator takes the value 4 or 5) or a country has an intermediate level of centralization and additionally a high level of coordination (values above 2.25 for the coordination index), which theoretically allows to offset the negative effect from the intermediate centralization system. Intermediate systems are countries with a value of centralization below 4 and above 2 and a value of coordination below 2.25. Countries with low levels of centralization (a value below 2 for the centralization index) are considered as decentralized, irrespective of the degree of coordination, as I do not expect additional benefits from coordination when systems are decentralized. The reader may refer to Appendix V for an exact grouping of the respective countries according to the above described framework.

[27] The exact description of the data used in the regression is given in Appendix V, with detailed information on sources and abbreviations used within this paper.

[28] Due to the importance of this variable in the context of this paper, a brief discussion of the literature with respect to the choice of the variable that reflects the wage setting system is given in Appendix V ("Labor Market Variables"), in order to motivate more thoroughly the indicator used in this paper.

[29] Elemeskov et al (1997) and Nicoletti and Scarpetta (2004) have applied a very similar technique in constructing their wage bargaining indicator. However, it is notoriously difficult to determine which index is most appropriate. Kenworthy (2001) gives a good overview over the controversy about which index is preferable and lists 15 indicators from different authors which are supposed to reflect either behavioural or formal characteristics of wage setting, some of which take government involvement into account others rely on union concentration, while others again rely on the pure formal setting.

To test the hypothesis on the effect of openness under different degrees of centralization, the three dummies of centralization are inter-acted with a measure of openness. Two main measures of openness were considered: trade in % of GDP and imports in % of GDP. As openness in the above framework is understood as increased competition from foreign competitors, the import measure promises to capture this idea better than trade in % of GDP, which includes exports that do not necessarily increase competition. Nevertheless, all models have also been re-estimated using trade in % of GDP as openness indicator, because also exports face foreign competition, albeit in third markets. Instead of taking only the current value of imports into account, I use the average of the imports in % of GDP over current period and the values in the two preceding periods. The rationale for doing so is that wage setters are possibly perceiving increased competition from foreign competition from import penetration in the past, which's effects are observable for the unions.

Another variable that affected unemployment in the framework is the "fall-back wage" in the case of unemployment ($\bar{V} = h(W_R)$). Anything that increases this value tends to increase wage demands and thereby increase unemployment. To reflect this, I use the benefit replacement rate in the respective countries, which is basically a measure of how much a person can expect to get from the unemployment insurance relative to the former wage earnings in case of becoming unemployed. This measure is then multiplied with a measure of duration for the benefits. The data for the benefit replacement rate is provided by the OECD in two year intervals and the duration measure is taken from Nickell et al. (2001).

Besides these variables which derive directly from the theoretical framework developed in chapter 3, it is important to control for other explanatory variables that may influence the unemployment rate, namely: union power, employment protection, and taxes.

It is plausible that stronger union bargaining power will induce unions to raise wages more. The literature distinguishes here between two indicators: the union density and the union coverage. Whereas the former one reflects the part of the labor force that is a union member the second indicator reflects the actual part of the labor force which will be covered by the negotiated wage agreement that unions determine jointly with the employer organizations. Although it would be preferably to use both indicators, only union density is available over the studied period.

An additional variable that has been used widely to explain unemployment rates is the restrictiveness of employment protection. The expected sign in this case is however not so clear. While a higher degree of employment protection may prevent firms from firing easily and thereby prevent the "insiders" from loosing their job, a higher degree may also make firms more reluctant to employ new workers, as the cost of firing in a downturn is high, and thus may increase unemployment.

The difference between the actual wage rate the employee receives and the wage the employer pays, the so-called tax wedge, may also affect the unemployment rate. One would expect a big tax wedge, i.e. a net wage the employee

receives that is well below what the employer pays to increase unemployment as ceteris paribus a higher tax rate induces the employee to increase wage demands in order to keep his net real wage unchanged. Given that such an increase would be realized, the employer will face a higher marginal cost for an unchanged level of productivity and therefore will have to reduce employment to increase the marginal productivity of labor.

Active labor market policy is another variable used in some empirical studies that attempt to explain the unemployment level. Unfortunately, the available data dates only back to the early 80s and can hence not be used in the analysis.

I introduce additionally a constructed variable based on the Employment Protection Legislation Index and the inter-acted openness measure.[30] The rationale behind this "Pressure Index" is that the competitive effect stemming from increased openness may be dampened if employment protection is high and unions do not perceive the higher trade-off between unemployment and wages, as unions believe that "firing" is unlikely due to the high protection. Hence, I simply divide the value of the lagged imports by the value of the EPL Index, such that countries with higher degree of employment protection perceive less pressure from foreign competition than countries with lower employment protection but the same level of openness. The construction of this index finds a further motivation on the basis of the rather recent literature on the interaction of product market regulations and labor market institutions (See for example Blanchard and Giavazzi 2003 or Nicoletti and Scarpetta 2004). This literature starts from the assertion that regulations can lower the intensity of competition between firms. Thus deregulation may increase competition as the number of firms may increase, increasing output and employment and lowering potential rents (Nicoletti and Scarpetta 2005, p.7). This in turn may pave the way for competitive wage setting, as the scope for distribution between firms and workers shrinks, which encourages moderate wage setting (Berger and Danniger 2005, p.5). Although, the literature focuses primarily on restrictions to firm entry, Nicoletti and Scarpetta (2004, p.2) state that one measure of product market competition can be seen in the foreign competition (i.e. openness to trade) of a country. The authors' estimation results "strongly suggest that reforms in both labour and product markets are needed to raise significantly long-run employment rates", where the labor market institutions encompass the employment protection legislation (Nicoletti and Scarpetta 2004, p.3). The importance of EPL as an indicator for restrictions in the labor market is confirmed by the assertion that "the insider power of workers employed in firms sheltered from competitive pressures can be compounded by the presence of unduly restrictive EPL, pushing up wage premia and lowering equilibrium employment" (Nicoletti and Scarpetta 2004, p.8). Also Kugler and Piga (2004) find in an empirical investigation that the two policies are complements and that the gains from labour market reforms are only reaped when product markets are

[30] Other authors have already inter-acted the wage setting dummies with the EPL index, finding a differential effect of EPL under different wage setting systems. See for example Belot and van Ours (2000) or Nicoletti and Scarpetta (2004).

deregulated as well.[31]

Hence, the idea of the literature on product market regulations and labor markets involves the assertion that strict product market regulations impede competition in the product market and lead to imperfect competition, making labor market deregulations less effective. Though imports in percent of GDP is certainly not a perfect indicator for the extent of product market regulations, the idea that is supposed to be covered by the openness indicator, namely reflecting the extent of foreign competition, is similar to the notion in that literature. The "Pressure Index" covers, therefore, also to some extent the notion of the literature with respect to the complementarity of the two policies, as a reduction in the EPL will have a stronger impact, when coupled with a higher level of openness.

Besides these labor market variables, I make use of one additional macroeconomic variable in order to reflect the current state of the economy. More precisely, I use the output gap to reflect whether the economy in the respective period was coined by rather a growth above trend or below, in order to capture possible deviations from the equilibrium rate of unemployment. By including the output gap in the regression I attempt to capture any possible cyclical fluctuation in the unemployment rate which has not been taken out yet through the averaging over five years. This allows the analysis to focus on the structural and not the cyclical determinants of the unemployment rate.

Descriptive Statistics

A look at the data reveals quickly that the variation in the unemployment rate in the sample is wide, with the mean being roughly 6%. The variation across countries is more pronounced than within individual countries, except for the output gap. This holds for all the variables used in the regression.[32] The variation in the degree of centralization across countries and time can be found in Appendix V. The sample of 20 OECD countries has seen a move towards less centralized systems of bargaining across time. Also the measure of openness reveals a wide spread. Interestingly, countries with decentralized wage setting systems tend to be less open than their counterparts, while intermediate bargainers are slightly more open on average than centralized systems. Looking instead at the "pressure index" reveals the opposite picture: Decentralized systems do perceive foreign competition stronger than centralized systems and those stronger than intermediate systems. This result is attributed to the fact

[31] The complementarity of these two policies is straightforward to show in a theoretical framework. In a schedule of the labor market with a given labor demand and supply curve, the increased competition in the product market would lead to a rightward shift in the demand curve as well as a flattening of it, due to the higher elasticity of substitution between the increased number of products. This leads to a higher real wage and employment level. However, the augmentation of the employment level would be magnified, if there were a parallel movement of the labor supply curve to the right. Such a movement can be obtained by a deregulation in the labor market which, for instance, could be a reduction in the employment protection, which makes employers more willing to hire workers and weakens the position of unions, rendering the labor supply curve flatter and moving it possibly to the right (Estevão 2005, p.9). See Berger and Danniger (2005) for a simple illustration of this argument.

[32] See Appendix VI for an overview of the descriptive statistics.

that decentralized systems tend to have lower employment protection legislation. The within variation for the "pressure index" is much more pronounced than for the simple openness measure, which is due to the spread in employment protection and due to the fact that the data reveals a tendency towards a reduction in the strictness of employment protection in nearly all countries starting in the early 80s.[33]

A preliminary look at the hump-shaped hypothesis, by using a simple graph of the average unemployment rates across countries with identical bargaining system, indicates the existence of the hump from the late eighties on, while the graph rather supports the corporatist idea in the 70s (See Appendix VI).[34] However, as mentioned before such a simple static exercise is unlikely to shed much light on the question, as too many possible explanatory variables, that might overshadow the relationship are left out of consideration and the answer to the question should be analyzed via a more encompassing approach.

4.2 Estimation Technique

Given the difficulty with the data and the fact that there is little variability over time of the labor market variables, I continue the analysis by making use of five year averages. This appears to be an appropriate approach as the interest is in explaining rather the structural unemployment level and not the short run fluctuations which are likely to be due to short run variation in macroeconomic variables. Hence, the regression will be based on a set of 20 countries and 6 observations in time. As stated before, I will make use of panel techniques in order to capture changes over time and exploit the increase in observations which allows the inclusion of more explanatory variables than are feasible in a cross-country regression of only 20 countries.

As the variability of the labor market variables is limited over time and, as seen in the descriptive statistics section, the variation in the explanatory variables across countries is higher than over time for the single country, one tends to prefer generally the use of a random-effects model over the fixed effects model. On the other hand, the sample of countries is not drawn randomly, which would rather suggest the use of a fixed effects model. Given that for some countries single labor market variables do not change over time, the fixed effects approach has the disadvantage that these specific countries will not contribute to the explanation of the coefficient of this variable, while this would not be the case in the random effects model. On the other hand, the fixed effect model allows to some extent to correct for cross country heteroskedasticity via absorbing the fixed country effects, while this is not so in the random effects model. For these reasons, I will contrast in the following fixed effect estimation results with

[33] This observation will later be analyzed in more detail, when applying the regression to a diffrent time period.

[34] Calmfors and Driffill (1988, p. 42) already stated that the theoretical framework is better suited for the post oil-shock period, as pre 1973 most economies were nearly at full employment.

random effect results, when it is considered important. However, the validity of the choice of the estimation technique remains to be tested formally.

The general form of the estimated model is the following:

$$Y_{it} = \mu_0 + \mu_i + v_t + X_{it}\beta + (w_{it} \cdot z_{it})\delta + \epsilon_{it}$$

Y_{it} represents the unemployment rate over time and across countries. μ_0 is the common constant and μ_i represents the respective country specific time-invariant effects. Furthermore, I will allow for fixed time effects (v_t), in the sense that where appropriate time dummies are included. β covers the coefficients to be estimated for the time-variant variables X_{it}. δ is the coefficient for the interacted openness variable. More precisely, the entire second term from the left may be written as:

$$(w_{it} \cdot z_{it})\delta = \begin{pmatrix} w_{it}^H & 0 & 0 \\ 0 & w_{it}^M & 0 \\ 0 & 0 & w_{it}^L \end{pmatrix} \cdot z_{it} \cdot \delta = \begin{pmatrix} z_{it}^H & 0 & 0 \\ 0 & z_{it}^M & 0 \\ 0 & 0 & z_{it}^L \end{pmatrix} \begin{pmatrix} \delta_H \\ \delta_M \\ \delta_L \end{pmatrix}$$

, where w_{it} is the wage system dummy and z_{it} is the degree of openness (H, M, and L refer to the level of bargaining which are centralized, intermediate, and decentralized, respectively). Both variables vary over time and across individuals.

4.3 Regression Results[35]

The basic approach here is to start from the simplest regression, directly derived from the theoretical framework and modify this regression subsequently. The first regression (Benchmark Model A, Table 1 in Appendix VII), is hence based on the simple openness indicator and does model the hump by the inclusion of the dummy for intermediate bargaining systems. The Hausman test rejects the Null of no correlation between the error term and the independent variables for the random effects model, and therefore supports the use of the fixed effects model. The coefficient on Employment Protection turns out to be negative,

[35] All estimation results are reported in Appendix VII. The models have also been estimated using trade in per cent of GDP as openness indicator, instead of imports in percent of GDP. There are no essential changes with respect to the interpretation of the coefficients. Therefore, I refer only to the measure of imports in the main text. To facilitate the reading, the labelling of the models has been designed according to the following key: "A": models that employ the bargaining dummy interacted with imports in % of GDP; "B": models estimated with the pressure index and imports being the openness indicator; "C": as "B", but trade being the openness indicator; and "D": as "B", but excluding the output gap from the estimation. If the letter is not followed by a number the estimation technique employed is OLS. If the letter is followed by a number, the number indicates for: "1": that the estimation includes an AR(1) term; "2": that the estimation is performed in difference instead of level; "3": that the estimation is a 2SLS estimation; "4": that the x variables are lagged by one period; "5", "6" and "7" relate to robustness checks by dropping outliers from the sample.

while all other coefficients have the expected sign. However, most of the coefficients are insignificant, with the output gap, the tax wedge, and EPL being the exception. When using instead the Pressure Index the picture changes (Benchmark Model B). The Hausman test again rejects the Null. Now, all coefficients turn out to be significant with the exception of union density and the unemployment benefit measure. All coefficients carry the expected sign. The constant takes a value of 6.8 which is only slightly above the average unemployment rate of the whole sample over time. A country that reduces its taxation such that the tax wedge reduces by 10 percent points is expected to experience a reduction in its unemployment rate of 1.4%. The particular interest is in the dummy for intermediate bargainers and the magnitude of the coefficients associated with the Pressure Index. I find both the hypothesis to be supported by these results. Firstly, countries that moved to an intermediate level of bargaining tend to experience higher unemployment rates. Secondly, the magnitude of the Pressure Index indicates, that intermediate bargainers experience a more beneficial effect in terms of lower unemployment rates from a given level of the Pressure Index than countries with other systems of wage bargaining (-0.153 compared to -0.085 and -0.093 for decentralized and centralized systems, respectively). Including a dummy for centralized systems does not alter this conclusion. However, the inclusion of this dummy increases the magnitude of the dummy for intermediate bargainers to a higher level. Given that the included dummy is insignificant and does not increase the fit of the model, I reject this specification in favor of the Benchmark model B.[36] One should realize, however, that the coefficient on the dummy does not reflect the exact effect of being an intermediate bargainer, as the coefficient on the Pressure Index is different for different wage setting systems. An example based on Model B may illustrate this point: France is coined by an intermediate level of bargaining and exhibits a value for the openness indicator of 22% by the end of the sample period, while its EPL value is 1.4. To compare the differential effect the wage setting system has on France's unemployment rate, one has to compute the negative impact coming from the Pressure Index for a fixed value of EPL and openness and add this to the value of the dummy, which will give a value of 1.87 (=4.27 + (-0.153*22/1.4). If France has had either a centralized system or a decentralized system of bargaining, it would only experience the beneficial effect from the Pressure index, which would take a value of –1.46 (=-0.093*22/1.4) or -1.34 (=-0.085*22/1.4), respectively. Hence, the hump amounts to an unemployment rate for intermediate bargainers, which is 3.19 percentage points (=1.86-(-1.34)) higher than for decentralized systems and 3.32 percentage points (=1.86-(-146)) higher than for centralized systems.

The effect of employment protection is somewhat more complex as it enters the regression separately and via the Pressure Index. On the one hand, a lower level of employment protection increases unemployment (an increase by one point on the scale from 0 to 2 leads to a reduction in unemployment by

[36] The economic interpretation of only including a dummy for systems with intermediate levels of bargaining is that there is no significant difference between decentralized and centralized economies with respect to the unemployment rate.

more than 5%). On the other hand, a reduction in the Employment Protection Index increases the pressure coming from foreign competition and thereby tends to offset the former effect. Moreover, the relationship is not linear due to the particular construction of the index (i.e. dividing the level of openness by the EPL index). Additionally, the coefficients on the Pressure Index suggest that employment protection under decentralized and centralized systems affects unemployment less via the Pressure index than in the case of intermediate bargainers.[37] Therefore, ceteris paribus, the effect of a reduction of EPL can lead to an increase or a reduction in unemployment, depending on the level of openness, the bargaining system and the magnitude of the reduction. For example a country which has an intermediate level of openness (Imports exhibit 30 % of GDP) and has a quite restrictive level of EPL (1.4) will experience an increase in its unemployment rate when reducing the EPL to 0.9 by either 1.6%, 1%, or 1.8% in centralized, intermediate and decentralized systems, respectively. Were the same country to reduce the index from 1.4 to 0.4, the effect would be a reduction of the unemployment rate by 2.6% for intermediate bargainers and an increase in the unemployment rate by 0.6% for centralized systems and 1% for decentralized systems. The more open the economy in all of the three cases the less reduction in the EPL is required in order to attain an outcome in which unemployment rates will fall as a consequence of the increased competition. These results are in line with Nicoletti and Scarpetta (2004) as well as Kugler and Puga's (2004) findings that product market competition and labor market regulations are complements and that the gains from labour market reforms are only reaped when product markets are deregulated as well, in the sense that a liberalization of the labor market through a weakening of the employment protection legislation is ineffective (and even worse, for very low levels of openness, it has an adverse affect) with respect to reducing unemployment figures. Higher levels of openness will always result in lower unemployment rates for a given level of the EPL. For example a country with an intermediate level for the EPL (1) will be able to reduce its unemployment rate by 1.53% if the imports in per cent of GDP increase by 10% points under intermediate bargaining levels and reduce the unemployment rate by 0.85% points or 0.93% points under decentralized or centralized systems, respectively.

The hypothesis formulated in the theoretical part included the idea hat the hump-shape will not disappear with increased openness. It is clear however, that due to the fact that for a given level of the EPL intermediate bargainers gain more from increased openness in terms of a reduction in the unemployment rate, there must be a theoretical level of openness at which the gain from increased openness outweighs the disadvantage from being an intermediate bargainer. The

[37] A detailed representation of the differential effect of the EPL under different wage setting systems is given in Appendix VIII. Nicoletti et al. (2001, p.48) find also that a reduction in the EPL has a more beneficial effect on employment for intermediate bargainers than it is the case for centralized or decentralized bargainers. The authors state in another paper that this is "in line with the hypothesis that when insiders have strong bargaining power, they may more easily resist attempts by employers to reflect high turnover costs (due to strict EPL) in lower wages, even if this works to the detriment of outsiders." (Nicoletti and Scarpetta 2004, p.26)

question is hence, at which level of openness does the hump disappear, and is such a level credible or not? Referring again to the example of France, one can verify that the hump will persist (though continuously be lower) up to a level of openness of 85%. Recall that the 85% are imports in % of GDP and the actual level for France is 22%! Hence, in the case of France, it would require a level of openness that is close to four times higher than the actual one, for the hump to disappear. A quite unlikely happening (a doubling of France's openness value to 44% would reduce the hump by roughly 1% to 2%).[38]

When contrasting these results to the random effects model a similar pattern as in the fixed effects model can be found (with the exception of the tax wedge that turns out to be insignificant). Even though the Hausman test rejected the random effects model (and its results cannot be taken at face value) it is insightful to take a look at the results as the interpretation of the coefficients is different in the sense that the dummy for intermediate bargainers does not only apply to those who changed their system, but also to those who have been coined by an intermediate system of bargaining throughout the entire observation period. Therefore, these results support the hump-shaped hypothesis as the coefficients on the pressure index as well as the dummy for intermediate bargainers show a similar pattern.[39]

The results in this set of basic regressions, therefore, reject the simple relationship between openness and wage setting system as laid out in Benchmark Model A, and support the more complex relationship which takes additionally the level of Employment Protection into account. Furthermore, the results render support to the hypothesis of the hump-shaped relationship and the hypothesis that intermediate bargainers tend to benefit more from increased openness in terms of lower unemployment rates than other wage setting systems for a given level of the EPL Index. The results may also be interpreted in the sense that the overall design of the labor market matters and its single components can not always be regarded as having a separable impact.

Alternative Specifications

In order to evaluate whether the model might be mis-specified, the models are analyzed on possible problems stemming from heteroskedasticity, endogeneity and, serial correlation. A simple White test of heteroskedasticity rejected the presence of any further heteroskedasticity after estimating the model with

[38] Using instead of France as example the average values for EPL (1.1) and for the openness indicator (30) (see the Appendix on descriptive statistics), the hump amounts to 2.4 percentage points difference between intermediate bargainers and decentralized systems and 2.6 percentage points with respect to centralized systems. It would require more than a doubling of the average level of the openness indicator in order for the hump to disappear, which is still very unlikely. This is true when using imports or trade as openness indicator. See Appendix IX for more details on the effect of increased openness on the hump-shape, computed for the average level of EPL in the sample.

[39] The hump for Model 2, when following again the procedure as laid out for France in the example, amounts to an unemployment rate which is 3.97 percentage points higher for intermediate bargainers compared to decentralized systems and 4 percentage points higher compared to centralied systems.

fixed effects.[40] The adjusted Durbin-Watson statistic, however, indicates that there may still be some autocorrelation in the error term, even though five year averages have been used in the estimation. It is clear that the unemployment rate in a particular year will be highly correlated with its value in the preceeding year. Over a 5-year average this link becomes somewhat blurred. Furthermore, when estimating a panel of 5-year averages the primary interest is not in retrieving the best fit, but in attempting to explain the structural (equilibrium) level of unemployment as determined by exogenous, rather institutional variables. Hence, from an economic point of view modelling an AR(1) structure in the error term does not help in explaining the structural level of unemployment and why it might have changed over time. Nevertheless, it is important from an econometric point of view to see whether the inclusion of this adjustment will change the results dramatically and thereby question the explanatory power of the model when estimated in its structural version.

When re-estimating the model and including an AR (1) process (model B1), the explanatory power as measured by the within R-squared of the structural part reduces to 0.56. The coefficient on the taxrate remains unchanged. Now, the coefficient on the unemployment benefit measure becomes significant at the 10% level and has the expected sign. Although the magnitude of the coefficients on the variables of interest have changed, the interpretation remains unchanged. More precisely, the hump for the average sample (EPL=1.1 and imports=30), amounts to an unemployment rate which is 2% higher when comparing intermediate bargaining to decentralized bargaining systems and to 2.03% when comparing intermediate bargaining to centralized bargaining systems. Again it would require more than a doubling of the openness indicator for the hump to disappear. Also the effect of the EPL indicator is similar to the benchmark model's behavior. The basic pattern remains unchanged, but the beneficial effect stemming from a reduction in the EPL becomes somewhat stronger and the difference between the wage setting systems becomes less pronounced than under the baseline model.[41] Unfortunately, simply including an AR(1) structure in the error term leads to a bias in the reported standard errors due to the correlation between the fixed effects and the AR(1) term. Though this estimation technique is frequently employed in the literature, allegedly due to the finite sample bias of robust estimators, it has been shown that not accounting for the serial correlation through robust standard errors creates a bias which is bigger than any possible bias deriving from the finite-sample problem, at any sample size (Kezdi 2006, p 3). It may, therefore, be more appropriate to re-estimate baseline model B with autocrrelation robust standard errors through employing the Newey-West estimation of the covariance matrix for serial correlation of or-

[40] However, the models have been re-estimated by GLS, correcting for cross-section heteroskedasticty. All the results remain valid. Estimation results are not reported. Many authors in the literature routinely use heteroskedastic robust standard errors though some papers find in formal testing that homoskedaticity can not be rejected (See e.g. Bassanini and Duval (2006)).

[41] See Appendix VIII for the exact results of a change in the EPL on the unemployment rate under the different models.

der one, instead of including an AR(1) term in the fixed effect regression.[42] All the significant coefficients of model B remain significant at the same level, except for the output gap which is now only significant at the five percent level.[43]

Model	D	B	B1	B2	B3
Estimation Technique	OLS	OLS	OLS	OLS	2SLS
Dependent Variable	u	u	u	Δu	u
Labor Market Institutions					
EPL (1 unit)	-5.51***	-5.61***	-4.44***	-5.85***	-6.84***
Unempl. Benefit	3.96	3.97	5.87*	3.75	6.28
Union Density (10 PP)	0.54	0.44	0.53	0.65	0.22
Tax Wedge (10 PP)	1.4***	1.4***	1.4***	1.2**	1.92**
Corp M	4.57***	4.27***	3.04***	2.25*	3.70***
Macro variable					
Output Gap	-	-0.3**	-0.33***	-0.28*	-0.40***
Interacted institution					
Corp L * Pressure Index	-0.087***	-0.085***	-0.114***	-0.099***	-0.125***
Corp M * Pressure Index	-0.158***	-0.153***	-0.152***	-0.129***	-0.177***
Corp H * Pressure Index	-0.087***	-0.093***	-0.115***	-0.095***	-0.134***
Constant	6.45*	6.8**	6.06	0.02	7.67
Fixed Effects					
Country	Yes	Yes	Yes	No	Yes
Time†	Yes	Yes	Yes	Yes	Yes
Observations	114	114	94	94	94
Jarque Bera, prob. value	0.63	0.58	0.02	0	0.75
Adjusted Durbin-Watson	1.46	1.39	2.24	1.81	2.03
R^2 (between)	0.75	0.77	0.56	0.5	0.72

Table 1: Main Estimation Results

* =significan at 10%, ** = significant at 5%, *** = significant at 1%

† Time effects refer not to the whole period but only to two dummies for the 70s, which are highly significant. Time dummies for other periods were never significant.

While the majority of the emprical work on the determinants of unemployment regard the labor market institutions as causal and hence exogenous, the argument of policy endogeneity of institutions has gained importance in the literature, in recent years.[44] Since the late nineties, various authors started addressing the possibility of reverse causality and endogeneity going from the unemployment rate to various labor market institutions. Daveri and Tabellini

[42] Baccaro and Rei (2005, p.43) employ in a similar regression this technique.

[43] As the change in the t-values do not alter the results of model B, estimation results are not reported here, but are available from the author.

[44] See Saint-Paul (1996) as one of the main proponents of this view or Lalive and Zweimuller (2003).

(1997, p.24) proposed that high unemployment rates are likely to affect unemployment benefits and labor taxes as governments may be forced to increase taxes in order to pay the benefit entitlements of the increased number of unemployed. The authors address the problem by using the lagged value of those right hand side variables as instruments, and argue that "if the residuals of the unemployment equation are uncorrelated over time, these are pretty good instruments" (Daveri and Tabellini 1997, p.25). Baker et al (2005, p.22) confirm this idea, and assert that this reverse causality might be the reason why many empirical works that do not account for endogeneity find a "significant relationship between higher benefits or tax rates and higher unemployment". In another paper the same authors go even further and state that "with a decline in employment [..], taxpayers could reasonably want to give unemployed workers additional time to search for the right job [through increased unemployment benefits], thereby improving the quality of the match between workers and jobs" (Baker et al 2006, p.32).

Checci and Nunziata (2004, pp.1-3), who agree that from a political economy approach all institutions should be considered endogenous, argue more cautious and state that "if institutions are coordinating devices [..] they cannot be taken as fully exogenous". However, the authors continue by asserting that "the common practice to take them as (weakly) exogenous has prima facie some reliability" (Checci and Nunziata 2004, p.1). In their estimation Checci and Nunziata (2004, p.7) find that, when instrumenting union density, the causal relationship runs in the opposite direction, which leads them to conclude that workers are more inclined to join a union if unemployment is high.

Baccaro and Rei (2005, p.42) go so far as to instrument in one estimation all institutional variables using their past values as instrument and in another specification additionally the macroeconomic variables. However, in the end the authors favor a fixed effect model in the first difference over the estimation employing instruments.

A very recent paper by Bassanini and Duval (2006) addresses the issue of endogeneity very thoroughly. The authors point at the potential risk of reverse causality, which may be reflected in the action the government takes as a response to high unemployment rates (Bassanini and Duval 2006, p.15). Basannini and Duval (2006, p.117) instrument of the institutional variables, which are also present in the estimation in this paper, the tax rate, the employment protection legislation, the union density and the benefit replacement rate using the lagged values as instruments. The degree of corporatism, which is build in a similar fashion as in this paper is not assumed to be endogenous.[45]

[45] Although the authors do not explicitly state why corporatism is considered exogenous, I follow the authors' approach due to the lack of an instrument for this dummy variable. Given that the variable is a dummy variable that takes the value one or zero, it is impossible to use the lagged value of the indicator as an instrument. The only explanation why corporatism may be considered exogenous, may lie in Checci and Nunziata's assertion (2004, p.1) that some institutions evolve at a slower pace than macroeconomic variables, which would restrict the argument of reverse causality to institutions that are likely to adjust faster, which is unlikely to be the case for the bargaining regime which tend to vary little over time compared to other labor market institutions.

Hence, there is reason to believe that high unemployment rates are likely to affect the shape of the labor market institutions. If this endogeneity proofs to be strong, not accounting for it is likely to lead to a bias in the estimation results. There is no generally agreed upon method to address this issue and given the lack of alternative, appropriate instruments, I make use of a two stage least squares instrumental variable estimation and follow the literature by employing the lagged values in the level as instruments for their current value (model B3) for all institutional (and interacted) variables, except for the wage bargaining dummy.[46] This approach bears two limitations. Firstly, the number of observations reduces due to the loss of the first period from potentially 120 to 100 observations. Secondly, if autocorrelation of order one is still detected when re-estimating the unemployment equation with the use of instrumental variables, the residuals are correlated over time which introduces another bias, making the lagged values inappropriate instruments.[47]

The estimation results, however, reveal that the adjusted Durbin-Watson does not detect anymore first order autocorrelation, which makes the use of the lagged values as instruments feasible (model B3). Also the Jarque-Bera test indicates the normality of the error terms. The overall fit of the model is with a R-squared of 0.72 still relatively good. Nevertheless, the Davidson-MacKinnon test of exogeneity does not reject the exogeneity of the independent variables, with a prob.-value of 0.3. This implies that either the instruments are weak instruments or endogeneity has only a limited effect on the estimates. When testing the appropriateness of the instruments, the Sargens test of overidentification cannot reject the suitability of the instruments, with a prob.-value of 0.38. As this is a rather low value, one should be cautious to conclude that endogeneity does not have a significant impact on the estimation results. Instead, when analyzing the potential sources of endogeneity seperately, the Davidson-MacKinnon test reveals that exogeneity is rejected at the 10 percent level for the tax rate, the unemployment benefits as well as the employment protection legislation, which therefore confirms the appropriateness of the use of instrumental variable technique at least for those three variables.[48] Nevertheless, the implications of the estimation results seem to be in line with the findings of the other models. In particular, the hump amounts to an unemployment rate which is 2.52% higher when compared to centralized bargainers and 2.28% when compared to decentralized systems and, it still requires more than a doubling of the openness indicator for the hump to disappear. Furthermore, also the effect of a change in the EPL is very similar to the one of model B and B1. The most remarkable difference to the ordinary least square estimation appears to be the magnitude of the coefficient on the tax rate, which increased to 1.92, proposing a much stronger impact of the tax wedge on unemployment when accounting

[46] See the former footnote for a comment on the wage setting dummy.

[47] Another way of addressing the problem of reverse causality is to estimate the equation by OLS, but regressing the past values of the potentially endogenous variables on the current value of the unemployment rate. The results of this estimation are reported in the Appendix VII, Table 2 (model B4) but are not discussed here as the main implications remain unchanged.

[48] The prob.-value for the joint test is 0.093.

for possible endogeneity.[49]

Besides the labor market variables, possible endogeneity may also stem from the output gap to the unemployment rate. Again, a good instrument is not readily available and the lagged value seems inappropriate as the correlation is quite low, which is likely to stem from the fact that I am considering five-year averages. However, as I am not interested in the coefficient for the output gap but simply make use of this variable as control variable, I re-estimate model B, leaving out the output gap in order to evaluate whether this affects the coefficients significantly, implying a possible bias stemming form the endogeneity of this variable.[50] Leaving out a variable that has explanatory power, however, is at the cost of another possible bias stemming from the omitted variable. Nevertheless, either of these biases seem to be limited as a regression without the output gap (model D3) gives nearly identical coefficient estimates and leaves the explanatory power of the model relatively unchanged.[51]

Another form of mis-specification may stem from the fact that when looking at the variables on a yearly basis a unit root can not be rejected for all variables, but the output gap.[52] All the variables are however stationary in the first difference. Therefore, in order to avoid any spurious regression problems the model is re-estimated using the difference of the variables, except for the output gap, which remains in the level.[53] This time the Hausman test does not detect any correlation between the error term and the regressors, and strongly accepts the null, such that the random effects model is preferred to the fixed effects estimation. The overall fit of the model is 0.5. The effect of the tax rate is somewhat lower now with a coefficient of 1.2. The unemployment benefits are again insignificant as is the union density. The Durbin-Watson suggests that the problem of first order correlation is overcome with the use of the differences.[54] When evaluating the coefficients, it becomes clear that the hump is less pronounced. For the average sample values, the hump amounts now only to 1.32 when comparing to the centralized case and 1.43 when comparing to the decentralized case. However, for the given coefficients, it requires still more than a doubling of the openness indicator for the hump to disappear. The results for

[49] This stronger impact is confirmed by model D3 and model B4, which both address the issue of reverse causality.

[50] On the use of the output gap see also other authors: Elmeskov et al (1998), who do not instrument the output gap, or Bassanini and Duval (2006), who do instrument the output gap.

[51] See Appendix VII for the estimation results. Table 1, Model D for the OLS estimation and Table, 2 model D3 for the 2SLS estimation without the output gap. The Davidson-MacKinnon test for model D3 revelas a prob.-value of 0.43 for all institutional variables, 0.19 for the tax rate, the EPL and the benefit entitlements and, 0.08 for the tax rate and the EPL. The Sargens test for overidentification takes a prob.-value of 0.91, which supports the conclusion drawn for model B3.

[52] A unit root test on the 5-year average observations does not promise to give any conlcusive results as 6 observations in time are to few for the test results to have any relevance. The results of the test on the yearly observations are not reported, but may be obtained from the author.

[53] The results are reported in Appendix VII, Table 2, model B2 when using imoprts as openness indicator and model C2 when using trade as openness indicator.

[54] The critical value is 1.73.

the EPL again follow the same pattern and, the exact magnitude is in between the results of the benchmark model and model B1.

Given that in all cases, the results do not change in their essence to the Baseline model, the latter estimation results seem to give a reasonable well indication of the effects at play. Nevertheless, one should keep in mind that the actual magnitude of the effects may be slightly different.

Robustness Test

In the following I perform two separate tests. Firstly, I ask whether the results do change fundamentally when excluding countries from the sample that are likely to bias the results and secondly, I re-estimate the two benchmark models excluding the 70s from the sample. The latter does clearly reduce the number of observations and decreases the power of the estimation. But on the other hand, the highly significant time dummies for the two periods in the 70s as well as a look at the development of unemployment rates across time suggests that the 70s are coined by lower unemployment rates across all countries, while the post-oil shock period is coined by a generally higher level of unemployment (an exception may be the US).

Three outliers in terms of extraordinary developments of the unemployment rates appear in the sample: Spain, Finland and Ireland. Spain experienced a drastic increase in her unemployment rate in the early 80s which persisted at a high level throughout the rest of the period of analysis. Additionally, Spain switched from a centralized system of bargaining to an intermediate level of bargaining in the late 80s. It is, therefore, likely that the inclusion of Spain tends to favor the hum-shaped hypothesis. Finland, with its centralized system, instead experienced a sharp increase in unemployment in the 90s, which has partly been attributed to the decline of the Soviet Union and Finland's subsequent loss in exports. Ireland on the other hand experienced an increase in unemployment during the 80s and the early 90s but recovered by the end of the sample period. Within this period Ireland switched for one sample period from a centralized system to a decentralized system. In the first test I drop Spain from the sample and re-estimate Benchmark Model B (Model B6). The Hausman test rejects the use of the random effects model. As expected the magnitude of the coefficients on the intermediate level of bargaining (i.e. the dummy and the Pressure Index) reduce. Nevertheless, the main conclusion remains unchanged, although at a less discriminatory level.

Dropping instead Finland and Ireland from the sample, leads not to the rejection of the random effects model at conventional levels of significance. I therefore proceed by interpreting the results of the random effects model. Again, when using the simple openness measure the model performs relatively poor (Model A5). Using instead the Pressure Index reveals a similar pattern as the Benchmark Model B, with the exception of the coefficient on the tax wedge which remained significant at the 10% level but halved its value (Model B5). The dummy for intermediate bargainers is highly significant and proposes a similar pattern for the hump as in Model B. The Pressure Index does again support the idea that intermediate bargainers tend to reduce unemployment by

more for a given level of the EPL Index when openness increases.

When excluding the 70s from the sample the results change to some extent. Applying the same specification as in Benchmark Model B, the Hausman test rejects again the use of the random effects model. The output gap, the tax wedge, employment protection and, the dummy for intermediate bargainers are all significant at the 1% level and have the expected sign (Model B7). The coefficient on the tax wedge increased somewhat and the differential effect of the Pressure Index becomes more pronounced. Furthermore, the adjusted Durbin-Watson statistic, with a value of 2.05, does now reject the existence of an AR(1) structure. Most interestingly the simple openness indicator becomes now significant (Model A7). This might be due to the tendency starting in the 80s of a general reduction in employment protection. The less restrictive the employment protection, the more likely is an economy to react to stronger foreign competition in terms of wage restraint, and thereby reducing the negative impact on unemployment. However, at the same time, the EPL Index becomes insignificant and the dummy on intermediate bargainers as well. Given the worsening of the fit, I however still reject the use of this model in favor of Model B5, which employs the Pressure Index.

The various regression results and tests seem to support the conclusions drawn from the initial specification in Benchmark Model B, which supports the theoretical framework laid out in chapter 3. Nevertheless, the variation in the magnitude of the coefficients when using alternative specifications of Model B, asks to treat the exact values of the coefficients given in Model B with caution. Given the various test results, the version of model B, that accounts for endogeneity (model B3) is likely to give the most robust coefficient estimates.

4.4 Comparing the Results to Former Studies[55]

Clearly, a direct comparison with the results in other authors' papers is not possible with respect to the Pressure Index or the inter-acted openness indicator. However, it is interesting to see whether the coefficients on the "traditional" labor market indicators are similar in magnitude to former studies to evaluate the robustness of these results.

One of the earlier papers that looked at the effects of institutions on unemployment is by Nickell (1997). Using a GLS random effects model with a time dummy, on a sample of 20 OECD countries, using 6-year averages for the period 1983-1994, Nickell regressed the log of the unemployment rate on Employment Protection, Benefit Replacement, and Duration, Active Labor Market Policies, Union Density, Union Coverage, Wage Coordination, the total tax rate as well as the change in inflation. Nickell finds a negative relationship between wage coordination and unemployment, but does not check for a possible hump-shaped relationship. Additionally, his measure of wage coordination differs from

[55] Although model B3 should be preferred as a basis of comparison, I compare in the following the results of baseline model B to former studies' results, because the studies mentioned here did not address the issue of endogeneity.

the measure of centralization employed in this paper. The signs for the other variables which also appear in Benchmark Model B of this paper are identical. Unfortunately, except for union density (which appears insignificant in this paper) the indices used by Nickell are different from the ones employed here and therefore do not allow a comparison of the magnitude of the effects. Furthermore, one may argue about the appropriateness of applying a set of nine explanatory variables plus a time dummy on a sample of only 40 observations.

Elmeskov et. al. (1998) conduct a panel estimation of yearly data from 1983-1995 on a sample of 19 OECD countries, using random effects. The estimation results reveal that except for union density and active labor market policy all other explanatory variables appear significant in the various specifications. More precisely, the coefficient of the tax wedge ranges from 1 to 1.4 which is roughly comparable with the estimates found in this paper. The negative impact of the output gap is with a coefficient between -0.46 and –0.62, clearly stronger than the –0.3 value in Benchmark Model B. This might be due to the fact that based on yearly observations the unemployment rate reacts stronger to the cycle, while this effect is somewhat "smoothened out" when taking 5-year averages. Contrary, to the results presented here, Elmeskov et. al. find a positive relationship between employment protection and unemployment. However, also here the results are not strictly comparable as this positive relationship is also present in this paper, although through the Pressure index and only for a certain discrete change in the employment protection legislation. Elmeskov et. al. do employ a measure of wage centralization which is comparable to the one employed in this paper. Essentially decentralized and centralized economies are treated in the same way as both are included in the dummy of centralized systems (See Elemeskov et al. 1998, p.216). Using dummies for centralized (plus decentralized) and intermediate systems, they find that ceteris paribus a country with centralized system tends to have an unemployment rate which is about 2% lower than in countries that exhibit an intermediate level of bargaining. This renders support to the Calmfors-Driffill argument. The magnitude is about 0.5 percentage point below the level found in Benchmark Model B, but comparable to the results found when allowing for an AR(1) structure, when using the average values for EPL and openness.

Nickell et. al. (2001) perform a panel estimation on a set of yearly observations for a set of 20 OECD countries over the period 1961-1995, including the lagged dependent variable and taking account for macroeconomic shocks as well as interactions between institutions. The coefficient on the tax rate is with 1.59 very close to the value in this study. For employment protection, Nickel et. al. find a weak positive relationship, suggesting that if the EPL Index decreases by one unit, unemployment decreases by 0.15 percentage points.[56] Wage coordination is modeled according to the corporatist idea.

Belot and Van Ours (2002) estimate a panel of 17 OECD countries over the

[56] This is approximately equivalent to the effect of an intermediate bargainer who reduces its EPL from 1.4 to 0.4 and exhibits a level of openness slightly above 20% in the context of the model present in this paper. These values could represent the effect on France's unemployment rate, if France would have reduced its EPL by one unit by the end of the sample period.

period 1960-1999 using 5-year averages. When including country fixed effects in their estimation, Belot and Van Ours find that a ten percentage point increase in the tax rate leads to an increase of the unemployment rate by 2.4 percentage points, a level well above the one in this study. A higher level of employment protection reduces unemployment slightly (again the indicators are not strictly comparable to the one employed in this analysis). Finally, Belot and Van Ours find that centralization is described by the corporatist idea rather than the hump-shape, which was tested for, but not found significant.

Other papers that focus rather on the interaction of shocks with macroeconomic variables like Blanchard and Wolfers (2000) and Bertola et. al. (2001) find the traditional labor market institutions tax wedge, employment protection, wage coordination and unemployment benefit duration to be significant. Both find a small positive effect of employment protection on the unemployment rate. A 10 percentage point increase in the tax rate reduces unemployment by roughly 1 percentage point, which is below the levels found in this paper. Again wage coordination is found to be of a corporatist nature, with the indices being not directly comparable to the one employed in this paper.

Concluding this comparison it may be stated that the empirical evidence on the tax wedge seems to be indicating a common direction, with this study being in the upper-middle range for the value of the coefficient. The controversy with respect to the hump-shape is reflected in the different results mentioned here. The comparison to other studies leads one to be cautious in taking the actual magnitude of the effect found in Benchmark Model B at face value. The differential findings with respect to sign and magnitude of the employment protection legislation in the literature may be reconciled to some extent by the findings in this paper, which proposes a non-linear relationship, but the existence of two opposing effects which are at work and may either be in favor of an overall positive or negative effect depending on openness to trade and the bargaining structure.

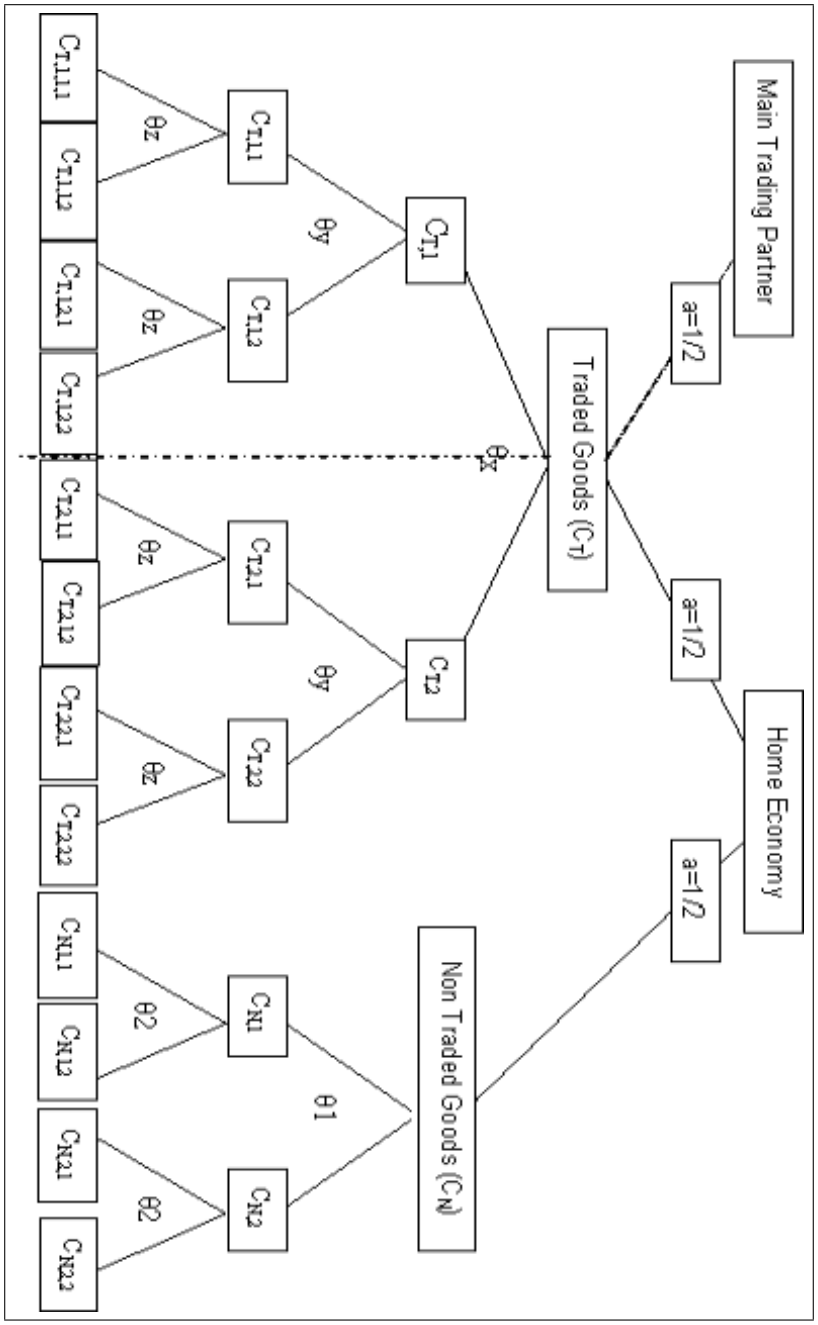
5 Conclusion

This paper investigated the relationship between labor markets, openness, and unemployment. A revised version of the Calmfors-Driffill argument in an open economy context with traded and non-traded good sector has been proposed. The implications of this theoretical set-up amount to a fusion of the Calmfors-Driffill argument in a closed economy and the open economy extension by Danthine and Hunt, as the hump-shape persists due to the existence of the sheltered non-traded good sector, but increased trade tends to reduce the hump in the sense that countries with intermediate levels of bargaining tend to reduce unemployment by more as a response to the increased foreign competition. In an empirical exercise this hypothesis has been tested. The evidence does render some support for the hypothesis, particularly in a broader context in which the employment protection legislation is taken into account. According to the esti-

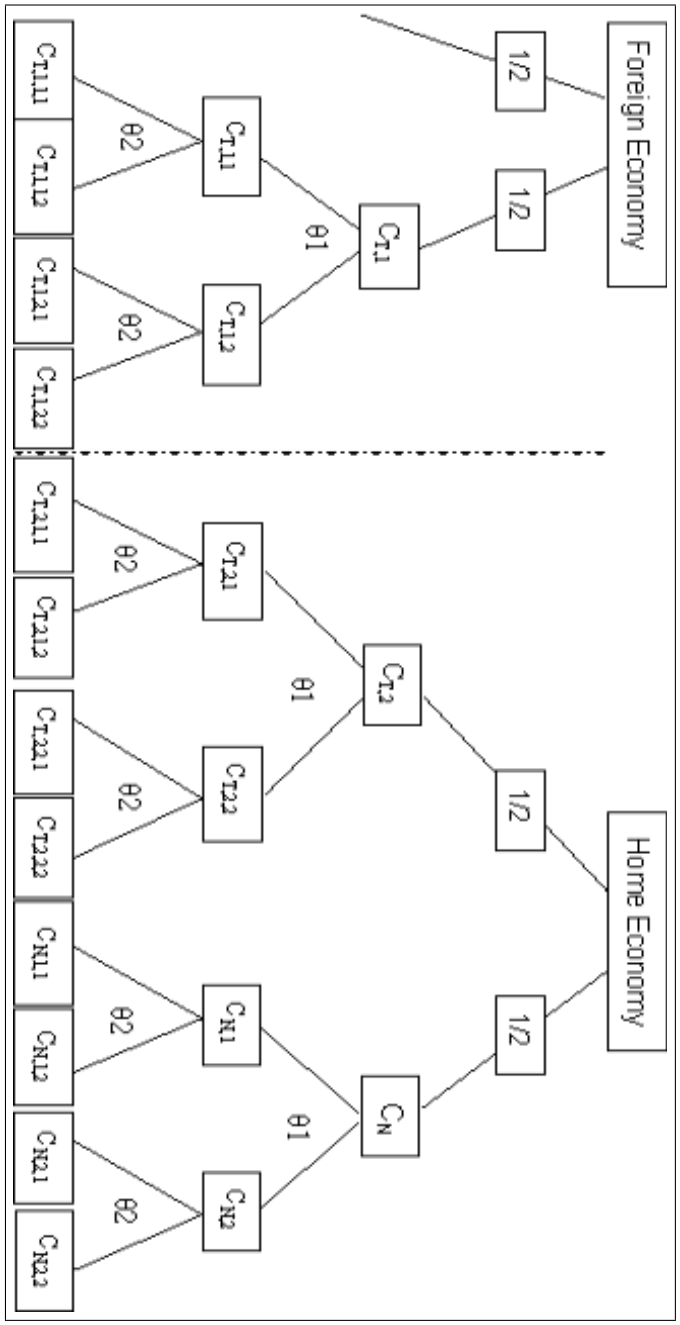
mation results, it requires an unlikely high increase in openness, for the hump to disappear, making the extremes, either centralized or decentralized wage setting systems, preferable to intermediate solutions. Furthermore, centralized and decentralized economies tend to loose less in terms of higher unemployment rates due to a strict employment protection legislation, compared to countries coined by intermediate levels of bargaining. The notion of the literature on product market regulation and labor market institutions is supported in the sense that economies which face stronger foreign competition in the product market are more likely to experience a reduction in unemployment levels when easening employment protection. The complementarity of the two policies is emphasized by the result that countries will benefit the most from increased trade in terms of lower unemployment rates, the lower the level of employment protection is. According to the estimates and assuming that openness will continue to increase, Belgium and the Netherlands seem to have embarked on the right policy by reducing there respective level of employment protection, while Italy still has a long way to go and France seems to be going in the wrong direction.

The implications of the empirical findings in this paper support the current line of research in labor economics in the sense that emphasis should be put on the interaction of different labor market structures as well as product market characteristics, instead of looking at the contribution of single labor market institutions to the overall performance in an economy. An additional aspect for possible future research might be to analyze to which extent different labor market structures tend to perform better under different macroeconomic constellations, as performed in this paper with respect to the degree of openness of an economy. Such an approach is likely to give more detailed policy implications of a "country-custom made nature" instead of a "one fits them all" approach.

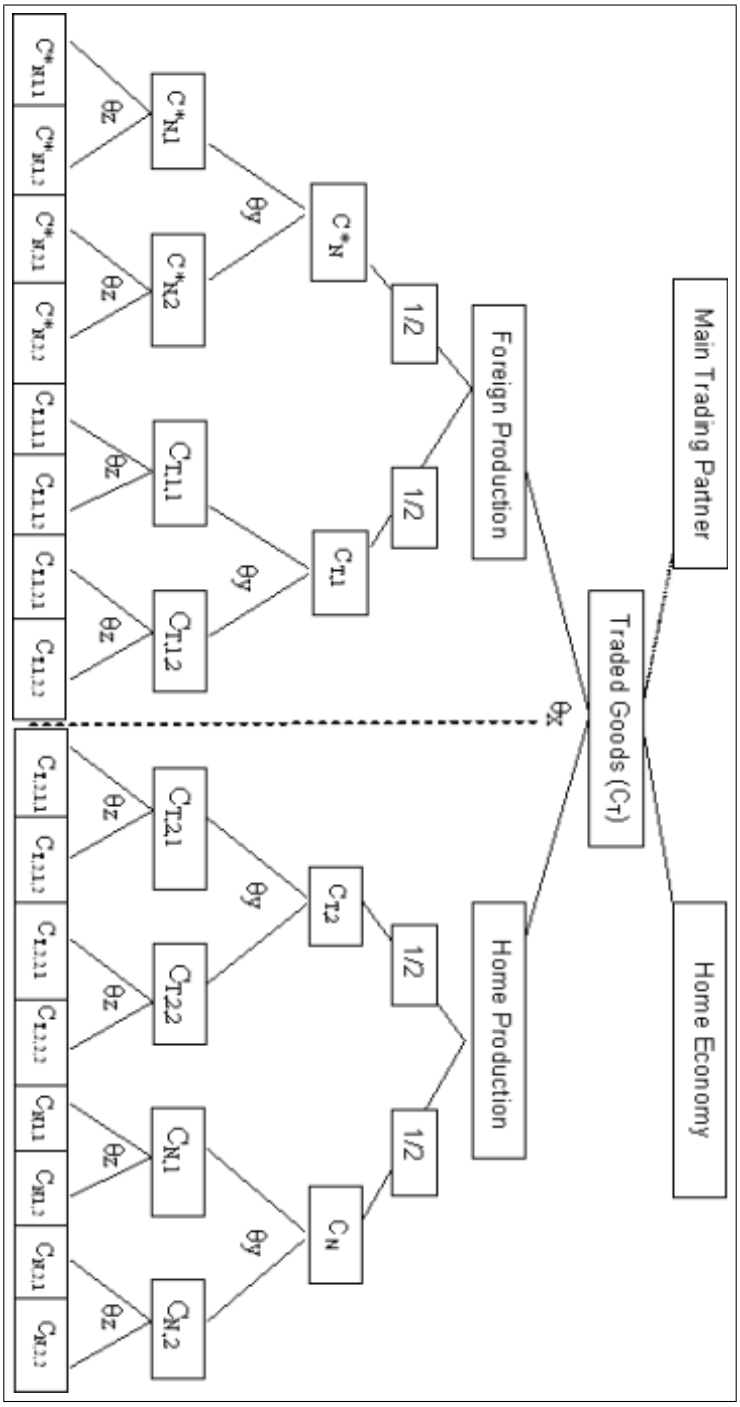
Appendix I: Consumption and Production a=1/2



Appendix II: Consumption and Production a=0



Appendix III: Consumption and Production under a=1



Appendix IV: Derivation of the Results

Production

The labor demand function is derived by solving the profit maximization problem of the firm with respect to labor: $\max \pi = y \cdot P_i. - wL - rK$. The first order condition reveals then the labor demand:

$$\frac{\partial \pi}{\partial L_i} = P_i \left(A + (1-A)L_i^{\rho}\right)^{\frac{1-\rho}{\rho}} (1-A)L_i^{\rho-1} - w = 0 \tag{A1}$$

$$\begin{aligned}
\left(A + (1-A)L_i^{\rho}\right)^{\frac{1-\rho}{\rho}} L_i^{\rho-1} &= \frac{w}{P_i(1-A)} \\
\left(A + (1-A)L_i^{\rho}\right) L_i^{-\rho} &= \left[\frac{w}{P_i(1-A)}\right]^{\frac{\rho}{1-\rho}} \\
AL_i^{-\rho} &= \left[\frac{w}{P_i(1-A)}\right]^{\frac{\rho}{1-\rho}} - (1-A) \\
L_i &= \left(\frac{1}{A}\left[\frac{w}{P_i(1-A)}\right]^{\frac{\rho}{1-\rho}} - \frac{(1-A)}{A}\right)^{-\frac{1}{\rho}}
\end{aligned} \tag{A2}$$

Using the labor demand function in the production function $y_i^{\rho} = AK^{\rho} + (1-A)L_i^{\rho}$ and recalling that $K = 1$ yields the inverse supply function:

$$\begin{aligned}
y_i^{\rho} &= A + (1-A)\left(\frac{1}{A}\left[\frac{w}{P_i(1-A)}\right]^{\frac{\rho}{1-\rho}} - \frac{(1-A)}{A}\right)^{-1} \\
y_i^{\rho}A^{-1} - 1 &= (1-A)\left(\left[\frac{w}{P_i(1-A)}\right]^{\frac{\rho}{1-\rho}} - (1-A)\right)^{-1} \\
y_i^{\rho}A^{-1} - 1 &= \left(\left(\frac{1}{(1-A)}\right)^{\frac{1}{1-\rho}}\left[\frac{w}{P_i}\right]^{\frac{\rho}{1-\rho}} - 1\right)^{-1} \\
\left(y_i^{\rho}A^{-1} - 1\right)^{-1} &= \left(\frac{1}{(1-A)}\right)^{\frac{1}{1-\rho}}\left[\frac{w}{P_i}\right]^{\frac{\rho}{1-\rho}} - 1 \\
\left[\frac{w}{P_i}\right]^{\frac{\rho}{1-\rho}} &= \left(1 + \left(y_i^{\rho}A^{-1} - 1\right)^{-1}\right)(1-A)^{\frac{1}{1-\rho}} \\
\left[\frac{w}{P_i}\right]^{\frac{\rho}{1-\rho}} &= \frac{y_i^{\rho}A^{-1}}{y_i^{\rho}A^{-1} - 1}(1-A)^{\frac{1}{1-\rho}} \\
P_i^{\frac{\rho}{1-\rho}} &= \frac{y_i^{\rho}A^{-1} - 1}{y_i^{\rho}A^{-1}}(1-A)^{-\frac{1}{1-\rho}} w^{\frac{\rho}{1-\rho}} \\
P_i &= (1-A)^{-\frac{1}{\rho}} w_i \left(1 - y_i^{-\rho}A\right)^{\frac{1-\rho}{\rho}}
\end{aligned} \tag{A3}$$

Consumption

The maximization of the utility yields the division of income between the two consumption baskets. The budget constraint may be rewritten using the baskets and their respective price indices, according to:

$$I = \sum_{i=1}^{n} P_{T,i,j,k} Y_{T,i} + \sum_{i=1}^{m} P_{N,i,j} Y_{NTG,i} = C_T P_T + C_N P_N \tag{A4}$$

The utility is then maximized according to: $\max U = C_T^a C_N^{1-a} + h(W_R)$ s.t. $I = C_T P_T + C_N P_N$. The first order conditions are given by:

$$\begin{aligned}
\frac{\partial U}{\partial C_T} &= 0 = P_T + a\lambda C_T^{a-1} C_N^{1-a} && \text{(A5)} \\
\frac{\partial U}{\partial C_N} &= 0 = P_N + (1-a)\lambda C_T^{a} C_N^{-a} && \text{(A6)} \\
\frac{\partial U}{\partial \lambda} &= 0 = I - C_T P_T - C_N P_N && \text{(A7)}
\end{aligned}$$

Using (A5) and (A6) in (A7) yields:

$$\begin{aligned}
C_N &= (1-a)\frac{I}{P_N} && \text{(A8)} \\
C_T &= a\frac{I}{P_T} && \text{(A9)}
\end{aligned}$$

Using (A8) and (A9) in the upper tier consumption basket yields the perfect price index for the highest level of aggregation (CPI):

$$\begin{aligned}
C &= C_T^a C_N^{1-a} \\
C &= \left(a\frac{I}{P_T}\right)^a \left((1-a)\frac{I}{P_N}\right)^{1-a} \\
C &= I^a I^{1-a} \left(\frac{a}{P_T}\right)^a \left(\frac{(1-a)}{P_N}\right)^{1-a} \\
\frac{C}{I} &= \left(\frac{a}{P_T}\right)^a \left(\frac{(1-a)}{P_N}\right)^{1-a} && \text{(A10)}
\end{aligned}$$

As aggregate income is equal to the value of aggregate production and consumption in equilibrium, it follows that: $CP = I$. Therefore, (A10) can be rewritten as the CPI:

$$P = \frac{P_T^a \cdot P_N^{1-a}}{a^a(1-a)^{1-a}} \tag{A11}$$

The demand for the next basket is derived by minimizing the expenditures for a target basket: $\min L = C_{N,1}P_{N,1} + C_{N,2}P_{N,2} - \lambda(C_N - \bar{C}_N)$, where the basket is defined over the two sub-baskets:[57]

$$C_N = \left(C_{N,1}^{\frac{\theta_1-1}{\theta_1}} + C_{N,2}^{\frac{\theta_1-1}{\theta_1}} \right)^{\frac{\theta_1}{\theta_1-1}} \tag{A12}$$

The first order conditions result in:

$$\begin{aligned}
\frac{\partial L}{\partial C_{N,1}} &= 0 = P_{N,1} - \lambda \left(C_{N,1}^{\frac{\theta_1-1}{\theta_1}} + C_{N,2}^{\frac{\theta_1-1}{\theta_1}} \right)^{\frac{1}{\theta_1-1}} C_{N,1}^{-\frac{1}{\theta_1}} \\
P_{N,1} &= \lambda C_N^{\frac{1}{\theta_1}} C_{N,1}^{-\frac{1}{\theta_1}} \qquad \text{(A13)} \\
\frac{\partial L}{\partial C_{N,2}} &= 0 = P_{N,2} - \lambda \left(C_{N,1}^{\frac{\theta_1-1}{\theta_1}} + C_{N,2}^{\frac{\theta_1-1}{\theta_1}} \right)^{\frac{1}{\theta_1-1}} C_{N,2}^{-\frac{1}{\theta_1}} \\
P_{N,2} &= \lambda C_N^{\frac{1}{\theta_1}} C_{N,2}^{-\frac{1}{\theta_1}} \qquad \text{(A14)}
\end{aligned}$$

Multiplying both sides of (A13) with $C_{N,1}$and both sides of (A14) with $C_{N,2}$ and then adding both equations yields:

$$\begin{aligned}
C_{N,1}P_{N,1} + C_{N,2}P_{N,2} &= P_N C_N = \lambda C_N^{\frac{1}{\theta_1}} \left(C_{N,1}^{\frac{\theta_1-1}{\theta_1}} + C_{N,2}^{\frac{\theta_1-1}{\theta_1}} \right) \\
P_N C_N &= \lambda C_N^{\frac{1}{\theta_1}} C_N^{\frac{\theta_1-1}{\theta_1}} = \lambda C_N \\
P_N &= \lambda \qquad \text{(A15)}
\end{aligned}$$

Using (A15) and (A8) in (A13) yields the demand for the sub-basket $C_{N,1}$:

$$\begin{aligned}
P_{N,1} &= P_N C_N^{\frac{1}{\theta_1}} C_{N,1}^{-\frac{1}{\theta_1}} \\
C_{N,1} &= \left(\frac{P_{N,1}}{P_N} \right)^{-\theta_1} C_N \\
C_{N,1} &= \left(\frac{P_{N,1}}{P_N} \right)^{-\theta_1} \frac{(1-a)I}{P_N} \qquad \text{(A16)}
\end{aligned}$$

[57] The derivations presented here are only performed for the non traded good sector. The analysis for the traded good sector is analagous and can be easily performed following the same steps. Note also that the assumption of symmetric countries allows to perform the analysis by looking only at the demand from the home country.

Similarly, the demand for the sub-basket $C_{N,2}$ can be derived:

$$C_{N,2} = \left(\frac{P_{N,2}}{P_N}\right)^{-\theta_1} \frac{(1-a)I}{P_N} \tag{A17}$$

Again, the perfect price index for this level of aggregation can be derived by using (A16) and (A17) in (A12):

$$\begin{aligned}
C_N &= \left[\left(\left(\frac{P_{N,1}}{P_N}\right)^{-\theta_1} C_N\right)^{\frac{\theta_1-1}{\theta_1}} + \left(\left(\frac{P_{N,2}}{P_N}\right)^{-\theta_1} C_N\right)^{\frac{\theta_1-1}{\theta_1}}\right]^{\frac{\theta_1}{\theta_1-1}} \\
C_N &= C_N \left[\left(\left(\frac{P_{N,1}}{P_N}\right)^{-\theta_1}\right)^{\frac{\theta_1-1}{\theta_1}} + \left(\left(\frac{P_{N,2}}{P_N}\right)^{-\theta_1}\right)^{\frac{\theta_1-1}{\theta_1}}\right] \\
1 &= P_N^{\theta_1-1}\left(P_{N,1}^{1-\theta_1} + P_{N,2}^{1-\theta_1}\right) \\
P_N &= \left(P_{N,1}^{1-\theta_1} + P_{N,2}^{1-\theta_1}\right)^{\frac{1}{1-\theta_1}}
\end{aligned} \tag{A18}$$

The analysis at the next level, which is the demand for the single non traded variety, proceeds in the same way. The consumption basket is now given by:

$$C_{N,i} = \left(C_{N,i,1}^{\frac{\theta_2-1}{\theta_2}} + C_{N,i,2}^{\frac{\theta_2-1}{\theta_2}}\right)^{\frac{\theta_1}{\theta_2-1}} \quad \text{for i=1,2} \tag{A19}$$

The minimization problem is given by: $\min L = C_{N,i,1}P_{N,i,1} + C_{N,i,2}P_{N,i,2} - \lambda(C_{N,i} - \bar{C}_{N,i})$. The first order conditions yield:

$$\begin{aligned}
\frac{\partial L}{\partial C_{N,i,1}} &= 0 = P_{N,i,1} - \lambda\left(C_{N,i,1}^{\frac{\theta_2-1}{\theta_2}} + C_{N,i,2}^{\frac{\theta_2-1}{\theta_2}}\right)^{\frac{1}{\theta_2-1}} C_{N,i,1}^{-\frac{1}{\theta_2}} \\
P_{N,i,1} &= \lambda C_{N,i}^{\frac{1}{\theta_2}} C_{N,i,1}^{-\frac{1}{\theta_2}}
\end{aligned} \tag{A20}$$

$$\begin{aligned}
\frac{\partial L}{\partial C_{N,i,2}} &= 0 = P_{N,i,2} - \lambda\left(C_{N,1}^{\frac{\theta_2-1}{\theta_2}} + C_{N,2}^{\frac{\theta_2-1}{\theta_2}}\right)^{\frac{1}{\theta_2-1}} C_{N,i,2}^{-\frac{1}{\theta_2}} \\
P_{N,i,2} &= \lambda C_{N,i}^{\frac{1}{\theta_2}} C_{N,i,2}^{-\frac{1}{\theta_2}}
\end{aligned} \tag{A21}$$

Multiplying (A20) with $C_{N,i,1}$ and (A21) with $C_{N,i,2}$ and then summing the two equation yields:

$$\begin{aligned}
C_{N,i,1}P_{N,1} + C_{N,i,2}P_{N,2} &= P_{N,i}C_{N,i} = \lambda C_{N,i}^{\frac{1}{\theta_2}}\left(C_{N,i,1}^{\frac{\theta_2-1}{\theta_2}} + C_{N,i,2}^{\frac{\theta_2-1}{\theta_2}}\right) \\
P_{N,i}C_{N,i} &= \lambda C_{N,i}^{\frac{1}{\theta_2}} C_{N,i}^{\frac{\theta_2-1}{\theta_2}} = \lambda C_{N,i} \\
P_{N,i} &= \lambda
\end{aligned} \tag{A22}$$

Using (A22) in (A20) and in (A21) yields the demand for the single non traded good varieties:

$$\begin{aligned} P_{N,i,j} &= P_{N,i} C_{N,i}^{\frac{1}{\theta_2}} C_{N,i,j}^{-\frac{1}{\theta_2}} \\ C_{N,i,j} &= \left(\frac{P_{N,i,j}}{P_{N,i}}\right)^{-\theta_2} C_{N,i} \\ C_{N,i,j} &= \left(\frac{P_{N,i,j}}{P_{N,i}}\right)^{-\theta_2} \left(\frac{P_{N,i}}{P_N}\right)^{-\theta_1} \frac{(1-a)I}{P_N} \text{ for i and j=1,2} \end{aligned} \quad \text{(A23)}$$

Again the perfect price index can be derived, substituting (A23) in (A19):

$$\begin{aligned} C_{N,i} &= \left[\left(\left(\frac{P_{N,i,1}}{P_{N,i}}\right)^{-\theta_2} C_{N,i}\right)^{\frac{\theta_2-1}{\theta_2}} + \left(\left(\frac{P_{N,i,2}}{P_{N,i}}\right)^{-\theta_2} C_{N,i}\right)^{\frac{\theta_2-1}{\theta_2}}\right]^{\frac{\theta_2}{\theta_2-1}} \\ C_{N,i} &= C_{N,i}\left[\left(\left(\frac{P_{N,i,1}}{P_{N,i}}\right)^{-\theta_2}\right)^{\frac{\theta_2-1}{\theta_2}} + \left(\left(\frac{P_{N,i,2}}{P_{N,i}}\right)^{-\theta_2}\right)^{\frac{\theta_2-1}{\theta_2}}\right] \\ 1 &= P_{N,i}^{\theta_2-1}\left(P_{N,i,1}^{1-\theta_2} + P_{N,i,2}^{1-\theta_2}\right) \\ P_N &= \left(P_{N,i,1}^{1-\theta_2} + P_{N,i,2}^{1-\theta_2}\right)^{\frac{1}{1-\theta_2}} \text{ for i=1,2} \end{aligned} \quad \text{(A24)}$$

Equality of demands

The framework which is presented in this paper builds on two essential parameters, (a) which is the share of consumption being spent on traded goods and θ_X the elasticity of substitution between traded goods from home and abroad. As long as $\theta_X > \theta_1$ and $\theta_1 \leq \theta_Y < \theta_2 \leq \theta_Z$ substitution in the traded good sector will be stronger than in the non traded good sector and therefore hold prices in the traded good sector below the levels in the non traded good sector when wages are determined in the two sectors separately.

In the extension of the baseline model it was argued that the demand for the traded good variety in the case of a=1/2 is identical to the demand for a traded variety in the case of a=1 and that the demand for the non traded variety is identical under a=1/2 and a=0. This is due to the fact that firms relocate between traded good sector and non traded good sector according to a. The proof of the equality of demands is performed in the following way:[58]

The demand for a non traded variety has already been derived in (A23). As we know that there will be balanced trade, and that in equilibrium $C_N = Y_N$ it must be true form the utility maximization and the budget constraint that the non traded good sector "finances itself" and $P_N Y_N = P_N C_N = (1-a)I$. The same logic applies for the traded good sector, which therefore implies that

[58] The reader may refer to Appendix I-III for consumption and production structure under the three different scenarios.

$P_T Y_T = P_T C_T = aI$. Hence, the demand (A23) may be rewritten for a=1/2 according to:

$$\begin{aligned} C_{N,i,j} &= \left(\frac{P_{N,i,j}}{P_{N,i}}\right)^{-\theta_2}\left(\frac{P_{N,i}}{P_N}\right)^{-\theta_1}\frac{(1-a)I}{P_N} \\ C_{N,i,j} &= \left(\frac{P_{N,i,j}}{P_{N,i}}\right)^{-\theta_2}\left(\frac{P_{N,i}}{P_N}\right)^{-\theta_1}\frac{P_N C_N}{P_N} \\ C_{N,i,j} &= \left(\frac{P_{N,i,j}}{P_{N,i}}\right)^{-\theta_2}\left(\frac{P_{N,i}}{P_N}\right)^{-\theta_1} C_N \end{aligned} \tag{A25}$$

In the same spirit, the demand for the traded variety can be rewritten according to:

$$\begin{aligned} C_{T,i,j,k} &= \left(\frac{P_{T,i,j,k}}{P_{T,i,j}}\right)^{-\theta_Z}\left(\frac{P_{T,i,j}}{P_{T,i}}\right)^{-\theta_Y}\left(\frac{P_{T,i,}}{P_T}\right)^{-\theta_X}\frac{aI}{P_T} \\ C_{T,i,j,k} &= \left(\frac{P_{T,i,j,k}}{P_{T,i,j}}\right)^{-\theta_Z}\left(\frac{P_{T,i,j}}{P_{T,i}}\right)^{-\theta_Y}\left(\frac{P_{T,i,}}{P_T}\right)^{-\theta_X}\frac{P_T C_T}{P_T} \\ C_{T,i,j,k} &= \left(\frac{P_{T,i,j,k}}{P_{T,i,j}}\right)^{-\theta_Z}\left(\frac{P_{T,i,j}}{P_{T,i}}\right)^{-\theta_Y}\left(\frac{P_{T,i,}}{P_T}\right)^{-\theta_X} C_T \end{aligned} \tag{A26}$$

a=0

When $a = 0$, we can derive the demand for a single variety following the same steps as laid out before, where the utility is now defined over $U = T_2^{0.5} C_N^{0.5}$. Utility maximization will result in the constant shares being spent on the two sub-baskets, according to: $\max U = C_{T,2}^{0.5} C_N^{0.5} + h(W_R)$ s.t. $I = P_N C_N + P_{T,2} C_{T,2}$

$$C_N = \frac{1}{2}\frac{I}{P_N} \tag{A27}$$

$$C_{T,2} = \frac{1}{2}\frac{I}{P_{T,2}} \tag{A28}$$

Performing again the same steps as before, we arrive at the final demand for the non traded good variety which may be written as:

$$C_{N,i,j} = \left(\frac{P_{N,i,j}}{P_{N,i}}\right)^{-\theta_2}\left(\frac{P_{N,i}}{P_N}\right)^{-\theta_1}\frac{1}{2}\frac{I}{P_N} \tag{A29}$$

As the elasticities of substitution applying to $C_{T,2}$ are identical to the ones applying to C_N and the number of varieties (firms) are identical (i.e. four in each branch), the demand for each variety under a=0 will be identical. That this demand is equal to the demand under a=1/2 for the non traded good variety

can be seen via the fact that under a=0 $I = P_N C_N + P_{T,2} T_2$ and due to the symmetric structure $P_N C_N = P_{T,2} T_2$, which implies that: $I/2 = P_N C_N$ and allows to rewrite (A29):

$$C_{N,i,j} = \left(\frac{P_{N,i,j}}{P_{N,i}} \right)^{-\theta_2} \left(\frac{P_{N,i}}{P_N} \right)^{-\theta_1} C_N \tag{A30}$$

Given that the number of firms under a=0 and a=1/2 are identical for the basket C_N, it must be the case that (A30) is equal to (A25), i.e. the demand for each single non traded variety under a=0 and a=1/2 is identical.[59] Therefore, the wage settlement for the whole economy under a=0 will be identical to the wage settlement under a=1/2 in the non traded good sector.

a=1

Under a=1 the expenditure minimization amounts to: $\min L = P_H C_H + P_F C_F$ s.t. $C - \bar{C}$ where all goods are now traded. The consumption basket is defined according to:

$$C_T = \left(C_H^{\frac{\theta_X - 1}{\theta_X}} + C_F^{\frac{\theta_X - 1}{\theta_X}} \right)^{\frac{\theta_X}{\theta_X - 1}} \tag{A31}$$

, where C_F refers to the consumption of foreign produced goods and C_H to the consumption of domestically produced goods.

The first order conditions are given by:

$$\begin{aligned} \frac{\partial L}{\partial C_H} &= 0 = P_H - \lambda \left(C_H^{\frac{\theta_x - 1}{\theta_x}} + C_F^{\frac{\theta_x - 1}{\theta_x}} \right)^{\frac{1}{\theta_x - 1}} C_H^{-\frac{1}{\theta_x}} \\ P_H &= \lambda C_T^{\frac{1}{\theta_x}} C_H^{-\frac{1}{\theta_x}} \qquad \text{(A32)} \\ \frac{\partial L}{\partial C_F} &= 0 = P_F - \lambda \left(C_H^{\frac{\theta_x - 1}{\theta_x}} + C_F^{\frac{\theta_x - 1}{\theta_x}} \right)^{\frac{1}{\theta_x - 1}} C_F^{-\frac{1}{\theta_X}} \\ P_F &= \lambda C_T^{\frac{1}{\theta_x}} C_F^{-\frac{1}{\theta_X}} \qquad \text{(A33)} \end{aligned}$$

Multiplying (A32) with C_H and (A33) with C_F and summing over both yields:

$$\begin{aligned} C_H P_H + C_F P_F &= P_T C_T = \lambda C_T^{\frac{1}{\theta_x}} \left(C_H^{\frac{\theta_x - 1}{\theta_x}} + C_F^{\frac{\theta_x - 1}{\theta_X}} \right) \\ P_T &= \lambda \qquad \text{(A34)} \end{aligned}$$

Using (A34) in (A32) gives the demand for the home basket:

[59] Due to the symmetric structure it must then also be true that the demand for the varieties in the basket $C_{T,2}$ is identical to the demands in the basket of C_N.

$$
\begin{aligned}
P_H &= P_T C_T^{\frac{1}{\theta_x}} C_H^{-\frac{1}{\theta_x}} \\
C_H &= \left(\frac{P_H}{P_T}\right)^{-\theta_X} C
\end{aligned} \tag{A35}
$$

Each sub-basket of C_H will receive half of the demand according to the constant expenditure division, such that:

$$
C_{T,2} = \frac{1}{2}\left(\frac{P_H}{P_T}\right)^{-\theta_X} C \tag{A36}
$$

$$
C_N = \frac{1}{2}\left(\frac{P_H}{P_T}\right)^{-\theta_X} C \tag{A37}
$$

Expenditure minimization at the next level of aggregation than proceeds according to $\min L = P_{T,2,1}C_{T,2,1} + P_{T,2,2}C_{T,2,2}$ s.t. $C_{T,2} - \bar{C}$, where the consumption basket is defined over:

$$
C_{T,2} = \left(C_{T,2,1}^{\frac{\theta_Y - 1}{\theta_Y}} + C_{T,2,2}^{\frac{\theta_Y - 1}{\theta_Y}}\right)^{\frac{\theta_Y}{\theta_Y - 1}} \tag{A38}
$$

Following the by now well known procedure, by taking the derivatives with respect to $C_{T,2,1}$ and $C_{T,2,2}$, solving for $P_{T,2,1}$ and $P_{T,2,2}$ and, multiplying by $C_{T,2,1}$ and $C_{T,2,2}$, respectively and, then summing the two equations yields:

$$
P_{T,2} = \lambda \tag{A39}
$$

Using this result in the respective first order conditions yields the demand for the two sub-baskets:

$$
C_{T,2,1} = \left(\frac{P_{T,2,1}}{P_{T,2}}\right)^{-\theta_Y} C_{T,2} = \frac{1}{2}\left(\frac{P_{T,2,1}}{P_{T,2}}\right)^{-\theta_Y}\left(\frac{P_H}{P_T}\right)^{-\theta_X} C \tag{A40}
$$

$$
C_{T,2,2} = \left(\frac{P_{T,2,2}}{P_{T,2}}\right)^{-\theta_Y} C_{T,2} = \frac{1}{2}\left(\frac{P_{T,2,2}}{P_{T,2}}\right)^{-\theta_Y}\left(\frac{P_H}{P_T}\right)^{-\theta_X} C \tag{A41}
$$

At the most disaggregated level of aggregation the expenditure minimization follows: $\min L = P_{T,2,j,1}C_{T,2,j,1} + P_{T,2,j,2}C_{T,2,j,2}$ s.t. $C_{T,2,j} - \bar{C}$,where the consumption basket is now defined over:

$$
C_{T,2,j} = \left(C_{T,2,j,1}^{\frac{\theta_Z - 1}{\theta_Z}} + C_{T,2,j,2}^{\frac{\theta_Z - 1}{\theta_Z}}\right)^{\frac{\theta_Z}{\theta_Z - 1}} \text{, for j=1,2} \tag{A42}
$$

Following again the steps as described above yields the demand for the single traded variety:

$$C_{T,2,j,k} = \left(\frac{P_{T,2,j,k}}{P_{T,2,j}}\right)^{-\theta_Z} C_{T,2,j}$$

$$= \frac{1}{2}\left(\frac{P_{T,2,j,k}}{P_{T,2,j}}\right)^{-\theta_Z}\left(\frac{P_{T,2,j}}{P_{T,2}}\right)^{-\theta_Y}\left(\frac{P_H}{P_T}\right)^{-\theta_X} C \text{ for j,k=1,2} \quad \text{(A43)}$$

Given that one half of the demand for home traded goods goes to the sub-basket C_N and the other half to $C_{T,2}$ and both sub-baskets are exactly identical (with respect to firm size and elasticities of substitution) the price index for home traded goods will be identical to:

$$P_H = \frac{1}{2}P_{T,2} + \frac{1}{2}P_N = \frac{1}{2}P_{T,2} + \frac{1}{2}P_{T,2} = P_{T,2} \quad \text{(A44)}$$

Substituting (A44) in (A43) yields the demand for a representative traded variety under a=1:

$$C_{T,2,j,k} = \left(\frac{P_{T,2,j,k}}{P_{T,2,j}}\right)^{-\theta_Z}\left(\frac{P_{T,2,j}}{P_{T,2}}\right)^{-\theta_Y}\left(\frac{P_{T,2}}{P_T}\right)^{-\theta_X}\frac{C}{2} \quad \text{(A45)}$$

This is identical to the demand for a single traded variety under a=1/2, which can be seen by comparing (A45) to (A26) and realizing that $C/2$ in the case of a=1 is equal to C_T in the case of a=1/2, where the traded good sector consists of half the amount of firms compared to a=1, while the elasticities of substitution in both cases are identical. Therefore, under a=1 the wage settlement, will be identical to the one in the traded good sector under a=1/2 in the baseline model with the wage difference between traded and non traded good sector.

Appendix V: Data Overview

The data set contains average values over the period 1970-2000. Except for the last period (95-00) averages are over a five year interval. The countries in the sample are the following 20 OECD countries:

Australia	Denmark	Ireland	New Zealand	Sweden
Austria	Finland	Italy	Norway	Switzerland
Belgium	France	Japan	Portugal	United Kingdom
Canada	Germany	Netherlands	Spain	United States

The time horizon are the following averages: 1970-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994, and 1995-2000

Macroeconomic variables:

Unemployment rate (ur)

In order to make the study comparable to other papers, I used the unemployment rate as a five year average over the data provided by Nickel et al.

(2001 and 2003) which is based on the OECD harmonized unemployment rate. The values for Italy are the exception. It is based on the US Bureau of Labor Statistics "correction to the OECD standardized rates" (See Nickel 2003, for a more detailed description). To avoid the break due to the German reunion, the German unemployment rate refers to West Germany.

Trade Openness (lagimp)

The proxy for trade openness used in the regressions is the five year average of the average of the imports in percent of GDP over the period t, t-1 and t-2. The data is taken from the World Bank Development Indicators. Alternatively, trade in percent of GDP was used. The measure was computed in the same manner as imports in percent of GDP and is also taken form the World Bank Development Indicators.

The Output Gap (outputgap)

The output gap is computed by applying a Hodrick-Prescott filter over a set of yearly observations of constant GDP taken from the World Bank Development Indicators (base year 2000) and then computing the percentage deviation of the actual output from its trend. In order to avoid imprecise values for the beginning and the end of the period a longer horizon was taken to compute the filter (where available the period 1962 to 2004). Then the values for the 6 respective periods where averaged.

Labor Market Variables:

Wage bargaining system (corp: hcorp, mcorp, lcorp)

The general discussion about which index to use in order to reflect the wage setting system of an economy appropriately, builds primarily on two concepts: wage centralization and wage coordination. While "wage centralization" refers to the level at which wages are bargained, "wage coordination" is a behavioural concept and refers to the "degree of harmony in the wage-setting process" (Kenworthy 2001, p.59 and p.75). Kenworthy (2001) notes that:

> "[..] a structural measure should be preferred in such analyses because structure is causally prior to behavior. [However,] using a structural measure to predict macroeconomic performance presumes [..] that the centralization of wage-bargaining arrangements determines wage-setting behavior, which in turn determines wage changes, which in turn determines macroeconomic outcomes. In other words, two links in the causal chain are assumed. Using a behavioral measure of centralization has the advantage of closing one gap in the hypothesized causal sequence. There seems no compelling a priori reason to favor either a measure based on wage-bargaining structures or one based on wage-bargaining behavior. It depends on the researcher's theoretical interest." (Kenworthy 2001, p.72)

Kenworthy (2001, p.7) continues by proposing an alternative index, using scores based on a set of expectations "about which institutional features of

wage setting arrangements are likely to generate more or less coordination." He creates along these lines an index which idea is similar in structure to the index used here, in the sense that he constructs an index ranging form 1 (decentralized) to 5 (centralized), where he considers countries more centralized/coordinated, if they exhibit besides industry-level bargaining a certain degree of coordination, bargaining by peak associations, regularized pattern setting or bargaining by a powerful, monopolistic union confederation (Kenworthy 2001, p.79).

The original index used by Calmfors-Driffill drew instead on two separate indices and summed their scores. The first index referred to within union cooperation and within employer organization cooperation and was increasing with stonger cooperation from 1 to 3. The second index was decreasing from 3 to 1 with increasing numbers of unions and employer organizations (e.g. 3 if bargaining takes place between only one union and one employer organization, hence at the national level (Calmfors and Driffill 1988, Annex A)).

Soskice (1990) criticized in his article the approach taken by Calmfors and Driffill and proposes to put more emphasis on the coordination across the country (Soskice 1990, p.41). According to him the degree of coordination in the wage setting process greatly influences wage outcomes, and bargaining centralization is only one mean, albeit an important one, to achieve such coordination. Hence, according to Soskice countries like Switzerland are supposed to be classified as centralized/ co-ordinated instead of treating them as a country on the lower end of the intermediate bargainers. He notes that using the centralization measure is unlikely to be wrong when a country is classified as centralized, as those countries tend to exhibit also a high degree of coordination. However, at lower levels of centralization, coordination may be low or high, asking for a different classification than one solely based on the centralization index (Soskice 1990, p.41). Also Germany, which exhibits a formal wage setting at the industry level should according to Soskice be regarded as centralized given the high coordination on the employer side and the general fashion in which one industry is leading in setting the wage which will be roughly imitated by the other industries (Soskice 1990, p.44). Disagreement with Soskice and the ordering used here relate to the Netherlands and Japan. While, Soskice would upgrade the Netherlands as well due to stronger cooperation, the case of Japan is less important as it would move only from decentralized to centralized, both of which are assumed to generate similar outcomes with respect to wage settlements, according to the theoretical part. Nevertheless, when comparing the ranking of Soskice to the classification established in this paper for the period of the late 80s, one can see that with the exception of Japan, the ranking is consistent in the sense that the lower end of Soskice's ranking for the degree of actual coordination (of only 11 countries) is made up by the USA (0), the UK (0) here classified as decentralized, the middle ground by France (1.5), Italy (2) and the Netherlands (3) here classified as industry bargainers, and the upper part by Germany (3.5), Sweden (4), Norway (4), Switzerland (4), Austria (5) and Japan (5), with the exception of Japan all classified as centralized in this paper (See Soskice 1990, p.55).

Also Halll and Franzese (1998, p.510) notice that if "wage negotiation occurs

among trade unions and employer organizations that are highly concentrated at the sectoral level but equipped with sufficient economy-wide linkages to transmit across the economy the settlement reached in a leading sector", one would have to treat them as more centralized than a less coordinated economy with wage setting at the sectoral level.

Similarly, Nicoletti and Scarpetta (2004) argue that:

> "[..] strong coordination allows industry unions to internalize the aggregate effects of their wage decisions into the negotiation process, de facto mimicking the outcomes of a highly centralized bargaining regime." (p.22).

The authors proceed by considering first the centralization index and then "upgrading" the intermediate bargainers who exhibit a high degree of coordination, which is considered as equivalent to a centralized wage bargaining system (p.22).

Therefore, given the arguments presented by Kenworthy (2001) and Soskice (1990) it appears important to use on one hand a rather structural measure for the wage bargaining process, but to allow for the influence of strong coordination. This hints at the appropriateness of the procedure employed by Elemskov et al (1997) and Nicoletti and Scarpetta (2004) in "upgrading" those countries to centralized countries which exhibit besides an industry level of bargaining a strong degree of coordination across unions and employer organizations.

The wage bargaining system employed in this paper is, therefore, identified via three dummies based on the OECD series of centralization of the wage bargaining process (ranging from 1 to 5) and the wage coordination index provided in Nickel et al (2001), which is an interpolation of the OECD index of wage coordination (ranging from 1 to 3). Both indices are increasing in the degree of centralization and coordination, respectively. More precisely, a value of 1 for the centralization index refers to company and plant level bargaining, 2 refers to a mix of plant and industry level , 3 to predominantly industry level bargaining, 4 to a mixture of industry and nationwide bargaining, and 5 to a predominant role of nation wide wage setting (See OECD Employment Outlook 2004).

The Index used in the empirical analysis is constructed in the following way: A country is considered:

- centralized if the centralization index is above 3.5 (irrespective of the coordination index) or if the centralization index is above 2 and the coordination index has a value equal to, or above 2.25. Hence, countries with intermediate bargaining level but high degree of coordination are „upgraded" in the sense that I expect a high degree of coordination to offset the negative effects on unemployment from the sole fact that bargaining takes place at an intermediate level of bargaining (a similar approach has been followed by Elmeskov at al 1997) - hcorp

- as having an intermediate level of bargaining if the centralization index takes a value from 2 to 3.5 (and does not have a value for the coordination index equal or superior to 2.25) - mcorp

- decentralized for all other cases (i.e. takes a value below 2 for the centralization index) - lcorp

The index will then result in the following grouping for the countries:

	1970-1974	**1975-1979**	**1980-1984**	**1985-1989**	**1990-1994**	**1995-2000**
Central (hcorp)	**Australia**, Austria, **Belgium**, Denmark, Finland, Germany, **Ireland**, Norway, **Portugal**, **Spain**, **Sweden**, Switzerland	**Australia**, Austria, Denmark, Finland, Germany, **Ireland**, Norway, **Portugal**, **Spain**, **Sweden**, Switzerland	**Australia**, Austria, Denmark, Finland, Germany, Norway, **Spain**, **Sweden**, Switzerland	**Australia**, Austria, Denmark, Finland, Germany, **Ireland**, Norway, **Sweden**, Switzerland	Austria, Denmark, Finland, Germany, **Ireland**, Norway, **Portugal**, Switzerland	Austria, Denmark, Finland, Germany, **Ireland**, Norway, **Portugal**, Switzerland
Intermediate (mcorp)	France, Italy, Netherlands, **New Zealand**, **UK**	**Belgium**, France, Italy, Netherlands, **New Zealand**, **UK**	**Belgium**, France, Italy, Netherlands, **New Zealand**, **Portugal**	**Belgium**, France, Italy, Netherlands, **New Zealand**, **Portugal**, **Spain**	**Australia**, **Belgium**, France, Italy, Netherlands, **Spain**, **Sweden**	**Australia**, **Belgium**, France, Italy, Netherlands, **Spain**, **Sweden**
Decentral (lcorp)	Canada, Japan, USA	Canada, Japan, USA	Canada, Japan, **Ireland**, **UK** USA	Canada, Japan, **UK** USA	Canada, Japan, **New Zealand**, **UK,** USA	Canada, Japan, **New Zealand**, **UK,** USA

I believe that this index reflects more accurately the effective level of wage setting than using one of the indices separately, which would neglect the positive effect that can come from coordination of the wage setting. The table makes clear that there has been a move towards more decentralized levels of bargaining over the time horizon.

Union Density (uniondens)

The OECD does provide a series on union density. However, the series is incomplete for several countries. Hence, I make use of the dataset of Nickel et al (2001) that is based on several sources (including the OECD) and the updated figures in Nickel (2003). For details on the composition see Nickel et al (2001).

Tax Wedge (taxrate)

The tax wedge describes the difference between the wage cost that arise to the employer and the actual net of tax wage that is available to the employee. The tax wedge is therefore the sum of the payroll tax rate, the income tax rate and the consumption tax rate. The data is taken from Nickel et al (2001) and the update Nickel (2003) and is based on the CEP-OECD database of the London School of Economics. See Nickel et al (2001) for an exact description.

Benefit Replacement Rate and Benefit Duration Index (brr, benefitrep, bb)

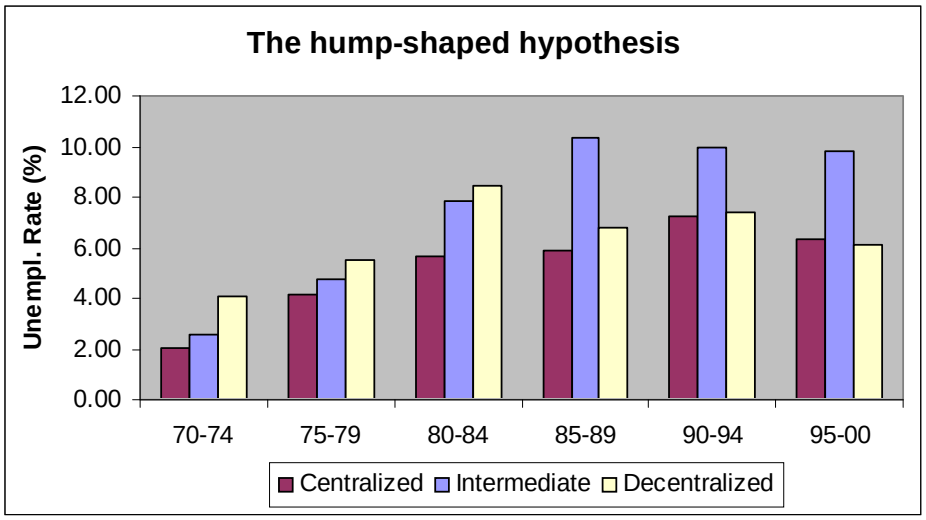
There are several indicators available. The gross benefit replacement rate is an indicator provided by the OECD in two year intervals (brr). The OECD measure is defined as the average of the gross unemployment benefit replacement rates for two earning levels, three family situations and three durations of unemployment. A second indicator is provided by Nickell et al (2001) and based on OECD figures. This index describes the replacement rate averaged over family types for the first year of unemployment (benefitrep). The same authors also provide an index ranging from 0 to 1, which captures the duration of benefit entitlements. Following Nickell et. al., I use the interaction of these two indices in the regression (bb). All of the indicators were used also separately, in order to check for the robustness of the significance and in order to determine which indicator gives the most conclusive results. Unfortunately, no constellation gave rise to persistent significant results.

Employment Protection Legislation (EPL)

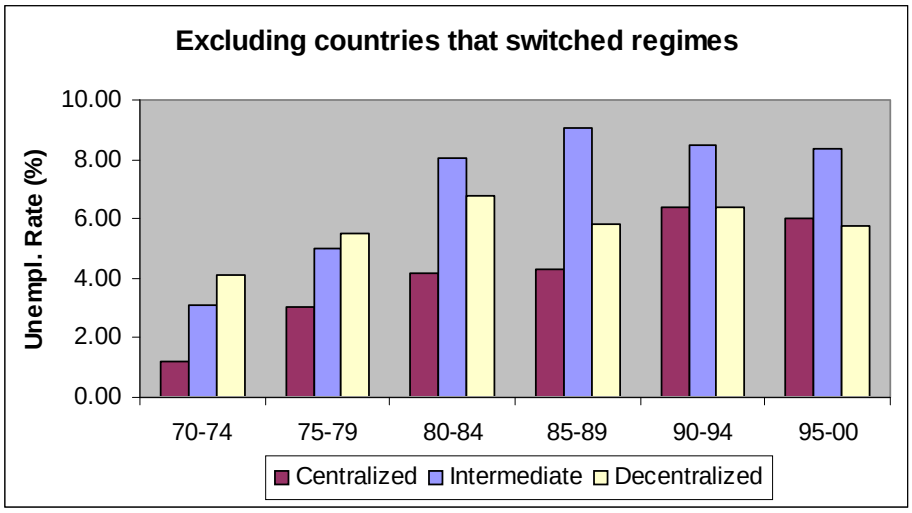
The OECD does not provide a long term series of the EPL index. Therefore, the EPL index is taken from Nickel et al (2001) and the updates available in Nickel (2003), which is based on four sources that are re-scaled in order to make them comparable. The sources are: Blanchard and Wolfers (2000), Lazear (1990), the OECD EPL index and the most recent value is provided by Nicoletti et al (2000). The index ranges from 0 to 2, increasing with the degree of protection. The values used for the first five periods in this paper are the averages over the Nickel et. al. (2001) figures and for the last period the value provided in Nickel (2003) for the year 1998. Due to the various sources this series may have some drawbacks in the exact measurement.

Appendix VI: Descriptive Statistics

The following two graphs show the average unemployment rate over the sample countries that are grouped into the three categories according to the wage bargaining index. The pictures suggest that since the 80s the hump-shaped hypothesis seems to hold.



When excluding all the countries that switched regimes during the analyzed period, the hump-shape appears already in the early eighties (the excluded countries are: Australia, Belgium, Ireland, New Zealand, Portugal, Spain, Sweden, and the UK). This however, reduces the size of the sample to only 12 countries which reduces the power of the argument.



Variable		Mean	Std. Dev.	Min	Max
ur	overall	6.22605	3.97759	0	20.12
	between		2.903103	1.871667	13.83
	within		2.771256	-4.86395	12.51605
output-gap	overall	.0954236	1.408396	-3.066562	4.900141
	between		.1528282	-.1970561	.3956648
	within		1.40043	-3.283706	4.682997
taxrate	overall	.4877193	.1259164	.26	.8
	between		.1226373	.31	.7333333
	within		.0432251	.344386	.574386
union-density	overall	.4212605	.1915174	.09	.85
	between		.1860419	.1216667	.8016667
	within		.0569788	.2132605	.5832605
epl	overall	1.075167	.5547836	.1	2
	between		.5414681	.1	1.893333
	within		.1640609	.3351667	1.465167
benefit repl.	overall	.4345378	.1836344	.02	.77
	between		.1494726	.1783333	.6766667
	within		.1102935	.0278712	.8562045
bb	overall	.1940336	.1436646	0	.66
	between		.1299123	0	.4583333
	within		.0659018	-.0042997	.4120336
brr	overall	26.28742	13.26092	.54	61.66
	between		11.58746	6.625	50.87333
	within		6.872005	4.327417	45.38908
hcorp* lagimp	overall	31.41958	10.43964	13.24799	68.1974
	between		11.5055	15.81916	54.14843
	within		3.623069	19.95785	45.46854
mcorp* lagimp	overall	33.37299	16.26709	15.78671	68.36503
	between		14.79891	19.39587	64.34251
	within		2.999272	24.43051	37.39551
lcorp* lagimp	overall	19.98008	11.95427	5.914852	57.7443
	between		17.49955	9.69942	57.7443
	within		2.867696	14.26234	29.95505
hcorp* pressure index	overall	36.4842	29.10058	6.924245	136.5975
	between		28.94776	8.150855	118.2859
	within		6.12154	20.57905	54.79584
mcorp* pressure index	overall	30.1211	18.85309	8.385972	83.13381
	between		21.34217	11.09294	81.69901
	within		5.159788	17.72083	50.3439
lcorp* pressure index	overall	65.9829	40.15799	5.840127	126.4142
	between		40.86874	7.193296	115.4886
	within		13.34735	28.13723	99.23281
lagimp	overall	29.65493	13.70968	5.914852	68.36503
	between		13.51572	9.69942	61.87703
	within		3.599446	17.32749	43.10458
pressure index	overall	40.61481	31.82461	5.840127	136.5975
	between		31.45598	7.193296	117.8196
	within		8.056172	2.769137	73.86472

Table 1: Basic Regression Results - Baseline Models

	A	B	C[a]	D	1	2	3
Labor Market Institutions							
EPL (1 unit)	-3.12**	-5.61***	-5.61***	-5.51***	-6.45***	-4.27***	-4.12***
Unempl. Benefit	3.96	3.97	4.58	3.96	3.66	4.04*	4.19
Union Density (10 PP)	0.59	0.44	0.45	0.54	0.44	0.19	0.2
Tax Wedge (10 PP)	1.5***	1.4***	1.4***	1.4***	1.3***	0.57	0.6
Corp M	2.6	4.27***	4.24***	4.57***	9.54***	5.26***	4.15
Corp H	-	-	-	-	5.05	-	-1.08
Macro variable							
Output Gap	-0.33**	-0.3**	-0.32***	-	-0.31**	-0.31**	-0.3**
Interacted institution							
Corp L * Pressure Index		-0.085***	-0.042***	-0.087***	-0.073***	-0.046***	-0.051***
Corp M * Pressure Index		-0.153***	-0.074***	-0.158***	-0.198***	-0.128***	-0.121***
Corp H * Pressure Index		-0.093***	-0.042***	-0.087***	-0.123***	-0.052***	-0.048**
Corp L * lag Imp	-0.028						
Corp M * lag Imp	-0.079						
Corp H * lag Imp	-0.062						
Constant	0.875	6.8**	6.35**	6.45*	4.8*	8.5***	8.8***
Fixed Effects							
Country	Yes	Yes	Yes	Yes	Yes	No	No
Time[T]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114	114	114	114	114	114	114
Jarque Bera, prob. value	0.97	0.58	0.47	0.63	0.71	0	0
Adjusted Durbin-Watson	1.21	1.39	1.59	1.46	1.39	1.02	1.03
R^2 (between)	0.68	0.77	0.76	0.75	0.77	0.74	0.74

* =significan at 10%, ** = significant at 5%, *** = significant at 1% [+)] Time effects refer not to the whole period but only to two dummies for the 70s, which are highly significant. Time dummies for other periods were never significant.

Table 2: Results of the Modified Estimations

	B1[b]	C1[a,b]	B2[c]	C2[a,c]	B3	D3	B4
Labor Market Institutions							
EPL (1 unit)	-4.44***	-4.02***	-5.85***	-5.72***	-6.84***	-6.89**	-3.42**
Unempl. Benefit	5.87*	6.31*	3.75	4.2	6.28	5.07	5.83
Union Density (10 PP)	0.53	0.57	0.65	0.72	0.22	0.18	0.76*
Tax Wedge (10 PP)	1.4***	1.5***	1.2**	1.3**	1.92**	1.91*	1.70***
Corp M	3.04***	3.10***	2.25*	2.27*	3.70***	4.20***	3.43***
Corp H	-	-	-	-	-	-	-
Macro variable							
Output Gap	-0.33***	-0.36***	-0.28*	-0.32*	-0.40***	-	-0.36***
Interacted institution							
Corp L * Pressure Index	-0.114***	-0.050***	-0.099***	-0.047***	-0.125***	-0.138***	-0.067***
Corp M * Pressure Index	-0.152***	-0.071***	-0.129***	-0.063***	-0.177***	-0.196***	-0.112***
Corp H * Pressure Index	-0.115***	-0.046***	-0.095***	-0.042***	-0.134***	-0.141***	-0.061**
Corp L * lag Imp							
Corp M * lag Imp							
Corp H * lag Imp							
Constant	6.06	5.00	0.02	0.07	7.67	8.67	0.68
Fixed Effects							
Country	Yes	Yes	No	No	Yes	Yes	Yes
Time[†]	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	94	94	94	94	94	94	94
Jarque Bera, prob. value	0.02	0.03	0	0	0.75	0.61	0.01
Adjusted Durbin-Watson	2.24	2.18	1.81	1.78	2.03	2.03	1.66
R^2 (between)	0.56	0.55	0.5	0.49	0.72	0.67	0.66

[a)] using trade in % of GDP as openness indicator. [b)] rho=0.31 for model C; rho=0.29 for model B

[c)] R2 refers to the overall model R2. The model is a random effect model regressed in differences except for the outputgap. The value of the Hausman test was 0.99 in both cases.

Table 3: Results when Accounting for Outliers

	A5[d]	B5[d]	B6[e]	A7[f]	B7[f]
Labor Market Institutions					
EPL (1 unit)	-1.18	-4.16***	-4.87***	-2.39	-5.5***
Unempl. Benefit	4.85**	3.77	2.03	4.59	4.80
Union Density (10 PP)	0.05	-0.01	0.42	0.65	0.75*
Tax Wedge (10 PP)	0.6**	0.7*	1.0**	1.6***	1.7***
Corp M	4.27**	5.06***	2.38*	4.8	3.94***
Corp H	-	-	-	-	-
Macro variable					
Output Gap	-0.27**	-0.23*	-0.28**	-0.36**	-0.34**
Interacted institution					
Corp L * Pressure Index		-0.083**	-0.091***		-0.114***
Corp M * Pressure Index		-0.130***	-0.119***		-0.209***
Corp H * Pressure Index		-0.052**	-0.081***		-0.115***
Corp L * lag Imp	0.068			-0.278***	
Corp M * lag Imp	-0.079			-0.353***	
Corp H * lag Imp	-0.065			-0.288***	
Constant	4.07*	9.15***	7.89**	6.2	4.85
Fixed Effects					
Country	No	No	Yes	Yes	Yes
Time[†]	Yes	Yes	Yes	No	No
Observations	102	102	108	76	76
Jarque Bera, prob. value	0	0	0.11	0.61	0.91
Adjusted Durbin-Watson	0.94	1.07	1.37	1.83	2.04
R^2 (between)	0.71	0.76	0.71	0.58	0.63

[d)] The outliers deleted from the sample are Ireland and Finland. The Hausman value is 0.24 for A5 and 0.14 for B5. [e)] Spain was dropped. [f)] Excluding the 70s. The adjusted Durbin-Watson statistic rejetcs the Null of an AR(1) structure.

Appendix VIII: Simulations of the Effect of a Change in the EPL Index

The composite effect of a change in EPL is a separate effect coming from the reduction in EPL plus a effect coming from the Pressure Index which varies with system, degree of openness and, the level of EPL at which a country starts. The following examples give an impression of how different changes in EPL affect the unemployment rate. For example, a country which has an initial EPL value of 1.9, a degree of openness (imports) of 45%, and exhibits a centralized system of bargaining, will experience an increase in the unemployment rate by 1.66 % points, when reducing the EPL to 1.5 (4th row, 4th column).

Regression B	**EPL Starting Level: 1.9**											
Openness	**60**			**45**			**30**			**15**		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1.8	0.40	0.29	0.41	0.44	0.36	0.45	0.48	0.43	0.49	0.52	0.49	0.52
1.7	0.78	0.55	0.81	0.86	0.70	0.89	0.95	0.84	0.96	1.04	0.98	1.04
1.6	1.13	0.78	1.18	1.27	1.00	1.31	1.41	1.23	1.43	1.55	1.46	1.56
1.5	1.46	0.96	1.53	1.66	1.28	1.71	1.85	1.60	1.89	2.05	1.92	2.07
1.4	1.76	1.08	1.85	2.02	1.51	2.09	2.28	1.94	2.33	2.54	2.37	2.57
1.3	2.01	1.14	2.13	2.35	1.69	2.44	2.69	2.25	2.75	3.03	2.81	3.06
1.2	2.21	1.11	2.36	2.64	1.81	2.75	3.07	2.52	3.14	3.50	3.22	3.54
1.1	2.35	0.97	2.54	2.89	1.85	3.02	3.42	2.73	3.51	3.95	3.61	4.00
1	2.41	0.70	2.63	3.07	1.79	3.24	3.73	2.87	3.84	4.39	3.96	4.45
0.9	2.35	0.24	2.63	3.16	1.58	3.37	3.98	2.93	4.12	4.79	4.27	4.86
0.8	2.13	-0.47	2.48	3.14	1.19	3.40	4.15	2.85	4.33	5.16	4.51	5.25
0.7	1.70	-1.55	2.13	2.96	0.52	3.28	4.21	2.59	4.43	5.47	4.66	5.58
0.6	0.93	-3.18	1.48	2.52	-0.56	2.93	4.11	2.06	4.39	5.70	4.68	5.84
0.5	-0.37	-5.67	0.34	1.69	-2.29	2.22	3.74	1.09	4.10	5.80	4.47	5.98
0.4	-2.60	-9.70	-1.65	0.16	-5.17	0.87	2.91	-0.64	3.38	5.66	3.89	5.90

Regression B	**EPL Starting Level: 1.5**											
Openness	**60**			**45**			**30**			**15**		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1.4	0.30	0.12	0.32	0.36	0.23	0.38	0.43	0.34	0.44	0.49	0.45	0.50
1.3	0.55	0.18	0.60	0.69	0.42	0.73	0.84	0.65	0.86	0.98	0.89	0.99
1.2	0.75	0.15	0.83	0.99	0.54	1.05	1.22	0.92	1.26	1.45	1.30	1.47
1.1	0.89	0.02	1.01	1.23	0.57	1.32	1.57	1.13	1.63	1.91	1.69	1.93
1	0.94	-0.26	1.11	1.41	0.51	1.53	1.88	1.28	1.96	2.34	2.04	2.38
0.9	0.89	-0.71	1.10	1.51	0.31	1.67	2.13	1.33	2.23	2.75	2.35	2.80
0.8	0.67	-1.43	0.95	1.49	-0.09	1.70	2.30	1.25	2.44	3.11	2.59	3.18
0.7	0.24	-2.51	0.60	1.30	-0.76	1.57	2.36	0.99	2.55	3.43	2.74	3.52
0.6	-0.53	-4.13	-0.05	0.86	-1.84	1.22	2.26	0.46	2.50	3.65	2.75	3.77
0.5	-1.83	-6.63	-1.19	0.03	-3.57	0.51	1.89	-0.51	2.21	3.75	2.55	3.91
0.4	-4.06	-10.66	-3.18	-1.50	-6.45	-0.84	1.06	-2.24	1.50	3.61	1.96	3.83

Regression B	**EPL Starting Level: 1.1**											
Openness	**60**			**45**			**30**			**15**		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1	0.05	-0.27	0.10	0.18	-0.06	0.21	0.31	0.14	0.33	0.43	0.35	0.45
0.9	-0.01	-0.73	0.09	0.28	-0.27	0.35	0.56	0.19	0.61	0.84	0.66	0.86
0.8	-0.22	-1.45	-0.06	0.26	-0.66	0.38	0.73	0.12	0.81	1.21	0.90	1.25
0.7	-0.65	-2.52	-0.41	0.07	-1.33	0.26	0.79	-0.14	0.92	1.52	1.05	1.58
0.6	-1.42	-4.15	-1.06	-0.37	-2.41	-0.09	0.69	-0.67	0.87	1.75	1.07	1.84
0.5	-2.72	-6.65	-2.20	-1.20	-4.14	-0.81	0.32	-1.64	0.58	1.84	0.86	1.98
0.4	-4.95	-10.68	-4.19	-2.73	-7.03	-2.16	-0.51	-3.38	-0.13	1.71	0.28	1.90

Regression B	**EPL Starting Level: 0.7**											
Openness	**60**			**45**			**30**			**15**		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
0.6	-0.77	-1.62	-0.65	-0.44	-1.08	-0.35	-0.10	-0.53	-0.05	0.23	0.01	0.26
0.5	-2.07	-4.12	-1.79	-1.27	-2.81	-1.06	-0.47	-1.50	-0.34	0.32	-0.19	0.39
0.4	-4.30	-8.15	-3.78	-2.80	-5.69	-2.42	-1.31	-3.23	-1.05	0.19	-0.78	0.32

When performing the same simulation for the regression model B1, which includes an AR(1) process, the general pattern remains. However, the difference in the effect of a given change in the EPL on the unemployment rate under the three types of wage setting systems is less pronounced, when compared to the baseline model.

Regression B1	EPL Starting Level: 1.9											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1.8	0.24	0.18	0.24	0.29	0.24	0.29	0.34	0.31	0.34	0.39	0.38	0.39
1.7	0.46	0.32	0.46	0.57	0.46	0.57	0.67	0.61	0.68	0.78	0.75	0.78
1.6	0.65	0.43	0.66	0.82	0.66	0.83	0.99	0.88	0.99	1.16	1.11	1.16
1.5	0.81	0.50	0.82	1.05	0.82	1.06	1.29	1.14	1.30	1.53	1.46	1.54
1.4	0.92	0.51	0.93	1.25	0.93	1.26	1.57	1.36	1.58	1.90	1.79	1.90
1.3	0.99	0.45	1.00	1.41	1.00	1.42	1.83	1.56	1.83	2.24	2.11	2.25
1.2	0.99	0.31	1.01	1.52	1.01	1.53	2.05	1.71	2.06	2.58	2.41	2.58
1.1	0.91	0.06	0.93	1.57	0.93	1.59	2.23	1.81	2.24	2.89	2.68	2.90
1	0.73	-0.32	0.76	1.54	0.76	1.57	2.36	1.84	2.38	3.18	2.92	3.19
0.9	0.40	-0.89	0.44	1.41	0.44	1.44	2.42	1.77	2.44	3.43	3.11	3.44
0.8	-0.11	-1.72	-0.07	1.14	-0.07	1.17	2.39	1.58	2.41	3.64	3.23	3.65
0.7	-0.90	-2.90	-0.84	0.66	-0.84	0.70	2.22	1.21	2.24	3.77	3.27	3.79
0.6	-2.10	-4.63	-2.03	-0.13	-2.03	-0.08	1.84	0.57	1.87	3.80	3.17	3.82
0.5	-3.95	-7.22	-3.86	-1.41	-3.86	-1.34	1.13	-0.50	1.18	3.67	2.86	3.70
0.4	-6.96	-11.34	-6.84	-3.55	-6.84	-3.47	-0.15	-2.34	-0.09	3.26	2.16	3.29

Regression B1	EPL Starting Level: 1.5											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1.4	0.12	0.01	0.12	0.20	0.12	0.20	0.28	0.23	0.28	0.36	0.34	0.36
1.3	0.18	-0.05	0.19	0.36	0.19	0.36	0.53	0.42	0.54	0.71	0.65	0.71
1.2	0.18	-0.19	0.19	0.47	0.19	0.48	0.76	0.57	0.76	1.04	0.95	1.05
1.1	0.10	-0.43	0.12	0.52	0.12	0.53	0.94	0.67	0.95	1.36	1.22	1.36
1	-0.08	-0.82	-0.06	0.49	-0.06	0.51	1.07	0.70	1.08	1.65	1.46	1.65
0.9	-0.40	-1.39	-0.38	0.36	-0.38	0.38	1.13	0.64	1.14	1.90	1.65	1.90
0.8	-0.92	-2.21	-0.88	0.09	-0.88	0.12	1.10	0.45	1.11	2.10	1.78	2.11
0.7	-1.71	-3.40	-1.66	-0.39	-1.66	-0.36	0.92	0.08	0.95	2.24	1.81	2.25
0.6	-2.90	-5.12	-2.84	-1.18	-2.84	-1.13	0.55	-0.56	0.58	2.27	1.72	2.29
0.5	-4.76	-7.72	-4.68	-2.46	-4.68	-2.40	-0.16	-1.64	-0.12	2.14	1.40	2.16
0.4	-7.77	-11.84	-7.66	-4.60	-7.66	-4.52	-1.44	-3.48	-1.39	1.72	0.70	1.75

Regression B1	EPL Starting Level: 1.1											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1	-0.18	-0.39	-0.18	-0.03	-0.18	-0.02	0.13	0.03	0.13	0.29	0.24	0.29
0.9	-0.51	-0.95	-0.49	-0.16	-0.49	-0.15	0.19	-0.03	0.20	0.54	0.43	0.54
0.8	-1.02	-1.78	-1.00	-0.43	-1.00	-0.42	0.16	-0.22	0.17	0.74	0.55	0.75
0.7	-1.81	-2.96	-1.78	-0.91	-1.78	-0.89	-0.02	-0.59	0.00	0.88	0.59	0.89
0.6	-3.01	-4.69	-2.96	-1.70	-2.96	-1.67	-0.39	-1.23	-0.37	0.91	0.49	0.92
0.5	-4.86	-7.29	-4.80	-2.98	-4.80	-2.93	-1.10	-2.31	-1.07	0.78	0.18	0.80
0.4	-7.87	-11.40	-7.77	-5.12	-7.77	-5.05	-2.38	-4.15	-2.33	0.36	-0.52	0.39

Regression B1	EPL Starting Level: 0.7											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
0.6	-1.20	-1.73	-1.18	-0.79	-1.18	-0.78	-0.38	-0.64	-0.37	0.03	-0.10	0.04
0.5	-3.05	-4.32	-3.02	-2.07	-3.02	-2.04	-1.08	-1.72	-1.07	-0.10	-0.41	-0.09
0.4	-6.06	-8.44	-6.00	-4.21	-6.00	-4.16	-2.36	-3.55	-2.33	-0.52	-1.11	-0.50

Also model B2, the estimation in the difference, suggests a simlar effect of the EPL on the unemployment rate, where the exact values range in between the first two models:

Regression B2	EPL Starting Level: 1.9											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1.8	0.42	0.36	0.41	0.46	0.42	0.45	0.50	0.47	0.50	0.54	0.53	0.54
1.7	0.82	0.69	0.80	0.91	0.81	0.89	0.99	0.93	0.99	1.08	1.05	1.08
1.6	1.19	0.99	1.17	1.33	1.18	1.32	1.47	1.37	1.46	1.61	1.56	1.61
1.5	1.54	1.25	1.51	1.74	1.53	1.71	1.94	1.80	1.92	2.14	2.07	2.13
1.4	1.85	1.47	1.81	2.12	1.83	2.09	2.39	2.20	2.37	2.66	2.56	2.65
1.3	2.13	1.63	2.07	2.47	2.10	2.43	2.82	2.57	2.79	3.16	3.04	3.15
1.2	2.35	1.72	2.27	2.78	2.31	2.73	3.22	2.91	3.18	3.66	3.50	3.64
1.1	2.50	1.72	2.41	3.04	2.46	2.97	3.59	3.20	3.54	4.13	3.94	4.11
1	2.57	1.60	2.45	3.24	2.52	3.15	3.92	3.43	3.86	4.59	4.35	4.56
0.9	2.52	1.32	2.38	3.35	2.46	3.24	4.18	3.59	4.11	5.02	4.72	4.98
0.8	2.31	0.83	2.14	3.34	2.23	3.21	4.37	3.63	4.29	5.40	5.03	5.36
0.7	1.88	0.04	1.66	3.16	1.78	3.00	4.45	3.53	4.34	5.73	5.27	5.68
0.6	1.10	-1.22	0.83	2.73	0.99	2.52	4.36	3.19	4.22	5.98	5.40	5.91
0.5	-0.21	-3.22	-0.56	1.89	-0.36	1.62	3.99	2.49	3.81	6.09	5.34	6.00
0.4	-2.48	-6.50	-2.95	0.34	-2.68	-0.02	3.15	1.14	2.91	5.96	4.96	5.84

Regression B2	EPL Starting Level: 1.5											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1.4	0.31	0.22	0.30	0.38	0.31	0.37	0.45	0.40	0.44	0.52	0.49	0.51
1.3	0.59	0.38	0.56	0.73	0.57	0.71	0.88	0.77	0.87	1.02	0.97	1.02
1.2	0.81	0.47	0.77	1.04	0.79	1.01	1.28	1.11	1.26	1.52	1.43	1.51
1.1	0.96	0.46	0.90	1.30	0.93	1.26	1.65	1.40	1.62	1.99	1.87	1.98
1	1.03	0.34	0.94	1.50	0.99	1.44	1.98	1.64	1.94	2.45	2.28	2.43
0.9	0.98	0.07	0.87	1.61	0.93	1.53	2.24	1.79	2.19	2.88	2.65	2.85
0.8	0.77	-0.42	0.63	1.60	0.71	1.50	2.43	1.84	2.36	3.26	2.97	3.23
0.7	0.34	-1.22	0.15	1.42	0.26	1.29	2.51	1.73	2.42	3.59	3.21	3.55
0.6	-0.44	-2.48	-0.68	0.99	-0.54	0.81	2.42	1.40	2.30	3.84	3.33	3.78
0.5	-1.75	-4.47	-2.07	0.15	-1.89	-0.09	2.05	0.69	1.89	3.95	3.27	3.87
0.4	-4.02	-7.76	-4.46	-1.40	-4.21	-1.73	1.21	-0.66	0.99	3.82	2.89	3.71

Regression B2	EPL Starting Level: 1.1											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1	0.07	-0.12	0.05	0.20	0.06	0.18	0.33	0.23	0.32	0.46	0.41	0.45
0.9	0.02	-0.39	-0.03	0.31	0.00	0.27	0.59	0.39	0.57	0.88	0.78	0.87
0.8	-0.19	-0.88	-0.27	0.30	-0.22	0.24	0.78	0.44	0.74	1.27	1.10	1.25
0.7	-0.62	-1.68	-0.75	0.12	-0.68	0.03	0.86	0.33	0.80	1.60	1.33	1.57
0.6	-1.39	-2.94	-1.58	-0.31	-1.47	-0.45	0.77	-0.01	0.68	1.85	1.46	1.80
0.5	-2.71	-4.93	-2.97	-1.15	-2.82	-1.35	0.40	-0.71	0.27	1.96	1.40	1.89
0.4	-4.97	-8.22	-5.36	-2.71	-5.14	-2.99	-0.44	-2.06	-0.63	1.83	1.02	1.73

Regression B2	EPL Starting Level: 0.7											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
0.6	-0.77	-1.26	-0.83	-0.43	-0.80	-0.48	-0.09	-0.34	-0.12	0.25	0.12	0.23
0.5	-2.09	-3.25	-2.22	-1.27	-2.15	-1.38	-0.46	-1.04	-0.53	0.36	0.06	0.32
0.4	-4.35	-6.54	-4.61	-2.83	-4.46	-3.02	-1.30	-2.39	-1.43	0.23	-0.32	0.16

With a very low degree of openness (<15%) it requires in most cases a reduction below an EPL Index value of 0.5 in order to generate a reduction in unemployment rates. The picture that emerges is that closed economies tend to perform better when moving to more restrictive EPL, while open economies will perform better when moving to less restrictive EPL.

Regression B3	EPL Starting Level: 1.9											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1.8	0.45	0.37	0.46	0.51	0.45	0.52	0.57	0.53	0.57	0.63	0.61	0.63
1.7	0.87	0.71	0.90	0.99	0.87	1.02	1.12	1.04	1.14	1.24	1.20	1.25
1.6	1.26	1.00	1.31	1.46	1.27	1.50	1.66	1.53	1.68	1.85	1.79	1.87
1.5	1.61	1.25	1.68	1.89	1.62	1.95	2.17	1.99	2.21	2.45	2.36	2.47
1.4	1.91	1.42	2.01	2.29	1.92	2.36	2.66	2.42	2.72	3.04	2.92	3.07
1.3	2.15	1.52	2.28	2.64	2.17	2.74	3.13	2.81	3.19	3.62	3.46	3.65
1.2	2.32	1.53	2.49	2.94	2.34	3.06	3.55	3.16	3.64	4.17	3.97	4.21
1.1	2.39	1.41	2.60	3.16	2.42	3.32	3.93	3.44	4.04	4.70	4.46	4.75
1	2.35	1.13	2.60	3.30	2.38	3.49	4.25	3.64	4.38	5.20	4.90	5.27
0.9	2.14	0.63	2.45	3.31	2.18	3.55	4.49	3.73	4.65	5.66	5.29	5.74
0.8	1.71	-0.16	2.10	3.16	1.76	3.45	4.61	3.68	4.81	6.07	5.60	6.17
0.7	0.95	-1.37	1.44	2.77	1.02	3.13	4.58	3.42	4.82	6.39	5.81	6.52
0.6	-0.28	-3.22	0.34	2.02	-0.19	2.48	4.31	2.84	4.62	6.60	5.86	6.75
0.5	-2.27	-6.07	-1.48	0.69	-2.16	1.29	3.65	1.75	4.05	6.61	5.66	6.81
0.4	-5.61	-10.70	-4.54	-1.64	-5.46	-0.84	2.33	-0.22	2.86	6.29	5.02	6.56

Regression B3	EPL Starting Level: 1.5											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1.4	0.30	0.18	0.33	0.40	0.30	0.42	0.49	0.43	0.51	0.59	0.56	0.59
1.3	0.54	0.28	0.60	0.75	0.55	0.79	0.96	0.82	0.98	1.16	1.10	1.18
1.2	0.71	0.28	0.80	1.05	0.72	1.11	1.38	1.17	1.43	1.72	1.61	1.74
1.1	0.79	0.16	0.92	1.27	0.81	1.37	1.76	1.45	1.83	2.25	2.09	2.28
1	0.74	-0.12	0.92	1.41	0.76	1.55	2.08	1.65	2.17	2.75	2.54	2.80
0.9	0.53	-0.62	0.77	1.42	0.56	1.60	2.32	1.74	2.44	3.21	2.92	3.27
0.8	0.10	-1.41	0.41	1.27	0.14	1.51	2.44	1.69	2.60	3.62	3.24	3.69
0.7	-0.65	-2.62	-0.24	0.88	-0.60	1.19	2.41	1.43	2.61	3.94	3.45	4.04
0.6	-1.88	-4.46	-1.34	0.13	-1.81	0.53	2.14	0.85	2.41	4.15	3.50	4.28
0.5	-3.88	-7.32	-3.16	-1.20	-3.78	-0.66	1.48	-0.24	1.84	4.16	3.30	4.34
0.4	-7.22	-11.95	-6.23	-3.53	-7.08	-2.79	0.15	-2.21	0.65	3.84	2.66	4.09

Regression B3	EPL Starting Level: 1.1											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
1	-0.05	-0.28	0.00	0.14	-0.04	0.17	0.32	0.20	0.34	0.50	0.44	0.51
0.9	-0.26	-0.78	-0.15	0.15	-0.24	0.23	0.56	0.30	0.61	0.96	0.83	0.99
0.8	-0.69	-1.57	-0.50	0.00	-0.66	0.13	0.68	0.24	0.77	1.37	1.15	1.41
0.7	-1.44	-2.78	-1.16	-0.40	-1.40	-0.19	0.65	-0.02	0.79	1.69	1.36	1.76
0.6	-2.67	-4.63	-2.26	-1.15	-2.61	-0.84	0.37	-0.60	0.58	1.90	1.41	2.00
0.5	-4.67	-7.48	-4.08	-2.47	-4.59	-2.03	-0.28	-1.69	0.01	1.91	1.21	2.06
0.4	-8.00	-12.11	-7.14	-4.81	-7.88	-4.16	-1.61	-3.66	-1.18	1.59	0.56	1.81

Regression B3	EPL Starting Level: 0.7											
Openness	60			45			30			15		
Reduction to	H	M	L	H	M	L	H	M	L	H	M	L
0.6	-1.23	-1.84	-1.10	-0.75	-1.21	-0.66	-0.27	-0.58	-0.21	0.21	0.05	0.24
0.5	-3.23	-4.70	-2.92	-2.08	-3.18	-1.85	-0.93	-1.67	-0.77	0.22	-0.15	0.30
0.4	-6.56	-9.33	-5.98	-4.41	-6.48	-3.97	-2.26	-3.64	-1.97	-0.10	-0.79	0.04

The sample presented here shows one drawback of the index. When EPL is reduced to very low levels and a country exhibits a high degree of openness, the reduction in unemployment takes unlikely high values. However, this should not affect the sample as average EPL values are well above this threshold and recorded changes over time have been much smaller. Nevertheless, a more precise pressure index, which corrects for the "bias at the lower end" of EPL, might give even better estimation results.

Appendix IX: Simulation of the Hump under Different Degrees of Openness[60]

Level of Openness: Imports in percent of GDP	Model B (Centralization H)	Model B (Centralization L)	Model B1 (H)	Model B1 (L)	Model B2 (H)	Model B2 (L)	Model B3 (H)	Model B3 (L)	Model B6 (H)	Model B6 (L)
0	4.27	4.27	3.04	3.04	2.25	2.25	3.70	3.70	2.38	2.38
5	4.00	3.96	2.87	2.87	2.10	2.11	3.50	3.46	2.21	2.25
10	3.72	3.65	2.70	2.69	1.94	1.98	3.31	3.23	2.03	2.13
15	3.45	3.34	2.54	2.52	1.79	1.84	3.11	2.99	1.86	2.00
20	3.18	3.03	2.37	2.35	1.63	1.70	2.92	2.75	1.69	1.87
25	2.91	2.72	2.20	2.18	1.48	1.57	2.72	2.52	1.52	1.74
30	2.63	2.42	2.03	2.00	1.32	1.43	2.53	2.28	1.34	1.62
35	2.36	2.11	1.86	1.83	1.17	1.30	2.33	2.05	1.17	1.49
40	2.09	1.80	1.69	1.66	1.01	1.16	2.14	1.81	1.00	1.36
45	1.82	1.49	1.53	1.49	0.86	1.02	1.94	1.57	0.83	1.23
50	1.54	1.18	1.36	1.31	0.70	0.89	1.75	1.34	0.65	1.11
55	1.27	0.87	1.19	1.14	0.55	0.75	1.55	1.10	0.48	0.98
60	1.00	0.56	1.02	0.97	0.40	0.61	1.35	0.86	0.31	0.85
65	0.72	0.25	0.85	0.79	0.24	0.48	1.16	0.63	0.13	0.73
70	0.45	-0.06	0.69	0.62	0.09	0.34	0.96	0.39	-0.04	0.60
75	0.18	-0.37	0.52	0.45	-0.07	0.20	0.77	0.15	-0.21	0.47
80	-0.09	-0.68	0.35	0.28	-0.22	0.07	0.57	-0.08	-0.38	0.34
85	-0.37	-0.98	0.18	0.10	-0.38	-0.07	0.38	-0.32	-0.56	0.22
90	-0.64	-1.29	0.01	-0.07	-0.53	-0.20	0.18	-0.55	-0.73	0.09
95	-0.91	-1.60	-0.16	-0.24	-0.69	-0.34	-0.01	-0.79	-0.90	-0.04
100	-1.18	-1.91	-0.32	-0.41	-0.84	-0.48	-0.21	-1.03	-1.07	-0.17

Level of Openness: Trade in percent of GDP	Model C (Centralization H)	Model C (Centralization L)	Model C1 (H)	Model C1 (L)	Model C2 (H)	Model C2 (L)
0	4.24	4.24	3.10	3.10	2.27	2.27
10	3.95	3.95	2.87	2.91	2.08	2.12
20	3.66	3.66	2.65	2.72	1.89	1.98
30	3.37	3.37	2.42	2.53	1.70	1.83
40	3.08	3.08	2.19	2.34	1.51	1.69
50	2.79	2.79	1.96	2.15	1.32	1.54
60	2.49	2.49	1.74	1.95	1.12	1.40
70	2.20	2.20	1.51	1.76	0.93	1.25
80	1.91	1.91	1.28	1.57	0.74	1.11
90	1.62	1.62	1.05	1.38	0.55	0.96
100	1.33	1.33	0.83	1.19	0.36	0.82
110	1.04	1.04	0.60	1.00	0.17	0.67
120	0.75	0.75	0.37	0.81	-0.02	0.52
130	0.46	0.46	0.15	0.62	-0.21	0.38
140	0.17	0.17	-0.08	0.43	-0.40	0.23
150	-0.12	-0.12	-0.31	0.24	-0.59	0.08
160	-0.41	-0.41	-0.54	0.05	-0.78	-0.06
170	-0.71	-0.71	-0.76	-0.15	-0.98	-0.20
180	-1.00	-1.00	-0.99	-0.34	-1.17	-0.35
190	-1.29	-1.29	-1.22	-0.53	-1.36	-0.49
200	-1.58	-1.58	-1.45	-0.72	-1.55	-0.64

[60] The values are computed for the average sample EPL, which is equal to 1.1.

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