A Political-Institutional Model of Real Exchange Rates, Competitiveness, and the Division of Labor

Torben Iversen
Harvard University

and

David Soskice
Duke University and Nuffield College, Oxford

Previous versions of this paper have been presented in the Political Economy Seminar, Essex University, November 2007, in the Comparative Politics Seminar, Columbia University, April 23, 2008, Yale University, May 2008, and at the Political Economy of Service Transition Workshop, Trinity College, Dublin, May 16-17, 2008. We thank the participants in these meetings, and in particular Tim Hatton, Thomas Pluemper, Vera Troeger and Matt Winters for many helpful comments and suggestions.

Abstract

This paper addresses three unsolved puzzles in comparative political economy. The first is a purchasing power parity (PPP) puzzle: why do some countries have persistently higher real exchange rates than others when the law of one price implies convergence? The second is a competitiveness puzzle: Why are those countries with above-average price levels often stellar export performers? The final is a division of labor puzzle: Why do countries at comparable levels of development nevertheless differ notably in terms of the share of workers employed in sectors with different levels of productivity? In this paper we present a simple solution to these puzzles that emphasize how collective wage bargaining and skill formation systems, by altering the level and dispersion of wages, produce the observed patterns. The solution provides an understanding of cross-national differences in wage equality, employment, and competitiveness, and we show how these are underpinned by distinct partisan political coalitions.

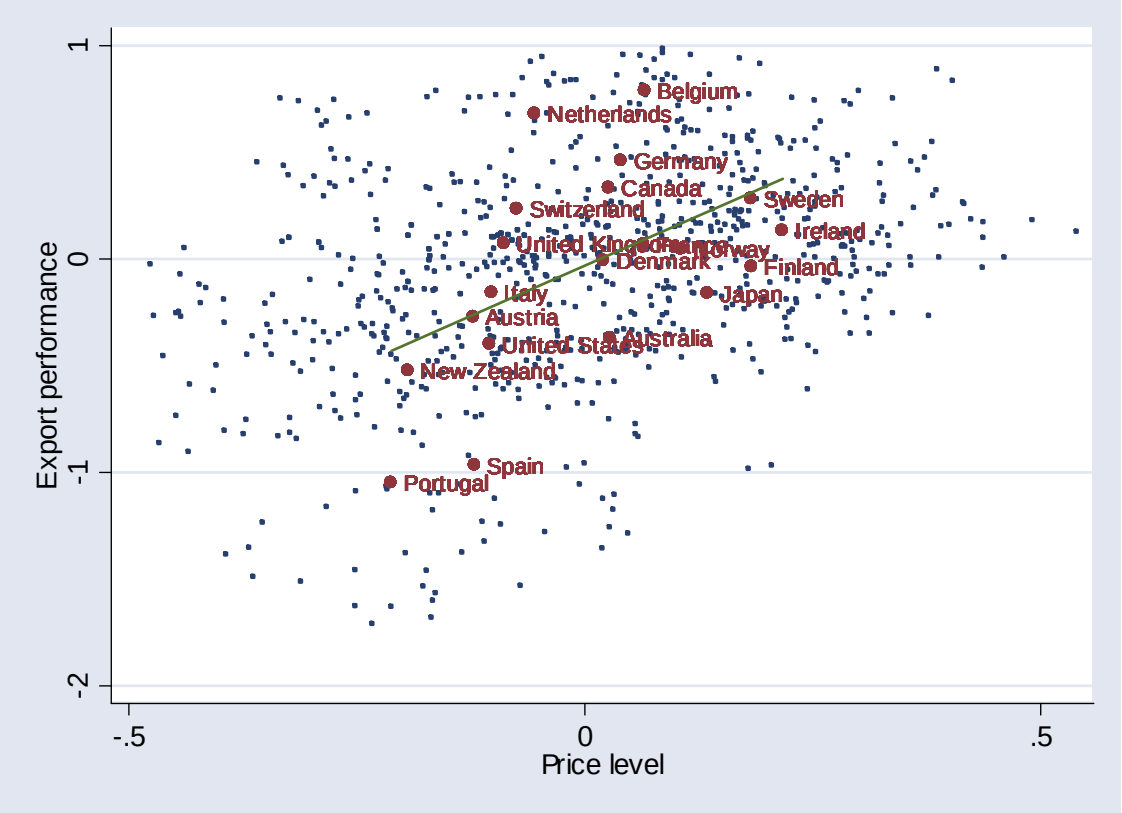
1. Introduction

Three related and unsolved puzzles keep surfacing in both the theoretical and empirical literature on trade among advanced economies. The first is a purchasing power parity (PPP) puzzle: why do some countries have persistently higher real exchange rates, or price levels, than others when the law of one price implies convergence? The second is a competitiveness puzzle: Why are countries with above-average real exchange rates, many found in continental Europe, nevertheless stellar export performers? The third puzzle is one about the division of labor: Why do countries at comparable levels of overall development and productivity nevertheless differ notably in terms of the share of worker employed in different sectors? There are several attempts to solve these puzzles, but none accounts for all three simultaneously, and proposed solutions to one tend to exacerbate another. In this paper we argue that the three empirical patterns are explained by a single underlying cause. The solution we propose helps us understand why countries, despite the pressures of globalization, exhibit enduring differences in wage equality, employment outcomes, and competitiveness – key foci for comparative political economy.

The first two puzzles are illustrated in Figure 1. It shows the price level on the x-axis and a measure of export performance on the y-axis. The price level is defined as the ratio of the consumer price level in country *I* to the US consumer price level, deflated by the nominal exchange rate of the *I* currency to the dollar so as to express it in a common currency. This is the inverse of the standard definition of the real exchange rate. When it is unity, purchasing power parity holds, so that a dollar buys the same amount in *I* as in the US. Note that we have subtracted the effect of GDP per capita on real exchange rates to take out the so-called the Balassa-Samuelson effect: the rise in the overall price level when wages and prices in the nontraded, low-productivity sector are pushed up by the rise in productivity in the export sector, which is linked to economic development (Balassa 1964 and Samuelson 1964). The *purchasing power parity (PPP) puzzle* is the large and persistent difference in price levels across countries (even after controlling for income). In the fully specified regression model estimated below, Swedish prices are nearly 40 percent higher on average than US prices across a 38-year time span. Indeed, large and

persisting differences are observed among *all* the advanced economies, and there is nothing in standard economic theory that can explain this.

Figure 1. Price levels and export performance, 1962-2000.



Notes: The price level is the log of the inverse of the real exchange rate, using the US dollar as the reference currency, minus the effect of GDP/capita on the real exchange rate. Positive values imply currency over-valuation relative to the US dollar; negative values currency under-valuation. Export performance is the share of OECD exports divided by the share of OECD GDP minus the effect of country GDP in a regression with real exchange rates and country GDP as independent variables.

One possible solution to the PPP puzzle is that prices in some countries are kept up by heavily regulated product and labor markets. It is notable that the economies with the highest real exchange rates are those in northern Europe, which are also the ones often highlighted as examples of over-regulated, cost-inflated economies. In a highly innovative paper Rogowski and Kayser (2002) use the well-known Stigler-Peltzman model of regulation (Stigler 1971; Peltzman 1976) to argue that higher consumer prices

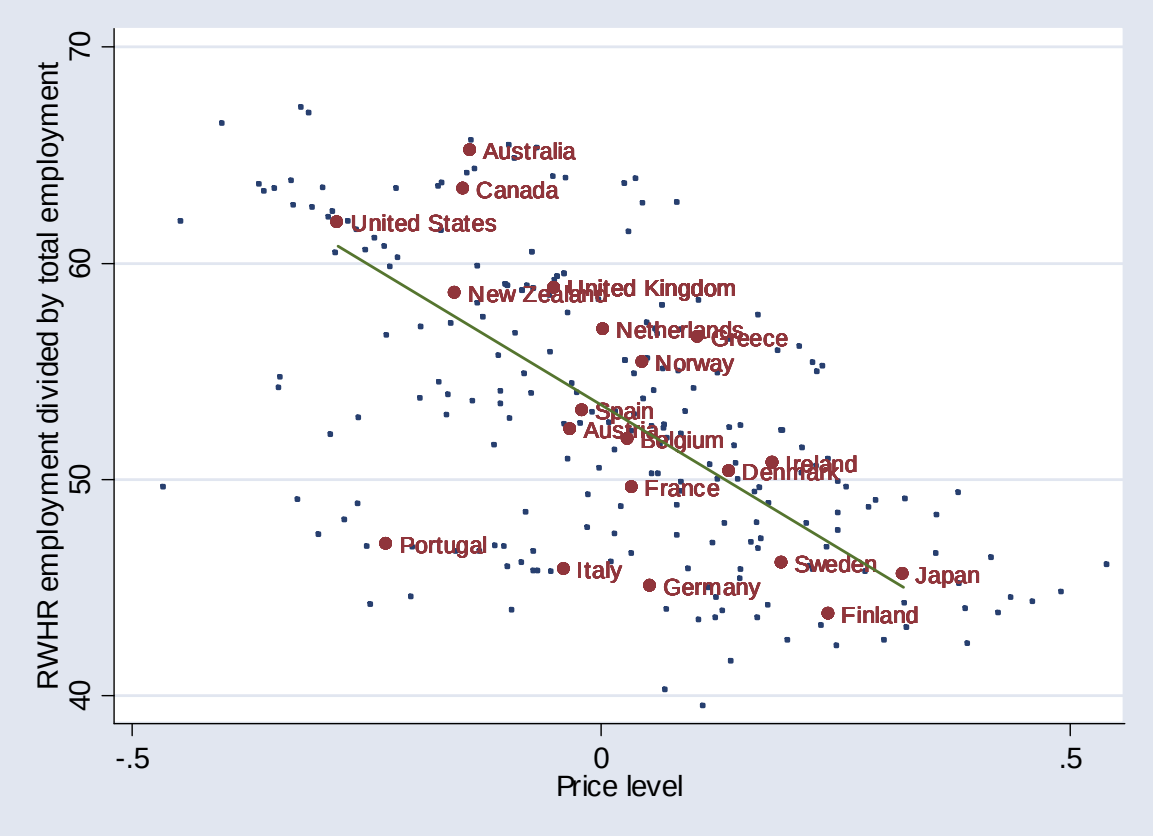
are a reflection of organized producer interests trumping consumer interests through regulatory policies. To account for the cross-national variation they argue that proportional representation (PR) electoral systems give politicians incentives to cater to well-organized producers without having to be overly concerned about losing elections, whereas politicians in majoritarian systems cannot stray far from the preferences of the median voter, who in their model represents consumer interests. The proportionality of the electoral system is thus related to regulations that raise prices. Rogowski and Kayser draw the conclusion that this tends to make PR systems uncompetitive in an increasingly globalized world economy, and they imply that it may even lead to attempts at switching to more efficient majoritarian institutions (p. 538).

But this conclusion is questioned by the *competitiveness puzzle,* also captured by Figure 1: there is, surprisingly, a *positive* relationship between price levels and export performance. When prices are adjusted for differences in GDP per capita the correlation is 0.52, and it is even higher (0.72) using unadjusted prices. Those presumably cost-inflated northern European economies do spectacularly well in international competition! Export performance is here measured as a country's share of OECD exports divided by its share of OECD output. To address the objection that small countries trade more than large ones for reasons that have nothing to do with competitiveness, we subtracted the effect of country GDP on performance by first regressing relative export shares on real exchange rates and on country GDPs. The correction makes large countries look relatively better, but strengthens the overall relationship.

Theoretically it is also not easy to reconcile the Rogowski-Kayser thesis with a large literature in comparative political economy that argues that success in export markets is related to the institutional capacity of employers and unions to keep wages and prices *down*, benefiting exports (Flanagan et al. 1983, Soskice 1990; Hall and Franzese 1998; Iversen 1999; Adolph 2004). Since wage bargaining tends to be highly coordinated in PR countries (Katzenstein 1985; Cusack et al. 2007), the argument runs counter to the Rogowski-Kayser model. But we also suggest in the conclusion how a modified version of Rogowski-Kayser may be fruitfully seen as complementary to our approach.

But if there is a positive relationship between coordinated wage-setting and international price competitiveness, as the neocorporatist literature implies, it is unclear why price levels in PR countries would be higher. Also, high performance in the export sector is not replicated in non-traded services, especially for employment-intensive industries at the lower end of the productivity distribution. Figure 2 shows employment in retail, wholesale, hotels and restaurants (RWHR) as a share of total employment in RWHR and manufacturing. The figures are for the 1990s when employment in manufacturing and services had everywhere reached relatively stable levels. Note that countries with higher price levels (measured by real exchange rates as before) have a smaller share of employment in low-productivity non-

Figure 2. Price levels and employment in retail, wholesale, hotels and restaurants (RWHR) as share of manufacturing employment, 1990s.



Notes: The price level is the log of the inverse of the real exchange rate, using the US dollar as the reference currency, minus the effect of GDP/capita on the real exchange rate. Positive values imply currency over-valuation relative to the US dollar; negative values currency under-valuation RWHR refers to employment in retail, wholesale, hotels and restaurants (RWHR).

traded services (r = -.62). This is a pattern that has also been noted by Scharpf (2000), Iversen and Wren (1998), Esping-Andersen (1990, ch. 8), among others. Since it suggests systematic differences in the sectoral division of labor across countries, we refer to it as the *division of labor puzzle*.

In this paper we present a simple model that helps solve all three puzzles simultaneously, while also explaining why advanced economies with relatively high real exchange rates, high international competitiveness, and high shares of employment in exports tend to have PR electoral systems. Key is union centralization and its effects on wage compression: given that export workers tend to be more highly skilled than service sector workers, our first insight is that compression lowers export sector wages – thus increasing international competitiveness – and raises wages in the service sector – thereby raising the real exchange rate. But we further argue that the ability of centralized unions to engineer long-term wage compression depends on a training system that ensures a large enough supply of skilled workers to enable unions avoid shop floor pressure against compression. Almost universally, work in recent decades on coordinated wage bargaining has neglected what we see as a central link between wage bargaining systems and publically subsidized vocational training. Finally, we suggest that PR systems with center-left coalitions can make implicit agreements with centralized unions to subsidize enough training to permit wage compression without shop floor revolts. These agreements are enabled by complementary coalitions of skilled and semi-skilled workers in the labor market and in the political system.

The economic model has its origins in the old and largely forgotten "EFO model", which focuses on inter-sectoral coordination of wages, especially the role of the export sector in "leading" wage-setting in the non-traded sector (Edgren, Faxen and Odhner 1973; Aukrust 1977). We capture the key insight of the EFO model in a setup that combines modern open economy macroeconomics with recent insights into the effects of collective wage bargaining on wages. The model shows how wage setting institutions can simultaneously affect competitiveness, prices, and the division of labor. These effects, however, are contingent on public investment in training, which is in turn closely related to electoral institutions and government partisanship.

The rest of the paper is divided into three sections. In the first we present the model; in the second we test its key implications for real exchange rates, competitiveness, and employment; the final section concludes.

2. A model of real exchange rates under coordinated and uncoordinated bargaining systems.

In this section we first show how the key intuitions of the paper – that coordinated bargaining and public investment in skills generate both high real exchange rates and a larger share of world markets for traded goods – can be derived from modern models of international trade. We then turn to the game between wage-setting and government educational policy that provides the political underpinnings for the outcomes we identify.

2.1. Basic assumptions

The last decade or so has seen the development in macroeconomics of a new basic model of the open economy (Obstfelt and Rogoff 1995; Lane 2001), characterized by economies each specializing in different traded goods, and microfounded on differentiated product oligopolistic markets as opposed to perfect competition. The generic model is often referred to as the New Open Economy Model (NOEM). We develop a simplified version of this model in which each of N symmetrically endowed countries produces a specific traded good; the traded good is produced by workers trained in the specific skills necessary to produce it; and there are two sectors in each economy, the traded good sector and a sheltered services sector in which only general skills – common to all workers in the economy – are required. Following Melitz (2003) we assume that only the most productive firms are exporters, and that high-productivity production requires high-skilled workers. Specifically, workers in the traded (T) sector are "skilled" with unit hourly productivity, while those in the sheltered (S) sector are "unskilled" with productivity $l_S < 1$. The sheltered service sector is thus a low skill and low productivity sector.

In addition to S-sector jobs requiring workers with low general skills and T-sector jobs requiring high specific skills, we can also distinguish workers with high general skills ("professionals"). We assume that these workers are high-paid and non-unionized, whereas all other workers are unionized. For simplicity, the wages of professionals can be thought of as being determined competitively in an internationally traded service, in which case their wages are completely exogenous to the domestic economy. With this simplifying assumption professionals play no role in the economic model, but we will show that they do in the political model.

Finally, we assume that the number of economies, *N,* is large enough that no individual country has effects on aggregate variables in the rest of the world. And the assumption of symmetric economies implies that workers (or households) everywhere have identical preferences over the *N* traded goods and domestically produced services.

We distinguish between two types of economies. In the Coordinated (*C*) type a centralized union confederation sets wages for all unionized workers and ensures that they get the same in both sectors, while investments in skills for non-professionals are publicly subsidized to the point where supply and demand meet. In Uncoordinated (*U*) economies unions bargain independently in each sector, and workers are responsible for their own training. Using these assumptions we will show that the real exchange rate and international competitiveness are both higher in *C* economies than in *U* economies, as is the proportion of the workforce in the traded sector relative to the service. For these results to hold politically, low wage workers must have influence on public training policies (in addition to influence within the union confederation). As we discuss in section 3, this condition is more likely to hold under a proportional representation (PR) political system in which left parties support centre-left coalitions in exchange for skill subsidization. In majoritatian systems, government coalitions tend to represent the interests of skilled workers (including professionals) only. This is incompatible with a centralized bargaining system.

2.2. Supply and demand for sectoral labor

In this and the next sub-section we set out the NOEM model in very simple graphical form (see Figures 3 and 4). The full model is in the appendix. The simple model consists of five key relationships (or equations) for a generic economy which may have either a *C* or a *U* collective bargaining system. We assume – in order to keep the two types of economies strictly comparable – that there is union bargaining in both *T* and *S* sectors (except for professionals, whose wages are always competitively set). The size of the unionized workforce is 1, with β working in *T* and $1-\beta$ in *S*. The five equations establish the following relationships:

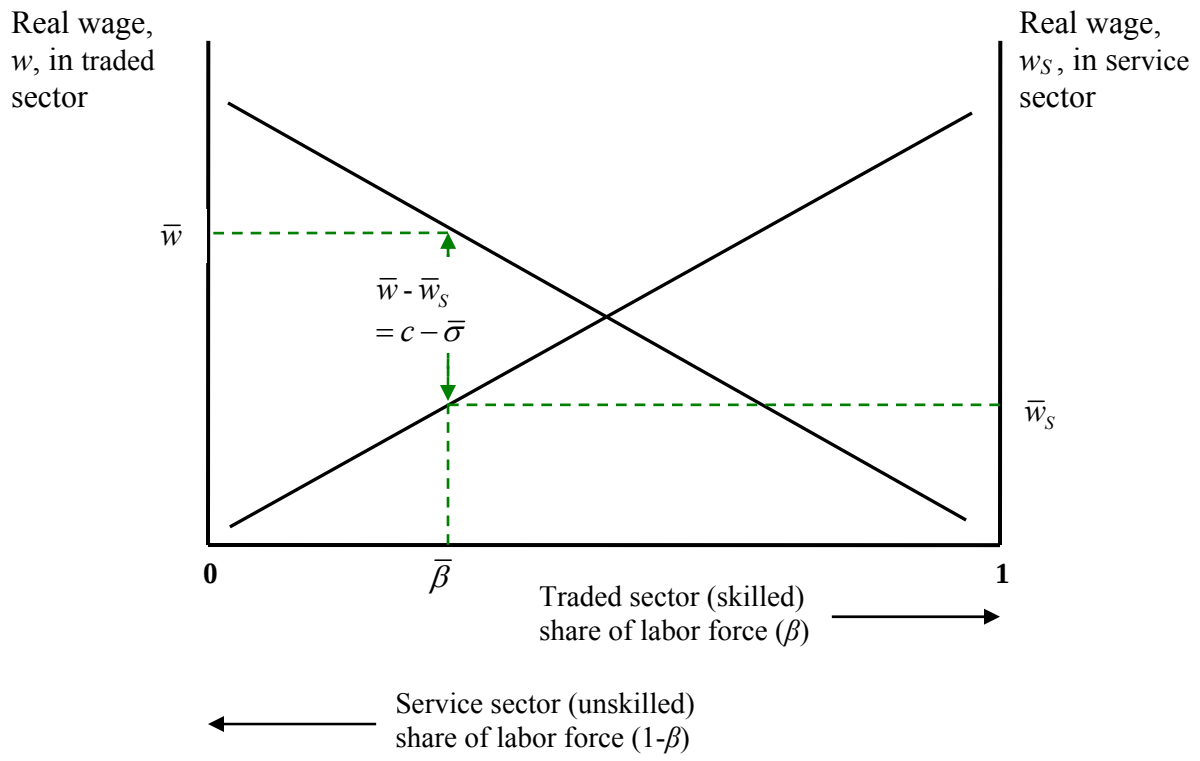
First equation: The *T* sector union sets a real wage which declines as β increases, as shown by the solid black line sloping down from left to right in Figure 3. The intuition is straightforward. The demand for the traded good in our generic economy depends on total world demand and the relative price of the traded good. As the proportion, β, of the workforce in *T* increases, the union has to accept a lower real wage to enable firms in *T* to set a lower relative price and hence increase net export demand and employment.

Second equation: A similar relationship holds for the services sector. The demand for the services sector in our economy depends on national income and the relative price of services. As the proportion of the workforce in services, $1-\beta,$ increases, the real wage has to fall to allow the relative price of services to fall sufficiently to raise the demand for (and employment in) services. This relationship is also illustrated in Figure 3 (the other black line), where an increase in the demand for services is a move *left* along the horizontal axis.

Third equation. This equation relates to investment in skills. Assume there is a cost, *c*, of acquiring the specific skills necessary to work in the *T* sector, which may be offset by a subsidy from the state of σ. Then in equilibrium there will be some relationship between the net cost of training to the individual,

$c-\sigma$, and the return to the training which can be approximated by $w-w_S$. Assume that if $w-w_S > c-\sigma$ more individuals train and therefore move from the services to the traded goods sector. Thus the long-run equilibrium is $w-w_S = c-\sigma$. If the government subsidy is $\bar{\sigma}$, then the corresponding long-run equilibrium is the dashed line in Figure 3. What this shows is that when the proportion of workers in *T* is $\bar{\beta}$ and in *S* it is $1-\bar{\beta}$, the gap between real wages in the two sectors is $\bar{w}-\bar{w}_S$. If the wage gap is equal to $c-\bar{\sigma}$ as shown by the vertical arrowed line there is no further incentive for *S* workers to train and move to *T*.

Figure 3. Real wages and the distribution of labor across two sectors



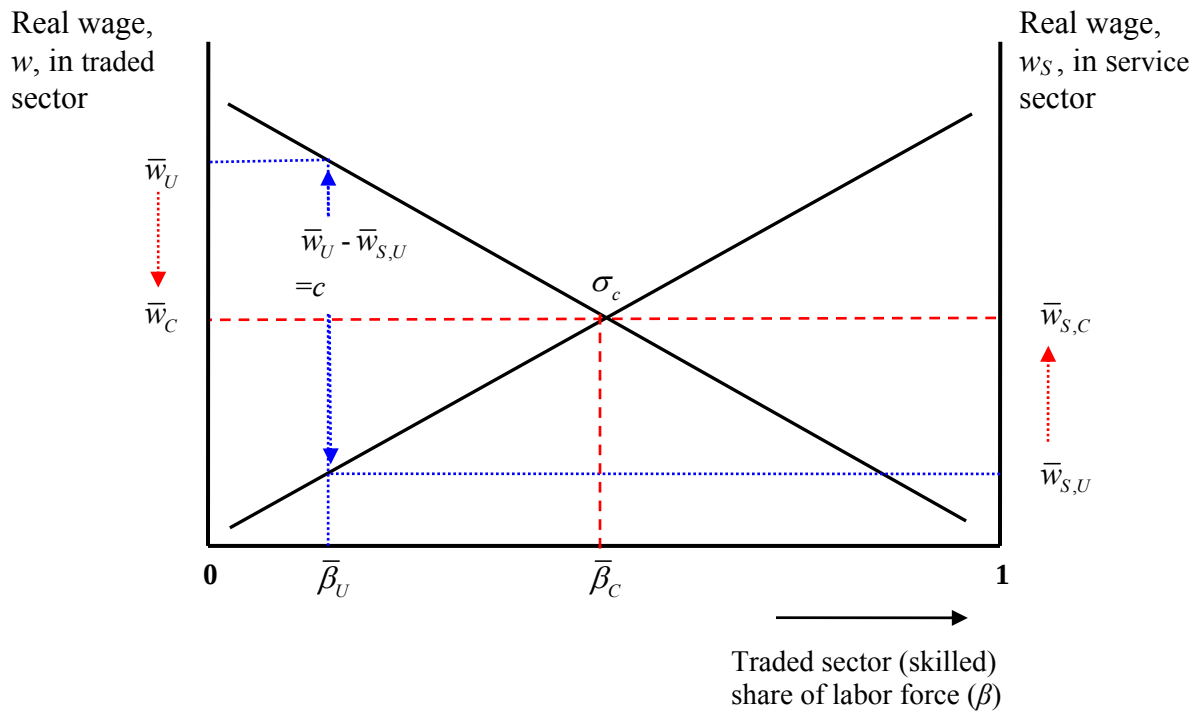
2.3 The role of wage bargaining.

Now we distinguish between coordinated *C* and uncoordinated *U* collective bargaining systems.[1] In *C* the centralized confederation has as an objective to secure equal wages for all its members (the horizontal dashed line in Figure 4). Such "wage solidarism" conforms to an old and very robust finding in the literature on wage-setting systems: the more encompassing is bargaining , the more compressed are wages are (see Freeman 1988; Iversen 1999; Wallerstein 1999; Rueda and Pontusson 2000). While there are several explanations for the underlying political-economic logic – including an interest in redistribution by the median union member, insurance against wage losses, and ideological commitments –in our model it is a bargain between the S- and T-sector unions, in which government plays a supporting role. We argue below that role of the government differs with partisanship, which is itself tied to the electoral system. What matters here is the possibility that an encompassing union can strike a bargain with center-left coalition governments, whereby in exchange for a subsidized training system it will ensure that wages are suitably held down in the *T* sector and suitably increased in the *S* sector. To illustrate this, we contrast the *C* case in which a center-left government provides a complete subsidy of $\sigma_C = c$ and the *U* case in which a center-right government gives no training subsidy, $\sigma_U = 0$. In Figure 4, the *U* case is where $\overline{w}_U - \overline{w}_{S.U} = c$ implying in the *U* equilibrium that $\beta = \overline{\beta}_U$. In the *C* case, we assume the *C* confederation has sufficient power to require its union in the *T* sector to impose the lower wage $\overline{w}_C$ on its members while allowing its *S* sector union to bargain the same wage $\overline{w}_{S,C} = \overline{w}_C$ in the "low skilled" service sector. The center-left government, seeing that the *C* confederation has the power to compress wages in this way (suggested by the arrows down in the left and up in the right margin) is prepared to subsidize training. [Here we assume for simplicity there is a complete subsidy, $\sigma_C = c$; we relax this assumption in the next section where it is modeled as an outcome of coalition bargaining.]

---

[1] We use coordinated and centralized bargaining interchangeably.

Figure 4. The effect of coordinated wage bargaining on relative wages and employment



It is not difficult to see that two opposite problems can arise in the centralized bargaining case: (i) If the confederation has insufficient power to control the *T* union (or the *T* union cannot control its existing members) the *T* wage will be pushed too high to employ all the newly trained workers. In this case $\overline{w}_C > \overline{w}_{S,C}$ and the unemployed skilled workers then seek work in the *S* sector preventing the *S* wage from rising. Or (ii) if by contrast the government fails to deliver on training, but the confederation tries to compress wages, then there will be wage drift in the *T* sector and unemployment in the *S* sector. Exports will also be hurt to the extent that fewer workers invest in training in response to a smaller gain in wages.

If however the confederation is strong, $\overline{w}_C = \overline{w}_{S,C}$, and the government is prepared to accommodate wage compression through subsidization of training, $\sigma_C = c$, we get the first result of the model:

Result 1*:* The *C* economy will have a higher proportion of the workforce in the traded sector than the *U* economy, that is $\overline{\beta}_C > \overline{\beta}_U$.

2.4. Real exchange rates and competitiveness

The effects of wage setting on exchange rates and competitiveness are captured by two additional equations:

Fourth equation. International competitiveness, measured as relative unit labor costs is inversely correlated with the real wage divided by labor productivity in the *T* sector. Intuitively, since the real wage is lower in the *C* economies and since productivity is assumed the same, this implies higher international competitiveness. (The Appendix shows that this intuitive relationship is not quite self-evident.)

Result 2*:* International competitiveness is higher in the *C* economies than in the *U* economies.

Result 2 also implies higher exports in *C* economies (as a proportion of GDP) so long as the government accommodates wage compression through training subsidies. If not, exports firms cannot meet international demand and output and exports will fall over time as fewer workers invest in training. The effect of centralized wage-setting on exports is thus conditional on government training policies.

Fifth equation. The real exchange rate (ratio of the consumer price index, P_C, to the world consumer

price index, P_C^*) -- is positively correlated with the service sector real wage.[2] The reason is as follows. The service sector real wage is $w_S \equiv W_S / P_C$. P_C is the weighted average of the service sector price level, P_S, and the world price of tradables, P_T^* (in which the price of the domestically produced tradable has an insignificant weight with large *N*). P_S is a mark-up on service sector costs of production, namely the service sector wage divided by the service sector labor productivity, and with the specific assumption of Bertrand pricing $P_S = W_S / l_S$. So

$$P_C = \alpha P_S + (1-\alpha)P_T^* = \alpha W_S / l_S + (1-\alpha)P_T^* \rightarrow 1 = \alpha \left(\frac{W_S}{P_C} \right) / l_S + (1-\alpha)\frac{P_T^*}{P_C^*}.\frac{P_C^*}{P_C}$$

$$\rightarrow 1 = \alpha w_S / l_S + (1-\alpha)\frac{P_T^*}{P_C^*}.\frac{1}{q}$$

where $q \equiv P_C / P_C^*$ is the real exchange rate[3]. Hence a rise in w_S, the service sector real wage, implies a rise in *r*, the real exchange rate.[4]

The intuition here is that service sector wages affect the consumer price index but the wage in the traded sector does not (or only minimally) because traded sector prices are largely set abroad. So the higher are service sector wages the higher will the (inverse of the) real exchange rate be:

Result 3*:* The real exchange rate is higher in *C* economies than in *U* economies, because service sector wages are higher in *C* economies.

---

[2] In economics the real exchange rare is technically the *inverse* of P_C / P_C^* but in line with common usage we equate a high real exchange rate with a high price level.

[3] In common with much of the flex price literature we ignore the nominal exchange rate, since we are interested in real variables. As can be seen in the above equation, for example, $\partial r / \partial w_S$ is independent of it.

[4] Note that since utility functions are assumed identical across economies α is constant across economies.

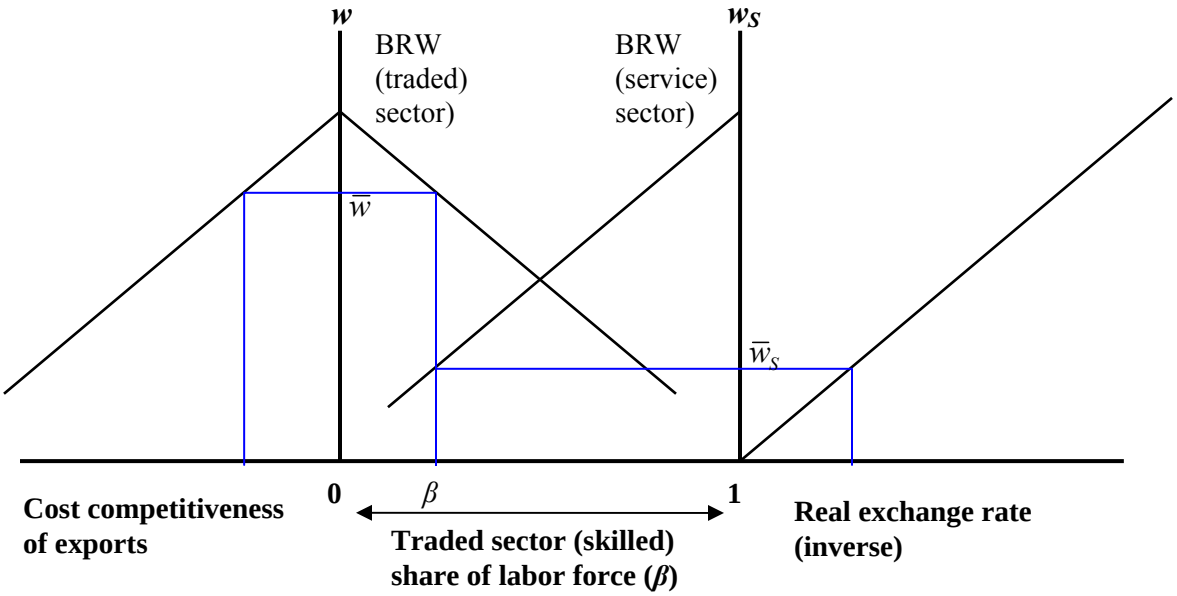
The three key results are illustrated in Figure 5 (and proved in the Appendix). Panel a) shows the uncoordinated case where wages are bargained separately in the two sectors. The center portion of the figure shows the bargained real wage (BRW) in the two sectors and the corresponding allocation of labor across the two sectors (the line projection). Wages in the service sector determine the real exchange rate since a) this is set by the consumer price index when the nominal exchange rate is given, and b) the consumer index is a weighted average of world prices on traded goods and prices on non-traded goods. With wages in services relatively low, the (inverse) real exchange rate is also low. Conversely, prices on exports, and hence cost competitiveness, are determined by wages in the export sector. The higher wages are, the lower is international competitiveness.

Panel b) shows what happens to the results when wage bargaining is centralized and wages are set identically in the two sectors. The comparative statics are captured by the effects labeled i, ii, and iii. First, because wages in the export sector is lower than the uncoordinated case, cost competitiveness is higher (effect i). This can be seen by comparing the red and blue line projections. Secondly, lower wages also implies higher employment shares as exporters hire more workers.

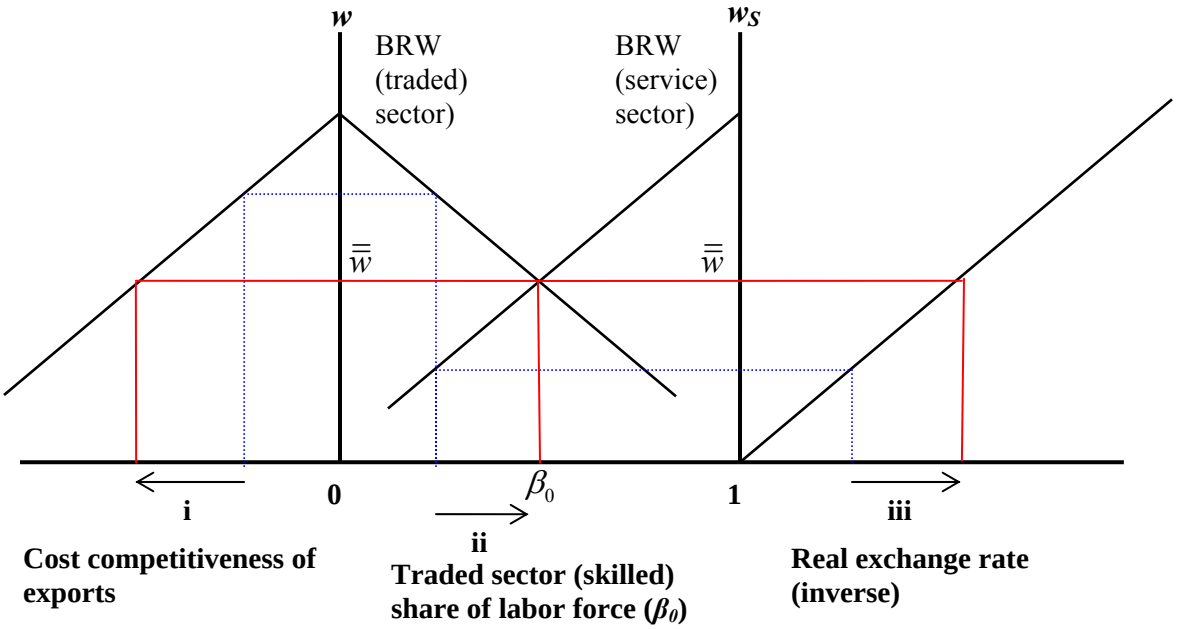
Conversely, relatively higher wages in services implies a smaller share or the labor force will be employed in that sector (effect ii). Finally higher relative wages push up prices on non-tradables, which increases the consumer price index and the real exchange rate (effect iii). Consequently, if countries vary in terms of the degree of centralization in their wage-setting institutions, high competitiveness will go hand in hand with high real exchange rates.

Figure 5. The relationship between the bargained real wage, the real exchange rate, cost competitiveness, and the allocation of labor

a) Uncoordinated bargaining



b) Coordinated bargaining



2.4. ***The role of government coalitions***

As noted above if public subsidies for training are low, solidaristic wage policies by an encompassing union will be problematic because it produces an under-supply of skilled workers and an oversupply of unskilled workers. Even if we assume that the confederation is very powerful, it is not difficult to see that it will find it difficult to prevent wage drift among high-wage workers, or outright defection by the high wage union, as the distance between the coordinated and uncoordinated wages increases. At some point of low public subsidization of training centralized bargaining therefore breaks down. With high subsidization, on the other hand, coordinated wages are sustainable as it brings supply of labor into line with the demand at bargained rates (at $\sigma_C = c$ in Figure 4). Because there is a strategic complementarity between wage-setting and public training, we need to endogenize the government decision to invest in training. Since this decision is shaped by electoral institutions there is an equilibrium relationship between these and real exchange rates, which is what Rogowski and Kayser find.

In the simple game developed here the government is assumed to be a minimal winning coalition of parties representing economic groups. In our setup the groups are low-wage unskilled workers (L), medium-wage skilled workers (M), and high-wage professionals (H). We assume that both the bargaining system (U or C) and the electoral system (PR or majoritarian) are exogenous, so that there are four possible games of which we consider two, that in which there is a centralized union and a PR electoral system, and that in which there are many unions and a majoritarian electoral system. In both games there are two moves in which the government first chooses an educational policy and the union(s) choose wages in the knowledge of the government's policy proposal.

For simplicity we assume that the high income group H (professionals) gain their income directly from world markets and have a taxable capacity of $\overline{T}_H$ where for convenience this taxable capacity is equal to the cost of training enough of the non-professional workforce to equalize wages in the traded and sheltered sectors, $\overline{T}_H = c\overline{\beta}_1$, where $\overline{\beta}_1$ is defined by the proportion of trained workers in the economy

such that $w = w_S = \overline{\overline{w}}$, or what we may refer to as "full" training. If training is only private $w = \overline{w}$ and $w_S = \overline{w}_S = \overline{w} - c$. Among L (which make up the share $1-\beta$ of the non-professional workforce) $\overline{\beta}_1 - \beta$ will train if training is public. For mathematical convenience the taxable capacity of the non-professional workforce is assumed to be zero.[5] Next we assume that the government can raise taxes of:

$$T \le \overline{T}_H$$

and use this (i) to fund a fully public training scheme, or (ii) distribute it as cash of $c\beta$ to M and $c(\overline{\beta}_1 - \beta)$ to L – ie what would have been spent on each group for training if there had been "full" training, or (iii) any linear combination of (i) and (ii).[6] Thus:

$$\overline{T}_H \ge T = \alpha c\overline{\beta}_1 + (1-\alpha)\left[c\beta + c(\overline{\beta}_1 - \beta)\right] = c\overline{\beta}_1$$

In terms of preferred policies,

(i) H prefers $T = 0$ (so M and L both get 0).

(ii) M prefers $T = \overline{T}_H$, cash distribution of $c\beta_0$ and $w = \overline{w}$ (so H pays $\overline{T}_H$ and L gets $c(\overline{\beta}_1 - \beta_0)$ with $w_S = \overline{w}_S$). Cash is always better than a training subsidy for M because cash does not negatively affect skilled wages.

(iii) L prefers full training with $w_S = \overline{\overline{w}}$ (so H pays $\overline{T}_H$, and M gets free training and $w = \overline{\overline{w}}$).[7]

---

[5] A sufficient assumption is that the taxable capacity is declining in income.

[6] Note that this implies that L always shares in government spending, an assumption that is analogous to the stipulation in the Iversen-Soskice (2006) model that net transfers are non-regressive.

[7] That L prefers training to cash implies an assumption, but we think it is one that is likely to hold: with full cash, L gets

$$(1-\beta)\overline{w}_S + c(\overline{\beta}_1 - \beta)$$

while with full public training L gets

$$(1-\beta)\overline{\overline{w}}$$

Now consider the two political systems. Following Iversen and Soskice (2006), we assume there are two parties in the majoritarian system, one of which can be thought of as representing some part of M and H (*MH* or the centre-right party), the other M and L (*LM* or the centre-left party), while in the PR system there are three parties *H, M* and *L* each representing the relevant social group (italicization indicates parties as opposed to groups)[8].

In the Majoritarian game M is the decisive voter and is indifferent between *MH* and *LM*, both of whom propose a full cash distribution. This result will be somewhat modified if governments cannot fully commit to an M platform, but as long as the probability of reneging on electoral promises is not too high it will not affect the conclusion that most spending is cash and that training is all or mostly private. When training is private, in the second stage of the game the decentralized union(s) set $w = \overline{w}$.

In the PR game *M* is formateur and has to choose between a coalition with *H* and a coalition with *L*.[9] In each case we assume the coalition splits the difference between ideal points, which follows straightforwardly from Rubinstein bargaining theory when discount rates are the same and neither party enjoy a first-mover advantage. Hence in the *MH* coalition, since M's preference is for a full cash distribution in which case M gets $c\beta$ (which requires $T = \overline{T}_H$); and H's preference is for $\overline{T}_H = 0$; then splitting the difference implies that H pays $\overline{T}_H / 2$ and M gets $c\beta / 2$ (with L getting $c(\overline{\beta}_1 - \beta)/2$). Note

---

So the condition is

$$\frac{\overline{\overline{w}} - \overline{w}_S}{c} = \frac{\overline{\overline{w}} - \overline{w}_S}{\overline{w} - \overline{w}_S} > \frac{\overline{\beta}_1 - \beta}{1 - \beta}$$

This holds so long as traded sector wages don't fall too far, and the proportion of remaining sheltered sector workers isn't too small. If there are externality effects on overall productivity this is likely to hold. Relatedly, the reason that an unskilled worker will not use his or her cash benefit for training is that the positive externality on the wages of those remaining unskilled is discounted. So despite the aggregate gain of training for L as a group, for the individual *c* never exceeds the wage gain from being skilled.

[8] In the language of Bawn and Rosenbluth (2007) the government in the majoritarian system is a party which is a coalition of groups, while in the PR system the government is a coalition of parties each representing social groups.

that, since it is only the size of the cash distribution which is being bargained over between *M* and *H*, $w = \overline{w}$ so the full payoff under *MH* is $\beta\left(\overline{w} + \frac{c}{2}\right)$.

In the *LM* coalition the optimal payoff to M (full cash) is $\beta\left(\overline{w} + c\right)$ and with full training $\beta\left(\overline{\overline{w}} + c\right)$. The optimal payoff to L (full training) is $(1-\beta)\overline{\overline{w}}$, with all L (and M) getting the same wage, and full cash $(1-\beta)\overline{w}_S + c(\overline{\beta}_1 - \beta)$. So long as the traded wage line and the sheltered wage line are both linear, we can split the difference with either. So M's payoff in the *LM* coalition will be:

$$\beta\left(\frac{\overline{w} + \overline{\overline{w}}}{2} + c\right)$$

Thus *M* will choose *L* iff:

$$\beta\left(\frac{\overline{w} + \overline{\overline{w}}}{2} + c\right) > \beta\left(\overline{w} + \frac{c}{2}\right)$$

and this is always true since $c = \overline{w} - \overline{w}_S$ and $\overline{\overline{w}} > \overline{w}_S$.

Hence in the PR game the *LM* coalition will form and will choose partial public training, with full training subsidy for all those trained plus a cash distribution, and the equilibrium wage in the traded sector will be

$$\overline{w}^* = \frac{\overline{w} + \overline{\overline{w}}}{2}$$

This is less than full equalization, but as we discussed in the previous section it will be difficult for the centralized union to compress wages more than what the government and training subsidy will support. Moreover this conforms to the reality of coordinated systems that there remains a difference between

---

[9] The key result that spending on training is higher under PR also follows if we assume that the formateur is randomly chosen.

skilled and unskilled earnings. That said, there is ample empirical evidence that PR and left governments are associated with more spending on primary and secondary education (Busemeyer 2007; Ansell 2008; Iversen and Stephens 2008).

The interaction between the wage-setting system and the political system can now be summarized in Table 1. A centralized bargaining system is only sustainable when the government subsidizes training, and such subsidies are higher under center-left governments, which are more prevalent in PR electoral systems. Centralized bargaining is prone to breakdown when public training subsidies are low because even powerful confederations will have difficulties keeping skilled unions in line. Since majoritarian systems are associated with lower subsidization of training, bargaining will tend to be decentralized and associated wage dispersion, low real exchange rates, and low competitiveness.

In the case of decentralized wage bargaining and PR, there will still be an incentive for skilled and unskilled workers to form government coalitions, but the incentive to spend on training subsidies will be reduced or absent since these would lead to unemployment in the T sector and inflationary pressures in the S sector. Instead, most redistribution would take the form of cash transfers. There is nothing in principle unsustainable about this, although the full competitiveness gains from centralized bargaining will not be realized. This is consistent with the one (U, PR) case that we know, namely New Zealand since 1996, where the dominant pattern has switched from center-right governments under the previous majoritarian system to center-left coalitions under PR. But there has been no significant move to mass subsidized training. Nor do we know any (C, Maj) case.

The reason for the predominance of (C, PR) and (U,Maj) has, we believe, to do with the historical origins of PR, which occurred exclusively in proto-coordinated political economies (Cusack et al 2007). Centralization is therefore strongly related to proportionality of the electoral system. A simple dichotomization of each variable would arguably produce a perfect correlation (ie, all cases would fall

into the shaded cells).[10] In turn, the relationship between PR and centralization explains why PR is linked to higher real exchange rates ("price levels") *and* higher competitiveness,. This relationship is not necessarily inconsistent with the Rogowski-Kayser model, but it does imply that there are beneficial effects of PR that offset the cost-inflating logic of PR in their model. In our model these offsetting effects occur through coordinated bargaining and public investment in skills, where both are associated with PR. The next section tests these implications.

Table 1. Coordinated bargaining, electoral systems, and economic outcomes.

	Majoritarian, center-right political system	**PR, center-left political system**
	→ *Low public subsidization of training*	→ *High public subsidization of training (or high transfers)*
Centralized/coordinated bargaining	Medium inequality, but under-investment in skills with high-skill shortages, low export performance, and small service sector	Low inequality, good export competitiveness, high real exchange rates/prices, small service sector share
De-centralized/un-coordinated bargaining	High inequality, medium export competitiveness, low real exchange rates/ prices, large service sector share	Medium inequality and service sector, but competitiveness and wage compression gains from coordination are not realized

3. Empirical tests

The strategy is to estimate real exchange rates, competitiveness, and the division of labor as a function of wage compression, centralization of wage setting, public investment in training, and PR. Each regression (or set of regressions) corresponds to one of the three puzzles in the introduction. Since real exchange rates are the dependent variable in the Rogowski-Kayser analysis, we begin there. As implied

[10] Following Castles (1994) one may see Australia and New Zealand as partial exceptions for part of the postwar period because of wage compression through the wage arbitration system, but no or little accommodation by government policies (the top left-hand cell). But this could only be done by relatively inefficient low-skill intensive production enabled by high trade barriers.

by effect iii) in Figure 5,we show that the real exchange rate is a function of the centralization of the bargaining system, with wage compression as the key intervening mechanism. The effect of PR on real exchange rates vanish once we control for centralization or wages, consistent with our argument but not with the Rogowski-Kayser model. We then show that compressed wages, centralization, public spending on education, and PR are positively related to export performance and negatively related to the share of employment in the non-traded sector. These are implications i and ii in Figure 5 above.

3.1. *Real exchange rates*

The (inverse) real exchange rate *q* – or the price level -- is defined as

(1) $$q_t = \frac{p_t}{e_t p_t *}$$

where *p* is the domestic consumer price index, and *p** is the foreign consumer price index, and *e* is the nominal dollar exchange rate. The fraction p/p* is the PPP exchange rate.

According to the law of one price *q* should equal 1. This is the null hypothesis in PPP theory. If prices are sticky, however, short term price or exchange rate shocks will not be immediately eliminated. Parity is thus achieved only after the period of time it takes for prices to adapt. To estimate this price conversion process we first express equation (1) in natural logarithms:

(2) $$\ln q_t = \ln p_t - \ln p_t * - \ln e_t$$

If PPP holds in the long run, the right-hand-side must revert to zero over time, which is equivalent to the real exchange rate being equal to 1. By implication, deviations from zero must be temporary, and any disturbance must be followed by a decay process. It is standard to model this decay process using the following equation:

(3) $$\ln q_t = \rho \ln q_{t-1} + \varepsilon_t$$

where ρ must be between 0 and 1 for disturbances to decay over time. Equivalently, by subtracting ln q_{t-1} on both sides, (3) can be written as

(4) $$\Delta \ln q_t = \delta \ln q_{t-1} + \varepsilon_t$$

where $\delta = \rho - 1$ is each period's decay in the initial deviation from PPP. For example, if $\delta = .25$ it means that disturbances are damped out at 25 percent in each period. Since we want to detect cross-national differences in deviations from PPP, we write (4) as:

(5) $$\Delta \ln q_{i,t} = \delta \ln q_{i,t-1} + \varepsilon_{i,t}$$

where i indexes countries. We control for the Balassa-Samuelson effect by including a GDP per capita variable, so that the model is

(6) $$\Delta \ln q_{i,t} = \delta \ln q_{i,t-1} + \gamma \ln y_{i,t-1} + \lambda \Delta \ln q_{i,t-1} + \eta_{i,t}$$

where $y_{i,t}$ is per capita income in country i at time t. The lagged difference term removes remaining first-order correlation, so that $\eta_{i,t}$ is spherical.[11]

Rogoff (1996) shows that the Balassa-Samuelson proposition is supported by data covering both rich and poor countries, but he also shows that per capita income fails to explain most of the variance among developed countries. This variance can be captured in a fixed effects model where real exchange rates can revert to different means, implying a systematic violation of the law of one price (see Frankel and Rose 1996, Lothian and Taylor 1996, Oh 1996, and Papell 1997). Including country-specific effects the model is:

(7) $$\Delta \ln q_{i,t} = \delta \ln q_{i,t-1} + \gamma \ln y_{i,t-1} + \lambda \Delta \ln q_{i,t-1} + \sum_{i=1}^{N} b_i d_i + \eta_{i,t}$$

---

[11] In principle, if including this term one should also include the first lagged difference of other variables, but it does not matter for the substantive results and complicates the presentation.

where d_i is the dummy variable for country *i*.

Our argument is that the persistent deviations from parity (one price) are due to cross-national differences in the institutionally mediated wage structure. We test this argument against the standard model by substituting a measure of wage compression, centralized bargaining, as well as PR, for the country dummies.

3.2. *Data*

The data on real exchange rates and real GDP per capita income are from the Penn World Tables (PWT), Mark 6.2. We focus on the post-Bretton Woods era (post-1971), and have data for 21 advanced democracies.[12] Coverage is more limited for the wage bargaining centralization variable, where we have data for 16 countries, covering between 21 and 25 years.[13] In most cases the period covered is 1973-95. The centralization measure is from Iversen (1999) and combines two dimensions of coordinated wage bargaining: the level at which bargaining takes place and the concentration of membership in unions covered by collective agreements at each level. It is defined as $\left(\sum w_j p_{ij}^2\right)^{1/2}$ where w_j is the weight accorded to each bargaining level j, ($0 \le w_j \le 1$ and $\sum w_j = 1$), and p_{ij} is the share of workers covered by union (or federation) *i* at level *j*. It is essentially a measure of the extent to which wage setting is "encompassing" in the sense of wages being determined for all workers within as well as across industries. A value of one would mean that all wages are set at the national level where the labor side is represented by a single confederation. As such it approximates the notion of centralization that we have

[12] The countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

[13] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, United Kingdom, and United States.

used in the theoretical model, and centralization has been shown to relate closely to cross national differences in wage compression, especially at the lower end of the distribution (see Wallerstein 1999; Iversen 1999; Rueda and Pontusson 2000).[14] (Since this measure shows periods of considerable volatility, which are unlikely to be related to short-term changes in our dependent variables, we use a five year moving average.)

We calculate wage compression using two different measures. One is OECD's estimate of the earnings of a full time worker at the bottom decile of the earnings distribution as a share of the earnings of a full time worker at the median (d1/d5 earnings ratios).[15] These data are available for all the 16 countries for which we have centralization data, but the time coverage varies a great deal from country to country. Of the 379 country-years for which we have centralization data, there are 268 country-years with d1/d5 earnings data. The second wage compression measure is hourly wages in retail, wholesale, hotels and restaurants (RWHR) relative to hourly wages in manufacturing (MAN). The former is used as a proxy for wages in non-traded services and the latter for wages in traded industry (it is referred to below as the relative non-traded sector wage). The data are based on industry earnings data from the 1998 OECD International Sectoral Data Base (ISDB) and cover 14 of the 16 countries with centralization data, for a total of 323 country-years. As expected, relative RWHR earnings are always below one. The correlation with the d1/d5 measure is .73.[16]

---

[14] It should be noted that this logic does not necessarily require wages to be institutionally coordinated across sectors. The relative price effect will occur whenever the wage leaders in nontraded industries, based on their labor market power, are able to keep up with wages in traded sectors, *and* wages within the sector are tightly coupled as a result of intra-industry wage coordination. This does not change the relationship between centralization, wage compression, and prices.

[15] The numbers are averages for the period from 1979 when data starts in most countries, to the early 1990s.

[16] The OECD also publishes a more comprehensive industry data set, STAN, which would enable us to include one additional country. But the recorded wages in STAN include both part- and full-time employees and therefore does not control for differences in the composition of employment. The

Finally, we use the 0-1 dummy variable for PR as defined in Rogowski and Kayser (2002).[17] The countries coded as majoritarian (or SMD) are Australia, Canada, France, New Zealand, United Kingdom, and the United States – the rest are coded as PR. More refined measures of electoral systems, such as Lijphart's effective threshold measure or Gallagher's disproportionality measure (see Lijphart 1999), yield the same substantive results and are omitted for presentational economy.

3.3. *Findings for real exchange rates*

Table 2, model (1) shows the results of estimating equation (6) on the complete data for the 21 OECD countries in the post-Bretton Woods era (1972-2000). Note that the parameter on the lagged dependent level variable is negative so that deviations from PPP dampen over time. This process of mean reversion is slow, however, with a half-life of almost 4 years. When we control for country-specific effects, as in model (2) of Table 2 (using the US as the reference country), there is a notable increase in the explained variance, and an F-test unambiguously shows that the country dummies belong in the model. Moreover, the half-life of deviations from parity is now significantly reduced to 2 years[18]. This is more consistent with a sticky price hypothesis, and similar to existing estimates. The key insight for our purposes, however, is the fact that real exchange rates in many countries *never* converge to PPP. To find out how much the real exchange rate of a country is undervalued (or the exchange rate overvalued) we take the inverse log of the parameter for that country's dummy and subtract 1 (parity) from the result. The long-run equilibrium value is determined by dividing by $-\delta$ (the parameter on the lagged dependent level variable). Using this formula, the (inverse) Swedish real exchange rate, to take a specific example, turns

---

correlation between this measure and the d1d5 ratios is therefore only .39. Still all the results go through at a .01 significance level using this alternative wage compression measure.

[17] Their variable is actually a dummy for majoritarian (SMD) systems, which we reverse to get a dummy for PR instead.

out to be an average of 30 percent overvalued compared to the US dollar. Hence, a dollar would on average buy you 30 percent less in Sweden than in the US during the period 1973-97. That is equivalent to 7600 dollars in 2000 prices.

Table 2. Change in real exchange rates for 14-23 OECD countries, 1972-2000[1)]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.56***	0.64**	1.76***	1.13***	1.44***	1.22***	1.01***	1.12***
	(0.17)	(0.24)	(-0.37)	(0.29)	(0.37)	(0.32)	(0.28)	(0.29)
ln(real exchange	-0.15***	-0.27***	-0.32***	-0.23***	-0.25***	-0.25***	-0.22***	-0.23***
rate) (t-1)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
ln(GDP per	0.06**	0.06**	0.18**	0.12**	0.13**	0.13***	0.11**	0.12**
capita) (t)	(0.02)	(0.02)	(0.04)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
ln(Centralization	-	-	-	0.023***	0.000	0.018**	-	0.019**
of bargaining)				(0.007)	(0.010)	(0.008)		(0.009)
d1/d5 wage	-	-	-	-	0.24***	-	-	-
ratio (t-1)					(0.08)			
Relative non-traded	-	-	-	-	-	0.095***	-	-
sector wage						(0.036)		
PR electoral	-	-	-	-	-	-	0.027***	0.010
system							(0.010)	(0.013)
Australia	-	0.03	0.07	-	-	-	-	-
Austria	-	0.00	0.02	-	-	-	-	-
Belgium	-	0.04	0.08	-	-	-	-	-
Canada	-	0.02	0.05	-	-	-	-	-
Denmark	-	0.06	0.09	-	-	-	-	-
Finland	-	0.07	0.12	-	-	-	-	-
France	-	0.03	0.07	-	-	-	-	-
Germany	-	0.03	0.07	-	-	-	-	-
Greece	-	-0.03	-	-	-	-	-	-

[18] This is in line with Wu (1996) 2.3 years, Papell (1997) 2.5 years and Oh (1996) 1 to 2 years; they use the related method of measuring real exchange rates as deviations from the national mean.

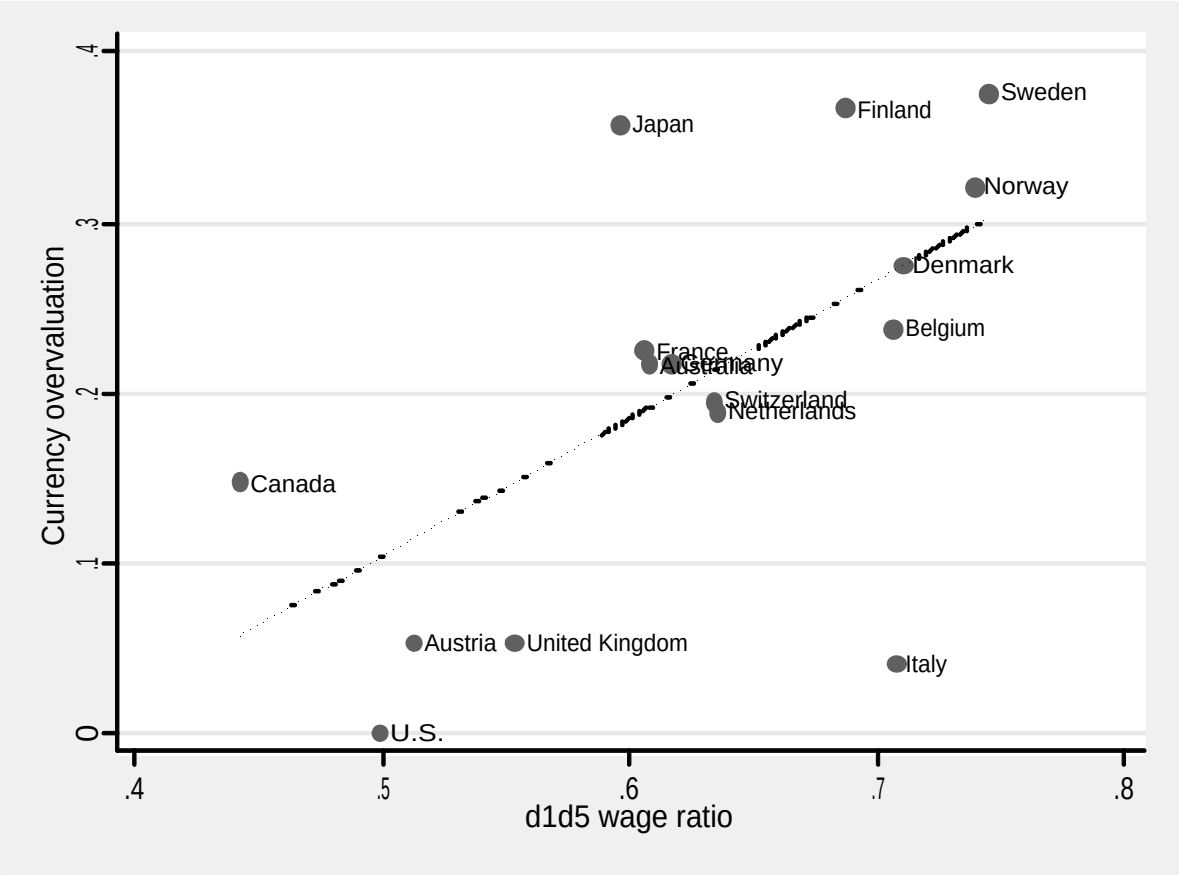
Ireland	-	0.04	-	-	-	-	-	-
Italy	-	-0.02	0.02	-	-	-	-	-
Japan	-	0.08	0.11	-	-	-	-	-
Netherlands	-	0.03	0.06	-	-	-	-	-
New Zealand	-	-0.04	-	-	-	-	-	-
Norway	-	0.07	0.10	-	-	-	-	-
Portugal	-	-0.10	-	-	-	-	-	-
Spain	-	-0.03	-	-	-	-	-	-
Sweden	-	0.08	0.12	-	-	-	-	-
Switzerland	-	0.07	0.06	-	-	-	-	-
United Kingdom	-	-0.00	0.02	-	-	-	-	-
Lagged	0.38***	0.41***	0.42***	0.40***	0.35***	0.44***	0.40***	0.39***
difference term	(0.04)	(0.04)	(0.05)	(0.04)	(0.06)	(0.05)	(0.04)	(0.05)
Adj. R-squared	.196	.273	.289	.250	.222	.282	.243	.250
No of observations	609	609	379	379	268	323	379	379
No of countries	21	21	16	16	16	14	16	16

Notes: Significance levels: ***<.01; **<.05 (standard errors in parentheses). [1)] Exchange rates are measured against the US Dollar, and expressed in logged differences. The reference country for the country dummies is United States.

Sources: Real exchange rates and real per capita GDP in 2000 prices: Penn World Tables (PWT), Mark 6.2; d5/d1 ratios: *OECD Electronic Data Base on Wage Dispersion*. Undated (but released in 2004 and 2006); relative hourly wages in retail, wholesale, hotels and restaurants (RWHR) as share of the hourly wages in manufacturing (MAN): International Sectoral Data Base (ISDB), OECD 1998; centralization of bargaining: Iversen (1999); SMD dummy: Rogowski and Kayser (2002).

For the smaller sample of 16 countries where we have centralization data (column 3) the overvaluation of the Swedish krona is nearly 40 percent, and the average currency deviations from parity are also larger. Our argument is that if wages are set through collective bargaining the most important determinant of the price effects of productivity differences is the extent of cross-industry wage coordination. The effect of wage compression is illustrated in Figure 6, which shows the relationship between earnings compression and the percentage overvaluation of countries' real exchange rates (using the estimates of the fixed effects from model 3, and the procedure described in the Swedish example above). The dispersion measure used here is OECD's d5/d1 ratios.

Figure 6. Compression of wages and currency overvaluation.



Note: Currency overvaluation is the long-term price level in a country minus the price level in the US, expressed as a share of the US price level (eg., a value of .1 means that the price level is 10 percent higher than in the US).

The relationship is in the predicted direction and moderately strong (r=.60). For example, the three egalitarian Scandinavian countries have significantly "overvalued" exchange rates, whereas three inegalitarian countries -- Britain, Canada and the US -- have relatively undervalued currencies. Italy is clearly an outlier, exhibiting a compressed wage structure but also a relatively "cheap" currency. This may in part reflect measurement issues because whereas on the d1d5 measure it is tied for the 4th rank, on the nontraded sector wage measure it is 9th . Omitting Italy, the correlation between d1d5 ratios and

overvaluation is 0.77. If we use the relative nontraded sector wage as the compression measure, the correlation .68 including Italy.

Wage compression is in turn a function of the centralization of the wage-setting system. The correlation between the two variables is .65, and centralization is also positively associated with the real exchange rate (r=.60). The latter effect is estimated more precisely in model (4) of Table 2 where centralization takes the place of the country dummies. Not surprisingly, given the correlation between the centralization variable and the fixed effects, there is a strong positive impact of centralization on real exchange rates. A one standard deviation increase in centralization raises the expected long-term real exchange rate by one quarter of a standard deviation or 7.1 percent. That is equivalent to an average of 1750 dollars in 2000 prices.

In models (5) and (6) we include wage compression as a variable to make the simple point that much, if not all, of the effect of centralization runs through the wage structure. If we use d1/d5 ratios, the entire direct effect of centralization disappears, whereas wage compression now explains much of the variance in real exchange rates. A standard deviation increase in the wage of a worker in the bottom decile relative to a worker at the median raises the equilibrium real exchange rate by 9.2 percent. The corresponding figure when using the relative nontraded wage is 6.4 percent if centralization is included and 8.8 percent if it is omitted. Centralization appears to have a residual direct effect on the real exchange rate after controlling for the nontraded sector wage, which suggest that the latter measure does not capture to entire wage effect of centralization. Be that as it may, it seems safe to conclude that centralization raises the real exchange rate and that much, if not all, of this effect runs through wage compression.

In model (7) we include the dummy for PR electoral systems (simply one minus the Rogowski-Kayser dummy for SMD). Note that the variable registers no effect when centralization is also included in the model. The same is true if we use Lijphart's effective threshold measure or Gallagher's disproportionality measure. When we omit centralization (model 8), electoral system does have the effect

on real exchange rates in the direction that Rogowski and Kayser predict. The magnitude of a 12.4 percent reduction in equilibrium prices in SMD systems is in fact slightly larger than the effect of 10.4 percent that Rogowski and Kayser report. But this is entirely a result of an omitted variable bias (the effect of the bargaining system). In this specification the electoral system affects real exchange rates through a different mechanism than in the Rogowski and Kayser model.

3.4. *Findings for competitiveness and the division of labor*

The electoral system is still important to our story because it affects partisanship and facilitates investment in skills, hence also both competitiveness and the division of labor. Unlike the Rogowski-Kayser model, our argument implies that PR countries will outperform majoritarian countries in international competition and promote employment in high-productivity exports. Centralized wage bargaining will have they same effects, corresponding to consequence i and ii in Figure 5b.

As in Figure 1, we measure export competitiveness as a country's share of OECD exports to its share of OECD output (GDP). It varies between .4 and 4.9. Since this ratio is partly a function of the size of the internal market, as well as overall productivity, we control for population and income per capita. The division of labor is measured as manufacturing employment as a share of total employment in manufacturing and in retail, wholesale, hotels and restaurants (RWHR) (identical to Figure 2). Manufacturing is a highly traded sector while RWHR is largely non-traded, so the variable roughly corresponds to β (the share of jobs in the export sector) in the theoretical model. In principle it can vary between 0 and 100 percent, but the observed range in our date is from 35 to 67. We use levels as a dependent variable and corrects for first order correlation within each series (Prais-Winsten regression).[19] To de-trend the data we include year dummies. Following Beck and Katz (1995), the reported standard

[19] The alternative of using a lagged dependent variable makes the regression stationery.

errors correct for heteroskedasticity and contemporaneous correlation. The results are shown in Table 3, excluding the time dummies.

For export performance the effects of PR and bargaining centralization are interactive. Centralization of wage bargaining undermines export performance when the electoral system is majoritarian, but it improves performance when the electoral system is PR. This finding is entirely consistent with the predictions in Table 1. Our explanation is that centralization hurts export performance if skill formation is privately financed since wage compression undermines individual incentives to invest in skills. We know from past research that public subsidization of training is lower in (center-right dominated) majoritarian than in (center-left dominated) PR systems. Only in the latter are firms therefore able to take full advantage of lower wages for high-skilled workers.

Our results imply that export performance in a PR country with a centralized bargaining system (defined as one standard deviation above the mean) is 32 percent higher than in a PR country with a decentralized system, assuming that the share of OECD exports in the latter equals its share of OECD output. Conversely, in a counterfactual experiment, these estimates imply that export performance would be 29 percent lower in a majoritarian country with centralized bargaining than with decentralized bargaining.

Keeping centralization constant, PR always increases competitiveness, but the effect is stronger in a centralized system. Thus, when bargaining is centralized (one standard deviation above the mean),

Table 3. Export performance and the division of labor in 15-16 OECD countries, 1973-1995[1)]

	Export performance (Share of OECD exports divided by share of OECD output)	**Division of labor** (Employment in manufacturing as pct share of total employment in manufacturing and retail, wholesale, hotels and restaurants)
Intercept	11.62*** (2.81)	163.91*** (12.74)
ln(Population)	-0.30*** (0.04)	2.58*** (0.42)
ln(GDP per capita)	-0.80*** (0.29)	-14.12*** (1.37)
PR electoral system	1.32*** (0.32)	8.30*** (1.83)
ln(Centralization of bargaining)	-0.22*** (0.08)	1.43** (0.68)
PR * Centralization	0.46*** (0.18)	-0.32 (1.04)
Adj. R-squared	0.57	0.91
No of observations	364	355
No of countries	16	15
Rho	0.90	0.93

Notes: Significance levels: ***<.01; **<.05 (standard errors in parentheses). Both regressions include year dummies (not shown)

Sources: Exports, output, and employment data from the OECD Stan Data Base. Population and real per capita GDP (in 2000 prices) data are from the Penn World Tables (PWT), Mark 6.2; centralization of bargaining index is from Iversen (1999).

PR increases competitiveness by over 90 percent (again assuming that the starting point is a country with equal shares of OECD exports and output). When bargaining is decentralized (one standard deviation below the mean), the estimated effect is 37 percent. Since there is little off-diagonal variance (ie., PR

systems with uncoordinated bargaining and majoritarian systems with coordinated bargaining) the results must be viewed with some caution. But it seems fair to conclude that any adverse effects on competitiveness due to product market regulation of the type associated with PR in the Rogowski-Kayser model are more than made up for by the beneficial effects of PR on competitiveness through the collective bargaining system and skill formation, PR is associated with *better* export performance.

The results for the division of labor (second column in Table 3) show that PR, as expected, is associated with a higher share of manufacturing employment. Centralized bargaining has the same effect, and this is true regardless of the electoral system (note the insignificant interaction term). The likely reason that centralization does not reduce employment in manufacturing when the electoral system is majoritarian, even though it is associated with lower export competitiveness when that is the case, is that centralization also negatively affects employment in nontraded services. Thus, the net effect is ambiguous. On the other hand, the theory is unambiguous in predicting that PR and centralized bargaining in combination will be associated with a higher share of employment the export sector. This is strongly confirmed by the results. A country with PR and centralized bargaining (again defined as one standard deviation above the mean) has a share of employment in manufacturing that is 10.5 percent higher than in a country with majoritarian institutions and decentralized bargaining. Considering that the mean share of employment in manufacturing is 52 percent, this is clearly a very meaningful result.

4. Conclusion

There are two interrelated core arguments in our paper: First, centralization of wage bargaining, since it implies the compression of wages between the skilled export sector and the less skilled sheltered sector and hence high wages in the latter, leads to relatively high prices in the sheltered sector; since the prices of traded goods are largely determined in world markets, and since the consumer price index is a weighted average of prices in the traded and sheltered sectors, high prices in the sheltered sector imply

high consumer prices and hence a high real exchange rate. This goes a long way, we submit, in accounting for the long-standing purchasing power puzzle in political economy. But centralized bargaining also implies that wages in the export sector are lower, which in turn explains higher international competitiveness and exports – what we have referred to as the competitiveness puzzle. Combining the two price-wage effects also explains differences across countries in the sectoral division of labor.

The second and related argument is that wage compression is only feasible in the long-term if there is a sufficient supply of skilled labor in the traded sector, and this we argue results from a political coalition behind the public provision of training in proportional representation political systems with centralized wage bargaining; by contrast, in majoritarian political systems with uncoordinated wage bargaining training is private and hence more restricted. We suggest that these two core arguments, although they may now be unraveling at the edges, reinforced each other over long periods of time.

Our model points to a very different reason for the observed correlation between PR and real exchange rates than in the Rogowski-Kayser model, and it clearly suggests a different perspective on the relationship between PR and competitiveness. Yet our argument is not necessarily contradictory to theirs. The reason is that as wage compression pushes up wages in the sheltered sector ~~rise~~ so the danger of low-cost competition to unionized employers in the sector increases. Thus both centralized union and sheltered sector employers have an aligned interest in regulating product market competition in services. Since consensus political systems exactly allow for the inclusion in regulatory policy-making of representative groups excluded from the governmental coalition, it is a short step to the regulation of competition and hence the safeguarding of profit margins in the service sector. In this perspective, the Rogowski-Kayser argument is complementary to ours, and the relationship between the two approaches seems a fruitful area for further research.

Bibliography

Adolph, Chris. 2004. *The dilemma of discretion: career ambitions and the politics of central banking*. PhD dissertation. Harvard University.

Ansell, Ben. 2008. "Traders, Teachers, and Tyrants: Democracy, Globalization, and Public Investment in Education", *International Organization* 62 (April), 2008:: 289-322.

Aukrust, Odd. 1977. "Inflation in the Open Economy: A Norwegian Model." In Lawrence Krause and Walter Salant (eds.), *Worldwide Inflation: Theory and Recent Experience*. Washington: Brookings Institution.

Balassa, Bela. 1964. "The Purchasing Power Parity Doctrine -- A Reappraisal." *Journal of Political Economy* 72 (6), 584-96.

Bawn, Kathleen and Frances Rosenbluth. 2006. "Coalition Parties versus Coalitions of Parties: How Electoral Agency Shapes the Political Logic of Costs and Benefits." *American Journal of Political Science* 50 (2), 251-65.

Beck, Nathaniel and Jonathan Katz. 1995. What to Do (and Not to Do) with Time-Series Cross-Section Data. *American Political Science Review* 89 (September), 634-48

Busemeyer, Marius. 2007. "Determinants of public education spending in 21 OECD democracies, 1980-2001." *Journal of European Public Policy* 14 (4), 582-610.

Castles, Frank G. 1994. "The Wage-Earners Welfare State Revisited. Refurbising the Established Model of Australian Social Protection: 1983-93." *Australian Journal of Social Issues* 29 (May), 120-45.

Cusack, Thomas, Torben Iversen, and David Soskice 2007. "Economic Interests and the Origins of Electoral Institutions." *American Political Science Review* 101 (3), 373-91.

Edgren, Gösta, Karl-Otto Faxen and Carl-Erik Odhner. 1973. *Wage Formation and the Economy*. London: Allen and Unwin.

Esping-Andersen, Gösta. 1990. *The Three Worlds of Welfare Capitalism*. Princeton: Princeton University Press

Flanagan, Robert J., David W. Soskice and Lloyd Ulman. 1983. *Unionism, Economic Stabilization, and Incomes Policies: European Experience*. Washington, D.C.: The Brookings Institution.

Frankel, Jeffrey A., Andrew K. Rose. 1996. "A Panel Project on Purchasing Power Parity: Mean Reversion Within and Between Countries." *Journal of International Economics* 40 (1-2), 209-224.

Freeman, Richard. 1988. "Labor Market Institutions and Economic Performance." *Economic Policy* 6 (April), 62-80.

Hall, Peter A. and Robert Franzese. 1998. "Central Bank Independence, Coordinated Wage-Bargaining, and European Monetary Union," *International Organization* 52 (summer), 505-35.

Iversen, Torben. 1999. *Contested Economic Institutions: The Politics of Macroeconomics and Wage Bargaining in Advanced Democracies*. Cambridge: Cambridge University Press.

Iversen, Torben and Anne Wren. 1998. "Equality, Employment, and Budgetary Restraint: The Trilemma of the Service Economy." *World Politics*, 50 (July), 507-46.

Iversen, Torben and David Soskice. 2006. "Electoral Institutions and the Politics of Coalitions: Why Some Democracies Redistribute More than Others." *American Political Science Review* 100 (May), 165-82.

Iversen, Torben, and John Stephens. 2008. "Partisan Politics, the Welfare State, and Three Worlds of Human Capital Formation." *Comparative Political Studies* 41, April-May, 600-37.

Katzenstein, Peter. 1985. *Small States in World Markets.* Ithaca, NY: Cornell University Press.

Lane, P.R. 2001. "The New Open Economy Macroeconomics: A Survey." *Journal of International Economics.* 54 (2), 235-266.

Lijphart, Arend. 1999. *Patterns of Democracy. Government Forms and Performance in Thirty-Six Countries*. New Haven: Yale University Press.

Lothian, James R., and Mark P. Taylor. 1996. "Real Exchange Rate Behavior: The Recent Float From the Perspective of the Past Two Centuries." *Journal of Political Economy* 104 (3), 488-509.

Melitz, Marc. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica* 71 **(**6**),** 1695-1725**.**

Oh, Keun-Yeob. 1996. "Purchasing Power Parity and Unit Root Tests Using Panel Data." *Journal of International Money and Finance* 15 (3), 405-418.

Obstfeld, Maurice and Kenneth Rogoff. 1995. *Foundations of International Macroeconomics.* Cambridge MA: MIT Press.

Papell, David H. 1997. "Cointegration and Exchange Rate Dynamics." *Journal of International Money and Finance* 16 (3), 445-459.

Peltzman, Sam. 1976. Toward a More General Theory of Regulation. *Journal of Law and Economics* 19: 211-40.

Rueda, David and Jonas Pontusson. 2000. "Wage Inequality and Varieties of Capitalism." *World Politics* 52 (3): 350-383.

Rogoff, Kenneth. 1996. "The Purchasing Power Parity Puzzle." *Journal of Economic Literature* 34 (2), 647-668.

Rogowski, Ronald and Mark Andreas Kayser. 2002. "Majoritarian Electoral Systems and Consumer Power: Price-level Evidence from the OECD Countries." *American Journal of Political Science* 46 (3), 526-539.

Samuelson, Paul. 1964. "Theoretical Notes on Trade Problems." *Review of Economics and Statistics* 46

(2), 145-54.

Scharpf, Fritz W. 2000. "Welfare and Work in the Open Economy. Constraints, Challenges and Vulnerabilities." Paper presented at the 96th American Political Association Meeting in Washington DC, August 31 - September 3, 2000.

Soskice, David. 1990. "Wage Determination: The Changing Role of Institutions in Advanced Industrialized Countries." *Oxford Review of Economic Policy* 6 (4), 36-61.

Stigler, George J. 1971. The Theory of Economic Regulation. *Bell Journal of Economics and Management Science* 2; reprinted in Stigler, *The Citizen and the State: Essays on Regulation*. Chicago: University of Chicago Press, 1975, chap. 8.

Wallerstein, Michael. 1999. Wage-Setting Institutions and Pay Inequality in Advanced Industrial Societies, *American Journal of Political Science* 43 (3): 649-680.

Wu, Yangru. 1996. "Are Real Exchange Rates Nonstationary? Evidence From a Panel-Data Test." *Journal of Money Credit and Banking* 28 (1), 54-63.

Web Appendix: New Open Economy Model

Preferences, product demand equations and price indices. There are N economies where N is a large number. Each economy I produces one traded good i with quantity, t_i, and a large number M of services, indexed j, of quantity s_{Ij}. The traded good i can only be produced in economy I. It is sold at the same price P_{t_i} in every economy (law of one price for traded goods). There is a workforce of size 1 in each economy. In economy I, β_I workers have specific skills and an hourly productivity of 1 in the production of the traded good t_i. $1-\beta_I$ workers have only general skills and an hourly productivity of $l<1$ in the production of services. (We avoid discussion of the *Professional* class by assuming that they are immobile, they provide the same traded service, and hence earn the same product real wage.) Preferences of all workers in all economies are identical and are generically given by:

$$U = C - \frac{\lambda}{2}e^2 = \left(\frac{T}{\alpha}\right)^{\alpha}\left(\frac{S}{1-\alpha}\right)^{1-\alpha} - \frac{\lambda}{2}e^2 \tag{1}$$
$$T \equiv \left(N^{\gamma-1}\sum t_i^{\gamma}\right)^{1/\gamma};\ S \equiv \left(M^{\delta-1}\sum s_j^{\delta}\right)^{1/\delta}$$

where e is the number of hours worked. (We can also interpret e as the probability of employment.) From this utility specification, the demand for T (real value of traded goods) in any one country is

$$T = \left(\frac{P_T}{P_C}\right)^{-1}\alpha C \tag{2}$$

where P_T is the (world) price index of traded goods and P_C the country-specific consumer price index. The demand for t_i in any one country as a function of T is:

$$t_i = \left(\frac{P_{t_i}}{P_T}\right)^{\frac{1}{\gamma-1}} N^{-1}T \tag{3}$$

and substituting this back into the utility function we derive P_T:

$$P_T \equiv \left(N^{-1} \sum \left(P_{t_i}^{\frac{\gamma}{\gamma-1}} \right) \right)^{\frac{\gamma-1}{\gamma}} \tag{4}$$

where for large N P_T can be taken as exogenous.

The world demand for t_i is then:

$$\begin{aligned} t_i &= \left(\frac{P_{t_i}}{P_T} \right)^{\frac{1}{\gamma-1}} N^{-1} \sum T_J = \left(\frac{P_{t_i}}{P_T} \right)^{\frac{1}{\gamma-1}} N^{-1} \alpha \sum \left(\frac{P_T}{P_{CJ}} \right)^{-1} C_J = \left(\frac{P_{t_i}}{P_T} \right)^{\frac{1}{\gamma-1}} N^{-1} \overline{T} \\ \rightarrow\ t_i &= \left(\frac{P_{t_i}}{P_T} \right)^{-\eta} N^{-1} \overline{T} \end{aligned} \tag{5}$$

where $\overline{T}$ is the world demand for traded goods, and η is the common elasticity of demand for each traded good. Note that for large N $\overline{T}$ can be taken as exogenous in any individual economy.

We can analogously derive the total demand for services in say economy I as

$$S_I = \left(\frac{P_{SI}}{P_{CI}} \right)^{-1} (1-\alpha) C_I \tag{6}$$

where the Is have been made explicit. The demand for the jth service in I is

$$\begin{aligned} s_j &= \left(\frac{P_{Sj}}{P_{CI}} \right)^{\frac{1}{\delta-1}} M^{-1} S_I = \left(\frac{P_{Sj}}{P_{CI}} \right)^{\frac{1}{\delta-1}} (1-\alpha) M^{-1} \left(\frac{P_{SI}}{P_{CI}} \right)^{-1} C_I \\ \rightarrow\ s_j &= \left(\frac{P_{Sj}}{P_{CI}} \right)^{-\phi} (1-\alpha) M^{-1} \left(\frac{P_{SI}}{P_{CI}} \right)^{-1} C_I \end{aligned} \tag{7}$$

where $\phi \equiv -\dfrac{1}{\delta - 1}$ is the common elasticity of demand for individual services.

Substituting back into the utility function we derive the price index for services in I:

$$P_{SI} \equiv \left(M^{-1} \sum \left(P_{s_j}^{\frac{\delta}{\delta-1}} \right) \right)^{\frac{\delta-1}{\delta}} \tag{8}$$

Finally we can write the consumer price index for *I* in one of two forms:

$$\begin{aligned} & P_C = P_T^{\alpha} P_S^{1-\alpha} \\ & \rightarrow P_C = \left(\left(N^{-1} \sum \left(P_{t_i}^{\frac{\gamma}{\gamma-1}} \right) \right)^{\frac{\gamma-1}{\gamma}} \right)^{\alpha} \left(\left(M^{-1} \sum \left(P_{s_j}^{\frac{\delta}{\delta-1}} \right) \right)^{\frac{\delta-1}{\delta}} \right)^{1-\alpha} \end{aligned} \tag{9}$$

Labour market in I. We now turn to the labour market in economy *I*. The money wage of a worker in t_i is W_{t_i} and in s_{Ij} is W_{S_j}. A skilled worker works e_{ti} hours and an unskilled worker e_{SIj} hours. We assume for simplicity that there is Bertrand competition in the production of each good and service so that

$$\begin{aligned} P_{t_i} &= W_{t_i} \\ P_{S_j} &= W_{S_j} / l \end{aligned} \tag{10}$$

where P_{t_i} is the price of the traded good *i* and P_{Sj} of service *j* (in economy *I*).

Labour demand. We derive first the labour demand equation for the *i*th traded good, and then for each of the *M* services. The total labour supply for t_i is $\beta_I e_{t_i}$; from now on we drop the *I* or *i* subscripts. And since we want labour demand in terms of the consumer real wage, note that $\frac{W_t}{P_T} = \frac{W_t}{P_C}\frac{P_C}{P_T} \equiv w_t \frac{P_C}{P_T}$ where w_t is the hourly consumer real wage:

$$\begin{aligned} t_i &= \left(\frac{P_{t_i}}{P_T} \right)^{-\eta} N^{-1} \alpha \left[\sum \left(\left(\frac{P_T}{P_{CJ}} \right)^{-1} C_J \right) \right] \\ \rightarrow e_t &= w_t^{-\eta} \left(\frac{P_C}{P_T} \right)^{-\eta} \frac{N^{-1}}{\beta} \alpha \left[\sum \left(\left(\frac{P_T}{P_{CJ}} \right)^{-1} C_J \right) \right] \end{aligned} \tag{11}$$

Similarly for the *j*th service

$$e_s = w_s^{-\phi}\left(\frac{P_C}{P_S}\right)^{-\phi} l^{\phi-1}\frac{M^{-1}}{1-\beta}(1-\alpha)\left[\left(\frac{P_S}{P_C}\right)^{-1} C\right] \tag{12}$$

where this equation is the same for each service in *I*.

Wage equations. There is an independent monopoly union in the *t* sector as well as in each of the *j* service sectors; workers cannot move between sectors. Unions simultaneously set wages to maximize the indirect utility function of a representative worker, subject to the relevant employment demand equation; (because of Bertrand pricing profits are uniformly zero).

$$\bar{U} = we - \frac{\lambda}{2}e^2 \tag{13}$$

Given large *N* and *M* each union can take P_C, P_S, P_T as given; the *T* union can take $\left[\sum\left(\left(\frac{P_T}{P_{CJ}}\right)^{-1} C_J\right)\right]$ and the *j*th *S* union *C* as given.

This implies the FOCs for the *T* sector:

$$w_t = \frac{\lambda\eta}{\eta-1}e_t$$

$$w_t = \left(\frac{\lambda\eta}{\eta-1}\left(\frac{P_C}{P_T}\right)^{-\eta}\frac{N^{-1}}{\beta}\alpha\left[\sum\left(\left(\frac{P_T}{P_{CJ}}\right)^{-1} C_J\right)\right]\right)^{\frac{1}{1+\eta}} \tag{14}$$

and for an individual *S* sector:

$$w_s = \frac{\lambda\phi}{\phi-1}e_s$$

$$w_s = \left(\frac{\lambda\phi}{\phi-1}\left(\frac{P_C}{P_S}\right)^{-\phi} l^{\phi-1}\frac{M^{-1}}{1-\beta}(1-\alpha)\left[\left(\frac{P_S}{P_C}\right)^{-1} C\right]\right)^{\frac{1}{1+\phi}} \tag{15}$$

Cost of training equilibrium: The final component of the model is the condition that

$$\bar{U}_t(\sigma) = (1 + c - \sigma)\bar{U}_s$$

where the return to training, $\bar{U}_t / \bar{U}_s$, is equal to its net cost, $1 + c - \sigma$. (Note that since training subsidies are paid by professionals, they do not affect the results so far.) Since $\bar{U}_t = w_t e_t - \frac{\lambda}{2} e_t^2$ and given (14), $\bar{U}_t = \frac{1-\eta^2}{\lambda\eta} w_t^2$ and $\bar{U}_s = \frac{1-\phi^2}{\lambda\phi} w_s^2$.

Results: We now derive the three results in the text.

Result 1*: The C economy will have a higher proportion of the workforce in the traded sector than the U economy, that is* $\bar{\beta}_C > \bar{\beta}_U$.

Proof: In the *C* economy, there is full wage compression and training is fully subsidized to bring this about. Hence at $\bar{\beta}_C$ $\frac{1-\eta^2}{\lambda\eta} w_{Ct}^2 = \frac{1-\phi^2}{\lambda\phi} w_{Cs}^2$. In the *U* economy, with $\bar{\beta}_U$, $\frac{1-\eta^2}{\lambda\eta} w_{Ut}^2 = (1+c)\frac{1-\phi^2}{\lambda\phi} w_{Us}^2$. Since $w_t^2(\beta) < 0$ (from *Proof* in Result 3) and $w_S^2(\beta) > 0$ (from *Proof* in Result 3) for $1 > \beta > 0$, $\bar{\beta}_C > \bar{\beta}_U$ ■

Result 2: *The international competitiveness of a C economy, measured in terms of relative unit labour costs, is higher than that of a U economy. This holds so long as α>β.*

Proof: From (4) given Bertrand pricing and since productivity is assumed uniformly equal to 1, and with large N, $P_T \equiv \left(N^{-1} \sum \left(W_{t_j}^{\frac{\gamma}{\gamma-1}} \right) \right)^{\frac{\gamma-1}{\gamma}}$ measures unit labour costs in the rest of the world

and hence $\overline{w}_t \equiv W_{t_i} / P_T$ measures *I*'s relative unit labour costs. Noting that $\overline{w}_t = w_t \left(\frac{P_C}{P_T} \right)$, we can write $\overline{w}_t = k\beta^{-\frac{1}{1+\eta}} \left(\frac{P_C}{P_T} \right)^{\frac{1}{1+\eta}}$ from (14). From the proof of Proposition 1 $\frac{P_S}{P_C} = \tilde{k}(1-\beta)^{-1/2}$, and from (9) $\frac{P_C}{P_T} = \left(\frac{P_S}{P_C} \right)^{\frac{1-\alpha}{\alpha}}$ so $\overline{w}_t = k'\beta^{-\frac{1}{1+\eta}}(1-\beta)^{\frac{1-\alpha}{2\alpha}\frac{1}{1+\eta}}$. This implies $\frac{d\overline{w}_t}{d\beta} > 0$ iff $\alpha > \beta$.

Since $\overline{\beta}_C > \overline{\beta}_U$ the result holds. ■

(We would normally expect the condition $\alpha>\beta$ to hold for similarly sized economies as modeled here given differences in labour productivity between traded and services sector. The perverse case where the preference for services, $1-\alpha$, is very large means that a switch of labour from services to traded goods implies a rise in P_C and a fall in w_t sharp enough that $e_t = \frac{\eta - 1}{\lambda \eta} w_t$ falls by more than β rises; this then means that $\overline{w}_t$ *rises* rather than falls with t_i falling corresponding to the fall in βe_t.)

Result 3**:** *The real exchange rate in a C economy is higher than in a U economy.*

Proof: The real exchange rate is $P_{CI} / \overline{P}_C$ where $\overline{P}_C$ is the average consumer price index in the rest of the world. Since $\overline{P}_C$ is independent of β_I we need to show that an increase in β_I increases P_{CI}. Dropping *I* and *i* subscripts, $w_s = \frac{P_S}{lP_C}$ in equilibrium since service sectors are identical. From (15) $\frac{P_S}{P_C} = k \left(\frac{P_S}{P_C} \right)^{\frac{\phi-1}{1+\phi}} (1-\beta)^{-\frac{1}{1+\phi}}$ so that $\frac{P_S}{P_C} = \tilde{k}(1-\beta)^{-1/2}$, implying $\frac{d(P_S / P_C)}{d\beta} > 0$.

Using (9), $P_C = \left(\frac{P_S}{P_C} \right)^{\frac{1-\alpha}{\alpha}} P_T$, where P_T is fixed with large *N*. Hence $\frac{dP_C}{d\beta} > 0$. Hence from Result 1 the real exchange rate is higher in a *C* economy than in a *U* economy. ■