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14 June 1994

Central Banks and the Wage Bargain

I. Introduction

Early work in the neo-corporatist tradition focused on the organization of labor in the economy (e.g., Berger (1981), Lehmbruch and Schmitter (1982), Lange (1984), Cameron (1984), Scharpf (1984), Goldthorpe (1984)). More recent work, in part building on that tradition, has begun to emphasize the importance of other actors in the economy to the functioning of neo-corporatist systems. The importance of government policy to the maintenance of such systems has been most cogently argued by Lange and Garrett (1985), Garrett and Lange (1986), Scharpf (1987,1991), and Alvarez, Lange, and Garret (1991). Swenson (1989,1991) and Soskice (1990a) have recently brought the organization of business into the neo-corporatist picture.² However, heretofore, only rare examples, including Bruno and Sachs (1987), Calmfors and Driffill (1988), Carlin and Soskice (1990) Calmfors (1990,1993), and Layard, Nickell, and Jackman (1991), have made any attempt to examine the impact of various institutional structures on wage bargaining in the context of a coherent, economic model. The first goal of this paper, therefore, is to conduct such an analysis in a simple yet defensible economic framework. We will focus on employer and labor

¹ I gratefully acknowledge the intellectual guidance of David Soskice in the early stages of the development of these arguments. I also wish to thank Alberto Alesina, Geoffrey Garrett, and Peter Hall for their helpful comments. Thanks are due the Wissenschaftszentrum Berlin, the National Science foundation, and the Center for European Studies at Harvard University for financial assistance. A previous version of this paper was presented at the Second conference on European Political Economy at the Center for European Studies in the Spring of 1994. Finally, researchers and staff at the Wissenschaftszentrum have and deserve my gratitude for providing the academic environment which was so conducive to the early development of these arguments.

² Soskice's subsequent work (1990b), along with that of Sorge (1991), has gone further to argue that the economic performance originally attributed simply to encompassing union-structure actually relied on a much broader system of national institutions.

organization; hopefully future work can incorporate the partisan aspects of the wage-bargain.

A largely unconnected³ literature on independent central-banks has focused upon the commitment value of that institution. The argument is that governments which can secure benefits from surprise inflation, interacting with a rational private-sector, are trapped in a high-inflation equilibrium without in general garnering any of the surprise-inflation benefits. If, however, the government can create an institution with the credibility of abstaining from attempting counter-cyclical bursts of inflation, then a low-inflation equilibrium can be achieved without any output losses (Kydland and Prescott (1977), Barro and Gordon (1983a,1983b), Rogoff (1985), Alesina and Tabellini (1987), Alesina(1988), Cukierman (1992), Alesina and Summers (1993)). The second goal of this paper is to illuminate the important connection between the wage- and price-bargaining and the monetary-policy institutions in an economy (and consequently between the corresponding literatures). In doing so, we will discover that there are indeed some costs to a central bank's maintaining low inflation: variable costs which are a function of the institutions of wage bargaining and of the sectoral structure of the economy. This is the main argument we wish to make formally and substantiate empirically here.^{4,5}

³ Sharpf's work (*op. cit.*) is exceptional in that he does consider, informally at least, the connection between wage-bargaining and monetary-policy institutions. In some ways, this work can be seen as formalizing, extending, and testing Sharpf's arguments.

⁴ Hall (1993) also (and independently) has raised the issue of whether the employment costs of central-bank independence may be contingent upon the structure of wage bargaining. His arguments receive some echo, extension, and supporting evidence here.

⁵ Independent central-banks will be important in our analysis, exactly as elsewhere, because they tend to enjoy greater credibility than monetary-policy authorities more directly linked to the government. Adam Posen (1993), however, has recently argued that central-bank independence is, in fact, epiphenomenal. That is, independent central-banks are established and/or are effective only where the structure of interests in the polity support anti-inflationary efforts. We disagree, however; extra credibility

In contrast to previous work which has made the simplifying assumption that inflation is "always and everywhere" a result of money-supply growth, we will need to recognize that inflation is, after all, the result of the price- and wage-setting decisions of private actors. The monetary authority can only accommodate or seek to combat the inflationary forces that may arise from these decisions. Our argument is that the independence of the central bank determines how likely it is to choose to combat inflationary pressures and that the institutions of wage-bargaining and the sectoral structure of the economy determine how likely such pressures are to arise and how workers and employers respond to the threat of central-bank reaction. In this potential conflict, the central bank can employ the usual mechanisms of monetary policy (open-market operations, interest rates on loans from it, reserve requirements, *etc.*), but to simplify and to avoid confusion we will think of the central bank as controlling a single interest-rate which prevails in the economy.⁶

arises from an independent central bank because, in creating an independent central-bank, the government establishes a separate policy-making institution the subsequent removal of which would require significant expenditure of political capital. That is, the government creates for itself costs in changing monetary policy which did not previously exist and consequently chooses in the future to abstain from loose policy in all but the most extreme of circumstances (or, as we will interpret it, to carry out stricter threats than it otherwise would). Although we therefore believe Posen's argument to be an overstatement, for our purposes it is not important whether he is correct. Whether the credible threats analyzed here come from the central bank or another monetary authority reacting to the constellation of interests favoring tough anti-inflation policy does not affect our theoretical conclusions. Moreover, in our empirical work, the central-bank-independence index can be re-interpreted as an index of the relative strength of the anti-inflationary forces in the polity, if one chooses, without otherwise altering the conclusions.

⁶ Of course, in free-market economies the central bank only directly affects the interest rate on loans from it: the discount rate, the Federal Funds Rate, the Lombard rate, *etc.* These interest rates, however, have great impact on the various other interest rates in the economy.

As support for the use of the interest rate as the monetary authority's policy instrument and for the simplifying assumption that the central bank has complete control of it, we may cite Bernanke and Blinder (1992). For the American case, they find that

We show how, in a very simple model with wage- and price-setting power on the part of the private sector and in which the central bank has the institutional autonomy and practical ability credibly to threaten to raise interest rates when prices or wages rise "excessively", low inflation equilibria can be achieved. That is, we show that a credibly independent central-bank remains an effective anti-inflation institution in a framework where price- and wage-setting power on the part of market actors is acknowledged. However, and this is a critical difference, when the central bank's interest-rate threats are enacted (and they must periodically be), they depress output. (This follows from the demand-determined-output structure of the macroeconomic model.) That is, the effectiveness of the central bank in controlling inflation is not output neutral;⁷ the actual effect on output will depend upon the institutional structure of wage- and price-setting in the economy and upon the sectoral composition of employment. Specifically, the traded sector is the least costly for the central bank to restrain, followed by the (private) sheltered sector and then the public sector (also a sheltered sector). Similarly,

the federal-funds rate is the best monetary predictor of future moves in real variables and that policy actions, rather than money demand shocks, overwhelmingly dominate the variance of money. Therefore, they conclude that the federal-funds rate is the best indicator of monetary policy, that such policy matters to real output, and that we may legitimately focus on policy shifts embodied in interest-rate movements rather than private demand for money shifts as money supply schedules are highly elastic (nearly flat at the target interest-rate).

⁷ That monetary policy has real effects has been established empirically (irrefutably to my mind) by Blanchard and Watson (1986), Gali (1988), Blanchard (1989), Friedman and Schwartz (1963), Romer and Romer (1989), Bernanke and Blinder (1992), and others. Authors disagree on the size and duration of these effects, but a general consensus could be achieved that they are certainly not negligible and last at least two years. In fact, authors finding smaller impacts and shorter durations have used long-run neutrality as an identifying assumption. Thus, their results do not allow the data to speak for themselves on the duration of monetary-policy effects and constrain estimates of the size of these effects. See Blanchard (1989) for a cogent critique along these lines of such work which would apply, for example, to Sims (1992) which finds smaller and shorter duration effects than most.

coordinated bargainers are less costly to restrain than uncoordinated bargainers. Making and sustaining these points analytically comprise the third goal of this paper. The fourth and final goal, of course, is to present some evidence supporting these conclusions.

II. The Model

We consider an open economy with domestic prices set as a mark-up on wage costs and with Keynesian demand-determined output in reduced form.⁸ Suppose we have simply:

$$\begin{aligned}
 (1) \quad Y &= \sigma_g G - \sigma_i (i - dP^d) + \sigma_\theta (E + P^* - P^d) \\
 (2) \quad P^c &= b \sum_j a_j W_j^u + b(1 - \sum_j a_j) W^n + (1-b)(E + P^*) \\
 (3) \quad P^d &= \sum_j a_j W_j^u + (1 - \sum_j a_j) W^n \\
 (4) \quad E &= e_i (i^* - i)
 \end{aligned}$$

This and all subsequent equations are written so that all of the parameters are positive. Real output, Y , is demand determined in the standard ISLM manner except that the monetary-policy instrument is the interest rate, i . G is real government-expenditure which is assumed to be exogenous for the moment. P^c (P^d , P^*) is the consumption (domestic, foreign) price level, and W_j^u and W^n are the j^{th} private-sector union and non-union wages respectively; a_j is a factor expressing the proportion of the economy covered by the j^{th} union and implicitly encompassing the mark-up. Public-sector wages do not directly enter the prices nor do they directly affect

⁸ Market power and bargaining on the part of labor and employers are, strictly speaking, insufficient to justify the assumption of *fixed* mark-up pricing (as opposed to continual optimization). If *menu costs* (Mankiw (1985)) or *near rationality* (or calculation costs in optimizing) (Akerloff and Yellen (1985)) are the reason firms and unions adopt such strategies, then the relevant time-frame for the model is that between adjustments by the individual price- and wage-setters to economy-wide prevailing prices. That is, the Nash bargaining solution described in the text prevails for one period (defined by the time between re-optimizations) and then is renegotiated. These assumptions are sufficient justification for the demand-determined output form of the model.

output.⁹ The equations are taken to be reduced forms in logs (therefore dP (dW), the first difference of P (W), is price (wage) inflation). Greatly simplifying, we will assume that exchange-rates are a monotonic function of the difference between foreign (i^*) and domestic interest rates. For our purposes, nailing down the direction of exchange-rate movements is sufficient, and few would dispute that exchange rates depreciate when foreign interest-rates exceed domestic.¹⁰ Finally, we will adopt the small, open-economy assumption, implying that P^* and i^* are independent of domestic conditions. Given that, we might as well assume them fixed at zero. We can now simplify by substituting (3) and (4) into (1), (4) into (2), and by applying the small, open-country assumption; we get:

$$(1a) \quad Y = \sigma_g G - \sigma_i (i - dP^d) - \sigma_\theta (e_i i + P^d)$$

$$(2a) \quad P^c = b \sum_j a_j W_j^u + b(1 - \sum_j a_j) W^n - (1-b) e_i i$$

$$(4a) \quad E = -e_i i$$

⁹ However, we do wish to note that conditions in the public-sector affect inflation and output in four ways. First, public-sector (nominal) demands on output must be made reconcilable with private-sector demands (including import materials-cost). Thus, higher public sector wages imply a smaller pie over which the private sector may bargain. One way or another (e.g., public-sector prices, direct taxes, allowance of higher inflation so as to garner greater seignorage), this will fuel private-sector wage-demands (see Layard, Nickell, and Jackman or Carlin and Soskice (*op. cit.*)). Second, (real) wage gains in the public sector may fuel private-sector wage-demands through jealousy effects. Third, increases in real public-sector employment generates a structure of the economy which is inconducive to wage restraint. Fourth, real public-spending (which is positively related to public-sector employment) increases output and lowers unemployment thereby strengthening labor in the wage-bargain. For these reasons, we will ask later what a central bank can do to constrain wage-settlements in the public sector.

¹⁰ One should not confuse the depreciation following an exogenous interest-rate increase which may occur in a Dornbusch-type (1976) exchange-rate model with a net depreciation of the currency. The depreciation which may occur in that model follows a discontinuous appreciation which it does not completely erode. One would need rather bizarre assumptions about expectation formation to get anything other than an appreciation of the currency when domestic interest-rates rise relative to foreign interest-rates. Certainly the relationship between the price of domestic currency and domestic interest-rates is generally positive (so that between domestic interest-rates and the exchange rate as usually defined is negative as we have modelled).

Assume now that we have a j monopoly unions (or groups of unions negotiating together) that care only about consumption real-wages and perhaps employment.¹¹ Each union has an employer (or group of employers) who bargains with it. The employer, of course, cares about profits, which for *given productivity*¹² are decreasing in the product real-wage and increasing in demand in that sector. Each union (group) and employer (group) may be in the traded sector, the public sector (in which case the employer is the government), or the rest of the non-traded sector. For simplicity, let there be a monotonic, positive relationship between output/demand in a sector and employment and profits there. Log-linear versions of the value functions implied by these statements would be as follows (we withhold discussing the government's value function for the moment):

$$\begin{aligned}
(5) \quad V_j^{uT} &= V_\omega^u (W_j^u - P^c) + V_{Y1}^{uT} (Y + Y^*) + V_{Y2}^{uT} (E - P^d) \\
(6) \quad V_j^{fT} &= V_\omega^f (E - W_j^u) + V_{Y1}^{fT} (Y + Y^*) + V_{Y2}^{fT} (E - P^d) \\
(7) \quad V_j^{uS} &= V_\omega^u (W_j^u - P^c) + V_{Y1}^{uS} (Y) + V_{Y2}^{uS} (P^d - E) \\
(8) \quad V_j^{fS} &= V_\omega^f (P^d - W_j^u) + V_{Y1}^{fS} (Y) + V_{Y2}^{fS} (P^d - E) \\
(9) \quad V_k^{uP} &= V_\omega^u (W_k^u - P^c) + V_Y^{uP} G
\end{aligned}$$

where the superscripts u or f denote union or employer (firm), and

¹¹ The union is a monopoly within its portion of the economy. Some barrier to entry into the unionized sector by workers outside of it is assumed. We shall not want to assume that the non-unionized labor-market clears because involuntary unemployment does exist. Instead, we shall assume that efficiency wages are paid outside the unionized sector. Union workers get a further premium above this which suggests an interesting hypothesis not explored here: specifically, that the cooperation often noted as a benefit of coordinated labor (see, for example, Soskice (1990b)) may itself rely on an efficiency-wage type of argument. The cooperation arises from and relies upon the existence of a secondary, non-unionized sector considered inferior by union workers. They cooperate because they fear being exiled thereto for poor behavior.

¹² Productivity growth will be assumed to be zero throughout. Allowing for (exogenous) productivity growth would merely force us to carry around an extra term reflecting it. Thus, wages could rise in line with productivity without affecting profits or output, and all our analysis would continue to hold provided we then spoke of wage increases relative to productivity growth rather than wage increases *per se*.

T , S , and P refer to traded, sheltered, and public sector respectively. The subscript w refers to derivatives with respect to real wages. The subscript Y refers to derivatives with respect to output which has two parts: the effect of national income on demand in the sector, $Y1$, and the effect of the relative price of output in the sector on demand there, $Y2$. Finally, the subscripts j (k for public-sector workers) refer to the j^{th} (k^{th}) worker or employer bargaining unit.

The first term in all the workers' value functions gives the utility from consumption real-wages, $W_j^u - P^c$ or $\bar{W}_k^u - P^c$. The next two terms (one in the public sector) reflect the utility gained from output/employment. For the traded sector, this is a function of world income, $Y+Y^*$, and the relative price of traded goods, $E - P^d$ (recall that we have written the equation so that all parameters are positive). For the (private) sheltered sector this is a function of domestic income, Y , and of the relative price non-traded goods, $P^d - E$. Public-sector employment, being relatively output inelastic, in turn responds only to real government-spending.

On the employer side, the first term in each value function reflects the relevant product real-wage, $E - W_j^u$ and $P^d - W_j^u$, respectively. Note that appropriate price for product real-wages in the traded sector is given by world prices and in the non-traded sector by the domestic-price index. The next two terms are analogous to those in the corresponding sector's value function for labor. However, in this case, the output and relative prices in the sector matters because they affect profits rather than because they affect employment. We leave open the possibility that the weight put on output in the labor and employer value-functions and in the traded and non-traded sector value-functions may differ.¹³

¹³ The coefficients may differ from labor to employer because the relationships between output on the one hand and employment or profits on the other need not be equal. Also, they may differ because the relative weight placed on output/employment in their value functions differ. Finally, they may differ from traded to sheltered sector, once we employ the small open-economy assumption to set Y^* to zero, because the domestic-income elasticity of demand is likely to be larger in the sheltered sector. Having no reason

Once we employ the small open economy assumption, Y^* drops out of equations 5 and 6.

Now, we will find it extremely useful and perhaps not too unrealistic to posit that each union-firm pair is in a Cournot game with the others and with the non-unionized sector. That is, the optimal choices for each actor is contingent only upon the strategy of its negotiation partner and the structure of the model. The idea that firms (unions) might coordinate their action with other firms (unions) is critically important, but we choose to represent it more simply by increasing the relevant a_j (a_k in the public sector). Thus, a group of unions and/or firms acting in a coordinated fashion are modelled as bargaining for a single wage to prevail throughout that coordinated sector (or at least wage increases are linked one-for-one).¹⁴ This makes matters considerably simpler while maintaining most of the substance of what coordination in bargaining means.

The next step is to determine the marginal benefit to each type of actor of getting/ceding a wage increase; that is, to take the derivative of each of these value functions with respect to

to suppose otherwise, we shall contend that all sectors place the same weight on real-wages, though as noted employers and workers may differ.

¹⁴ Wage-bargaining in Germany, for example, is characterized by negotiations between leader union and employer organizations (IG Metall and Gesamtmetall usually) which are then followed closely by other unions and employers. We do not distinguished between this and more explicit types of coordination in bargaining.

wages. The resulting expressions are as follows:

$$(10) \quad \frac{dV_j^{uT}}{dW_j^u} = V_\omega^u (1 - ba_j + (1-b) e_i \frac{di}{dW_j^u}) - V_{Y1}^{uT}(A) - V_{Y2}^{uT}(B)$$

$$(11) \quad \frac{dV_j^{fT}}{dW_j^u} = -V_\omega^f (1 + e_i \frac{di}{dW_j^u}) - V_{Y1}^{fT}(A) - V_{Y2}^{fT}(B)$$

$$(12) \quad \frac{dV_j^{uS}}{dW_j^u} = V_\omega^u (1 - ba_j + (1-b) e_i \frac{di}{dW_j^u}) - V_{Y1}^{uS}(A) + V_{Y2}^{uS}(B)$$

$$(13) \quad \frac{dV_j^{fS}}{dW_j^u} = -V_\omega^f (1 - a_j) - V_{Y1}^{fS}(A) + V_{Y2}^{fS}(B)$$

$$(14) \quad \frac{dV_k^{uP}}{dW_k^u} = V_\omega^u (1 + (1-b) e_i \frac{di}{dW_k^u}) + V_Y^{uP} \left(\frac{dG}{dW_k^u} \right)$$

where:

$$(15) \quad A = (\sigma_i + \sigma_\theta e_i) \frac{di}{dW_j^u} + \sigma_\theta a_j - \sigma_i \frac{dP^d}{dW_j^u}$$

$$(16) \quad B = e_i \frac{di}{dW_j^u} + a_j$$

Notice that di/dW_j indexes how accommodating the monetary authority is of the wage increase. Full accommodation would be large enough for real interest-rates to remain constant. More than full would be less than this, and an attempt to restrain wages would require more. For any given amount of external resistance to wage increases, the larger the derivative dV_j^u/dW_j the larger the nominal-wage increase that will be achieved/granted. Of course, the main source of external restraint upon the unions (firms) is to be found on the other side of the bargaining table, *i.e.* firms (unions). The actual wage-outcome will be reached through bargaining; critical to whether wage-restraint will be achieved in the settlement, therefore, is the propensity of the union to deliver it relative to the resolve of the firm in demanding it and their relative bargaining power. The central bank can affect both of these by establishing a schedule di/dW_j ; that is, by threatening to increase interest rates in response to wages. Notice that the central bank can obtain whatever degree of price and wage restraint it likes if it makes the threat, di/dW_j , such that the induced wage settlements hold inflation to the desired level. Thus, as

suggested above, central-bank independence maintains its anti-inflationary bite in a model where wages and prices are bargained.

The term di/dW_j is, therefore, the perhaps implicit, but credible, threat made by the central bank. The threats, if enacted, depress output; higher interest rates dampen investment and cause appreciation which latter in turn hurts exports and output. In fact, the threat works precisely because it is a threat to depress output, *i.e.* employment and profits; if it did not, workers and employers would ignore it. In a world of uncertainty and/or information asymmetry it is well known that the threats must periodically be enacted. Thus, as previously posited, central banks can achieve low inflation, but do so at some (variable) cost.¹⁵ How much and how frequently output must be depressed (*i.e.*, the expected amount of output depression required) by the central bank to constrain a particular bargaining unit, however, depends upon (1) how much benefit that unit derives from the real-wage increases produced by nominal-wage hikes, (2) how much wage increases by themselves depress employment/profits in the relevant sector, (3) how sensitive that unit is to the central-bank's interest-rate threat, and (4) how much weight that unit places on real wages relative to output. That is, it depends upon how disposed the bargaining unit is to autonomously (if the central bank did nothing) offer/demand wage restraint and upon how responsive the unit is to the central-bank's threat.

In this light, let us examine equations 10-14 to determine where we can expect such restraint to be greater. The easiest way to do this is to consider the first-order conditions for each type of bargaining unit in terms of marginal real-wage benefit equals

¹⁵ On the other hand, credibility would tend to decrease the frequency with which the threats must be enacted. Thus, to the extent that an independent central bank has anti-inflationary credibility the government lacks, independence is less costly than discretion *ceteris paribus*. The choice to establish an independent central-bank, therefore, results in both an inward shift of the Phillips curve (through credibility effects) and in a change in the slope of the curve at which the policy-maker achieves the optimum (toward more unemployment and less inflation). The resultant change in inflation is unambiguously negative, but unemployment may rise or decline.

marginal output/employment cost. The real-wage benefit reveals how much disutility must be derived from induced output losses for the bargaining unit to demand/accept no further wage inflation. Let us begin in the situation without a central-bank threat, *i.e.* $di/dW_j=0$. Then, we see that labor in both the traded and sheltered sectors derive a real wage benefit of $1-ba_j$ percent for each 1% increase in nominal wages they achieve. That is, coordination, reflected in larger a_j , leads to smaller real-wage gains. Unless the public sector coordinates perfectly with the private sector (as we have modelled it, bargaining units do not coordinate across sectors), they perceive a full 1% real-wage benefit for a 1% nominal-wage increase. Thus, private-sector workers perceive less real-wage benefit from nominal-wage gains than do public-sector workers, this difference being greater the more coordinated is bargaining.

These gains must be offset by the employment effects of nominal-wage increases. Absent a central-bank threat, there are two such effects. First, higher nominal wages mean higher domestic prices and therefore a loss of competitiveness (a real appreciation) and output falls hurting both private sectors. This countervailing force is stronger the more coordinated is bargaining (all this is reflected in the term $\sigma_0 a_j$ in A). The public sector is again unscathed (government spending is exogenous). Second, the real appreciation causes the composition of consumption to shift away from tradeables, exacerbating the losses in the traded sector and mitigating them in the non-traded sector. Again, this effect is stronger the more coordinated is bargaining (these considerations are reflected in the term a_j in B) and is not relevant to the price-insensitive public-sector. Two factors, then, distinguish sheltered-sector from traded-sector labor. One, the relative-price effect of appreciation benefits the sheltered sector while it hurts the traded sector (working to make the traded-sector more disposed to wage restraint); two, V_{y1}^{uT} is probably less than V_{y1}^{uS} reflecting the fact that domestic demand is a larger proportion of demand for non-tradeables than for tradeables (working in the other direction). We suspect that the former effect dominates, but the issue is an empirical one.

Finally, we see that bargaining *per se*, *i.e.* more j 's as opposed to larger a_j 's, hinders wage-restraint since bargained wages must exceed wages prevailing elsewhere.¹⁶

On the employer side, the product real-wage cost of nominal-wage increases differ by sector. Absent a central bank threat, we see that the traded-sector's employers lose one-for-one with wages because their prices are fixed by world prices. The sheltered sector, conversely, loses less the more wages are coordinated in that sector since more coordinated bargaining ensures that they can count on the prices of their rivals rising as well ($-V_w^f$ versus $-V_w^f(1-a_j)$). Added to this are the output effects which are identical to those discussed for labor. Thus, on the employer side, there is an additional factor disposing the traded-sector more to wage restraint than the sheltered sector.

Introducing a periodically enforced interest-rate-threat does two things. First, it magnifies the output losses each bargaining unit associates with a nominal-wage increase. As we have argued that coordination tends to increase the weight bargaining units place on output relative to wages, this should imply that the cost at which the central bank achieves low inflation decreases with coordination. Second, it increases the real-wage gains of labor through the effects of the induced appreciation on the consumption-price index while increasing the product-real-wage losses born by the traded sector. Thus, the output costs of bargaining may be higher, for a given degree of coordination, the more powerful labor relative to employers. Also, we see that the central bank has no direct leverage on public-sector workers. An interest-rate hike only helps them as the induced appreciation further augments the purchasing power of any nominal-wage gains they might make. (We will discuss later how the central bank might redress this problem.) We can therefore reasonably conclude that the output cost of low inflation is greatest when the public sector is largest, less great when the sheltered sector is largest, and least

¹⁶ Otherwise, labor would not bargain but rather accept the going, efficiency wage.

when the traded sector dominates.¹⁷ Let us summarize these points for future reference:

(1) Unionization *per se* hinders wage restraint and therefore bears employment cost.

(2) Coordination of wage bargaining, on the other hand, typically promotes wage restraint, particularly in the presence of an independent central-bank attempting to achieve low inflation. Therefore, coordination bears employment benefits particularly when there is an independent central-bank attempting to achieve low inflation.

(3) Employer organization may be more conducive to wage restraint than is labor organization unless employment is more output sensitive than profits and/or labor places more weight on output relative to real wages than do employers.

(4) The traded sector is more disposed to offer wage restraint than the sheltered sector and the latter more disposed thereto than public sector. Hence, greater traded-sector employment has least employment cost (most benefit), then sheltered-sector employment, and finally public-sector employment. Once again, particularly when there is an independent central-bank attempting to achieve low inflation.

Let us now consider the public sector in more detail. Note that the central bank has only perverse leverage directly on the public-sector unions. The central bank's threat, di/dW^u , enters only positively in equation (14). The only way the central bank could put any squeeze on public-sector unions directly would be to threaten to lower interest rates in response to public-sector-union wage-hikes. It would have to lower them enough for the induced depreciation to raise the (consumption) price level to the point where the public sector makes no real-wage gains. The perverse threat of lowering interest rates to induce depreciation is counter-productive from the bank's point of view as depreciation leads to exactly the inflation it is presumably fighting. Moreover, to threaten bargainers in the other sectors, the central bank must raise interest rates in response to wage-hikes there. In other words, given that wages will tend to move in the same direction, there exists no single strategy for the central bank

¹⁷ We have presumed that the weight the sheltered sector places upon domestic output does not sufficiently exceed that the traded sector places upon it to outweigh the difference in relative-price effects.

which simultaneously induces wage-restraint in the public and private sectors. It follows, therefore, that if the central bank wishes to affect wage settlements in the public sector, it must address itself to the other side of the bargaining table--to the employer, in this case, the government. How might the central bank be able to stiffen the resolve of the government in negotiations with public-sector unions?

Governments presumably care about output, inflation, and/or unemployment. After all, the evidence is surfeit that the performance of governments everywhere in the OECD is judged by voters largely on the basis of their management of the economy (Eulau and Lewis-Beck (1985); Lewis-Beck (1990); Norpoth, Lewis-Beck, and LaFay (1991)). Thus, let us presume that the government cares about output (employment, recall is a monotonic transformation of output), *i.e.*, $V^G = V^G(Y)$.¹⁸ Without a central-bank threat to raise interest rates when government spending rises, the government perceives no negative repercussions from increasing the size of the public sector (real spending) aside from its ability raise taxes and accumulate debt which we have not modelled explicitly here.

The central bank, however, has every incentive to resist such public-sector expansion (see footnote 9). An independent central-bank which can threaten interest-rate increases to punish "excess" government spending or employment can thereby strengthen the government's hand against the public-sector union. In particular, suppose the central bank threatens to increase interest rates in response to any increase in nominal government-spending. For a sufficient and successful threat, the central bank could obtain

¹⁸ While governments might also care about inflation, the question of why governments might wish to create a quasi-autonomous, monetary-policy authority that is more inflation-averse than itself is already well developed in Rogoff (1985) and would need little adjustment to apply here. That is all we need for our purposes: that the government cares relatively more about output than does the central bank. To focus on the key issue here, we will take the extreme case where government cares only about real output (employment).

zero nominal-spending growth.¹⁹ Then, any nominal wage-gains conceded to public-sector workers would decrease real government-spending and therefore output in general. This would presumably strengthen the resolve of the government in its negotiations with the public sector. The government would get the benefit of low inflation (though it gains the cost of depressed output), and it may be able to place the blame for the tight budget on the central bank. Moreover, if the government takes some of the real spending cuts out of employment, public-sector workers would face a stricter trade-off between real wages and their employment. The economy as a whole, on the other hand, suffers disproportionately since the government-spending multiplier exceeds one.

How can we aggregate these predictions about particular bargaining units into predictions for the whole economy? If we constrain the bargaining to be of Nash form, we can easily show that the Nash-bargaining first-order-conditions in each sector are approximately weighted averages of the first order conditions for unions and firms, the weights being their relative bargaining-power, α and β . We obtain the result as follows:

$$\begin{aligned}
 (17) \quad & \max_w (V^u)^\alpha (V^f)^\beta \\
 & \Rightarrow \\
 & \alpha (V^u)^{\alpha-1} (V^f)^\beta \frac{dV^u}{dW} + \beta (V^u)^\alpha (V^f)^{\beta-1} \frac{dV^f}{dW} = 0 \\
 & \Rightarrow \\
 & \alpha (V^u)^{-1} \frac{dV^u}{dW} + \beta (V^f)^{-1} \frac{dV^f}{dW} = 0
 \end{aligned}$$

Since the bargaining outcome is approximately (the approximation assumes the initial utility levels of the parties are not too disparate) a weighted average of bargaining units' first order conditions, points 1-4 above suffice to discuss an economy's potential for wage restraint, and the cost associated with the

¹⁹ We are not suggesting that a central bank could impose such a stringent threat without risking serious repercussions, but clearly possession of the monetary-policy reigns enables the central bank to somewhat counteract fiscal policy moves by the government. We use the extreme example here because it is pedagogically clearest.

central bank's aid in obtaining such restraint.

III. Summarizing the Argument Without the Math

In the typical economy, prices and wages and therefore inflation are set through bargaining. To control inflation, therefore, an independent central bank needs to influence these decisions. It does so by threatening (overtly or *via* reputation) to respond to "excessive" price or wage increases by raising (real) interest rates. Since price- and wage-setters care about output and since interest-rate hikes dampen output, this threat can maintain price stability.

The cost of such maintenance, however, depends on the responsiveness of the price- and wage-setters to the threat. A classic externality problem arises with uncoordinated price- and wage-setting as atomistic actors perceive the direct effects of their price and wage decisions on output and the interest-rate response to those decisions as exogenous. (Essentially, the atomistic actor (rationally) ignores the fact that one person's wage is another's price.) Equilibrium wages are, therefore, too high from the point of view of maintaining full employment. This problem is greater the larger is the part of the economy covered by atomistic bargaining.

As is well known, bargaining in more encompassing units, however, internalizes the direct costs of wage- and price-increases. What has not been noted heretofore is that encompassing bargaining also facilitates the internalization of the central-bank response to wage- and price-increases. Therefore, central-bank independence (and monetary-policy conservatism more generally) is less costly in terms of unemployment the more coordinated is bargaining in the economy.

The interest-rate threat, moreover, does not affect all sectors of the economy equally. High interest-rates dampen investment which, of course, lowers domestic output and employment. They also cause exchange appreciation which, by decreasing net exports, further lowers domestic output and employment. Thus, to the extent that private-sector employment (and profits) is (are) more sensitive to output fluctuations than public-sector

employment, private-sector workers and employers are more sensitive to the threat than is the public sector. Therefore, central-banks can least costfully restrain the traded sector, followed by the (private) sheltered sector, and finds it most costly to constrain the public sector.

Finally, as real wages are costs to employers and benefits to workers, and as interest-rate-induced appreciation increases real wages, it is possible that employer coordination is more beneficial and interacts with central-bank independence more favorably than does labor coordination. However, this conclusion rests on some contentious auxiliary assumptions (see above). In conclusion, we have four hypotheses: first, that central-bank independence is less costly the more coordinated is bargaining; second, that it is less costly the larger the traded sector and more costly the larger is the public sector with the private sheltered-sector being intermediate; third, less confidently, that employer organization is more effective at costlessly maintaining wage-restraint than labor organization; and fourth, that more wide-spread bargaining *per se*, as opposed to more encompassing bargaining, is detrimental to employment.

III. Discussion and Qualitative Evidence

How do these points relate to the aforementioned corporatist and central-bank-independence literatures? First, it points to a version of the argument laid out in Calmfors and Driffill (1988) that decentralized and centralized bargaining both achieve wage restraint, but that industry-level bargaining does not. Here we have argued that bargaining *per se* increases unemployment, but this is counteracted (whether more or less than completely is an empirical question) by coordination in that bargaining. Second, the success of "corporatism" (which we take to mean, simply and only, coordinated bargaining) is shown to depend greatly on the sectoral structure of the economy. The traded sector is most conducive to wage restraint and the public sector least with the sheltered sector intermediate. Third, it shows that an independent central-bank can assist corporatist wage-bargaining in achieving low inflation, but does so at a cost that depends on the sectoral

structure of the economy, the coordination of bargaining, and upon the relative power of employers and labor in the bargaining system. Fourth, we have provided further argument hinting that Swenson (1989, 1991) and Soskice (1990a, 1990b) were correct in stressing that employer organization was probably more effective than labor organization in attaining wage restraint.

As regards the independent-central-bank literature, two new hypotheses have emerged. First, the central bank has less to do to ensure low inflation if the structure of wage bargaining and of the economy generates larger autonomous disposition toward wage restraint. Thus, we have identified some potential omitted variables in the usual inflation-vs.-central-bank-independence regressions. However, it remains the case that the central bank can achieve whatever inflation rate it likes if it is willing to bear the cost. That is, central-bank independence is a sufficient but not necessary condition of low inflation. Second, and related, the cost at which the central bank achieves low inflation is larger the less the structure of the economy and of wage bargaining encourages autonomous wage-restraint.

Before proceeding to the econometric evidence, let us consider the implications of the theory for the much discussed case of the decline of corporatism across the developed countries, notably Denmark and Sweden, in recent years (Lange, Wallerstein, and Golden (1993); Iversen (1993a, 1993b)). Our model suggests that one particular trend in public policy bears greatest responsibility here. Most countries saw increased public-sector employment and spending over the last two decades, and Sweden and Denmark saw the greatest increases. The relative rise of the public sector will have decreased the ability of corporatist bargaining to deliver the goods of wage restraint. Simultaneously, the increasing integration of global financial markets should have made the escape hatch of depreciation less and less palatable. It is little surprise then, that corporatism collapsed in these countries while it may continue elsewhere where the sectoral structure of the economy has remained more conducive to wage restraint. Should the trend toward greater public-sector-employment and spending continue elsewhere, however, they too will find it increasingly difficult to

maintain corporatist bargaining.

As another example, we should expect to find countries wherein employers and/or the traded-sector took the lead in coordinated bargaining (Switzerland, Japan, and Germany) to have found it least difficult to maintain low inflation at low cost. The U.S. and Canada, with fairly independent central-banks but uncoordinated bargaining, relatively closed economies, and medium-sized government employment²⁰ should also have been able to obtain low inflation but at fairly high cost. As a verbal account of recent experience these statements seem plausible, but we defer further comment until we consider the econometric evidence.

Finally, as evidence that at least one independent central-bank approaches its task in these terms, consider the following quotations from scholars of the German *Bundesbank* and from the *Bundesbank* itself. For example, on June 24 of 1993 the Financial Times reported:

The *Bundesbank* yesterday stepped up pressure on the government and opposition in Bonn to summon the political will to cut spending. By dampening inflationary expectations, and helping to slow wage inflation, the central bank had won an important battle, Mr. Otmar Issing, a member of the bank directorate claimed... (p. 14, emphasis added)

The quote shows the *Bundesbank's* targets to be, as expected, wage-bargainers and the government. Statements to this effect are not difficult to find in any of the *Bundesbank's* public announcements. Ellen Kennedy's (1991) study of the *Bundesbank* provides a wealth of examples of the *Bundesbank* operating in the way predicted by the model. For instance, let's follow one particular episode in 1981:

President Pöhl and Vice President Schlesinger [of the *Bundesbank*] stress that the stable value of the mark made German economic success possible, and that fighting inflation remains the first priority in the *Bundesbank* catalogue of fiscal duties. But the rhetoric always has a particular opponent in sight--high-spending Chancellors, awkward allies, expectant domestic pressure groups (p. 27).

'A deficit country cannot afford a policy of low interest rates,' Pöhl asserted, trying to shift the blame for the Bank's decisions firmly back into the government's court...Wage demands [3% over inflation] in the current round of negotiations were specifically mentioned as a factor contributing to Germany's difficult external

²⁰ These countries have relatively small government spending to GDP ratios, but average public employment to total employment ratios.

position (p. 45, emphasis added).

...the *Bundesbank's* Vice-President, Helmut Schlesinger, warned of the consequences of excessive pay rises in the current round of negotiations... The government seemed unable to moderate labour demands in the pay dispute, and one of the largest unions, *IG Metall* (the metal workers) held out for 8% against the industries offer of 2.5% (p. 46)

...Pöhl...declared that... High interest rates would come down when Germany's budget was back in order. Speaking...just before the budget debate in the *Bundestag*, Pöhl made an even more direct attack on the government... 'The Public must do something, as must the state with its expenditure plans and negotiation partners in the round of pay agreements' (pp. 52-53).

We note that by September the *Bundesbank* was, broadly speaking, victorious. The SPD-FDP government fell to the CDU-FDP and 5% wage agreements were reached. Given that these are public statements, the nature of the threat is remarkably clear. The instrument of the threat is equally clearly the interest rate, and the targets are, as always, wage-bargainers and the government.

Although he is more concerned with the international aspects of monetary policy, some illustrative examples come to us as well from John Goodman's seminal work (1992) on politics and central banks.

...the *Bundesbank's* ability to pursue an independent monetary policy has also held important ramifications for other aspects of German economic policy, most notably fiscal and incomes policies. Given its independence, the *Bundesbank* has never been obliged to accommodate government deficits... For the same reason, unions and management could not assume that the *Bundesbank* would accommodate inflationary wage demands (p.59).

In January 1974, the DGB decided that the public service employees' union, ÖTV, would take the lead in the new round of wage negotiations. ÖTV demanded wage increases of 15 to 20 percent--twice the level of inflation forecast by the government...Brandt gave in and granted wage increases averaging 12 to 15 percent. On the basis of both union demands and government capitulation, senior *Bundesbank* officials concluded that monetary restriction was now more important than ever. The *Bundesbank* made it clear that it would hold inflation below 10 percent--no matter what the cost in unemployment...In the end...the *Bundesbank's* restrictive policy [held]...inflation in 1974 to under 7 percent. Consequently, real wages rose much higher than the unions expected, and an increase in unemployment resulted (p.71).

The 1974 bargaining round is an excellent example of the problems associated with coordinated bargaining led by the public

sector. As predicted in our model, ÖTV demanded too much and the government capitulated too easily. Also as predicted, the Bundesbank found it difficult to control affect this settlement *ex ante* and was forced to impose the punishment *ex poste*. Affecting the leading bargain is much easier when export-oriented IG Metall and Gesamtmetall are the bargainers. Goodman goes on to note that after this fiasco, the Bundesbank "imposed upon the country [a] 'new assignment'" by which was meant that the Bundesbank would explicitly take the lead in announcing monetary growth targets and allow union and employer bargainers to determine (un)employment by setting wages (p.72). Apparently the Bundesbank became convinced (wisely if our model is correct) that it should make its threats more explicitly.

Let us see, then, if the econometric evidence supports our arguments as well as do these qualitative examples.

IV. Data and Econometric Evidence

If the above arguments are correct, we should be able to discover a relationship between central-bank independence and unemployment which is dependent upon the institutional structure of wage- and price-setting and upon the sectoral composition of employment in the economy. Ideally, we would like to estimate a model regressing unemployment on the proportion of the economy somehow covered by bargaining arrangements; the organization of labor and the organization of employers; the proportion of employment and output in traded, sheltered, and public sectors; central-bank independence; and all interactions of these variables (plus some controls). Moreover, it is reasonable to suppose that

wage restraint has larger effects at higher levels of unemployment than at lower levels; *i.e.*, the equation should be non-linear. Even if complexity and data availability were not a problem, multicollinearity in such a model would almost surely prevent any strong conclusions.

Instead, we begin with some simplification in part dictated by data availability. Data for labor and employer organization are available only by country, *i.e.* the indices are not time variant. Data for central-bank independence is available, at best, by country-decade.²¹ Moreover, the threats we discuss need be enacted only periodically. Therefore, we considered it unwise to attempt to estimate the model using data more frequent than by decade. With 20 countries and 4 decades, this gives us at best 80 observations. The need to include a lagged dependent variable brought this down to 60 and limitations in the availability of some of the independent variables further restricts the sample to 50 observations.

The best we can do for sectoral-employment data is data for employment in the public, service, agricultural, and industrial sectors as percentages of total employment.²² Empirically, the

²¹ Actually, Cukierman's (1992) index is given for the periods 1950-59, 1960-72, 1973-1979, and 1980-1989. We mean these periods henceforth when we refer to decades and to the 50s, 60s, 70s, and 80s.

²² Note that employees of government-owned firms are not included in public-sector employment figures. This is actually fortunate for our purposes. An employee in an Austrian firm owned by the government still typically works for an internationally competing company and therefore is better considered a traded-sector employee than a public-sector employee. The key question is whether the worker will suffer from loss of competitiveness which such an employee would while, *e.g.*, postal workers do not.

affect of the agricultural and service sectors and that of their interaction with central-bank independence were indistinguishable from each other and from zero. Thus, our regressions will include public-sector and industrial-sector employment (the latter as a proxy for traded-sector employment) as regressors and treat the sheltered and agricultural sectors as the base case. Since we expect the size of the sector in terms of output to be important as well as in terms of employment, since it must be acknowledged that the industrial sector is an imperfect proxy for the traded sector, and since central banks will attempt to constrain public-sector spending and public-sector employment, exports plus imports and government expenditure as percentages of GDP will also be employed.

Finally, the interactive nature of the model plus the relatedness of the independent variables themselves and the few degrees of freedom ensure that multicollinearity will make precise estimates of individual effects difficult. Our solution is to present evidence for several versions of the basic model, making heavy use of tests of joint hypotheses, in an attempt to increase our confidence in the robustness of our results. An appendix will also detail some sensitivity (to omission of individual countries and to slight changes in the BO, LO, and CBI indices) analyses conducted. We now describe the data in greater detail.

Layard, Nickell, and Jackman (1991) provide us with indices for the proportion of workers covered by some bargaining agreement (COV), labor organization (LO), and business organization (BO). Each of these are coded 1, 2, or 3 and are in general agreement

with the literature.²³ Our analysis indicated that relative bargaining power was important along with absolute coordination, so we have transformed the BO and LO indices, weighting BO and LO by their relative bargaining power, the latter assumed to be reflected in the indices themselves by the typical Nash-bargaining formulae $BO/(BO+LO)$ and $LO/(BO+LO)$. These indices, BO2 and LO2, are thus equal to $BO(BO/(BO+LO))$ and $LO(LO/(BO+LO))$ respectively.

Table 1: Institutional Structure of Wage Bargaining

	LNJ COV*	LNJ LO*	LNJ BO*	BO2	LO2
U.S.	1	1	1	.5	.5
JAPAN	2	2	2	1	1
GERMANY	3	2	3	1.8	.8
FRANCE	3	2	2	1	1
ITALY	3	2	1	.33	1.33
U.K.	3	1	1	.5	.5
CANADA	2	1	1	.5	.5
AUSTRIA	3	3	3	1.5	1.5
BELGIUM	3	2	2	1	1
DENMARK	3	3	3	1.5	1.5
FINLAND	3	3	3	1.5	1.5
IRELAND	3	1	1	.5	.5
NETHERLANDS	3	2	2	1	1
NORWAY	3	3	3	1.5	1.5
PORTUGAL	3	2	2	1	1
SPAIN	3	2	1	.33	1.33
SWEDEN	3	3	3	1.5	1.5
SWITZERLAND	2	1	3	.25	2.25
AUSTRALIA	3	2	1	.33	1.33
NEW ZEALAND	2	2	1	.33	1.33

* Source: Layard, Nickell, and Jackman (1991)

Cukierman (1992) provides us with an index of central-bank independence (CBI) which (at least in principle) varies by decade. However, even though this index is the most thoroughly researched available, central-bank indices remain (as all indices) somewhat subjective in their codings. Since, we have several available

²³ We would have liked to improve these indices by using a scaled averaging technique as was done with CBI (see below). Unfortunately, previous indices of labor organization have made no attempt to disassociate employer from labor organization and were perhaps therefore not useful to this end. Other indices of employer organization do not exist to my knowledge. Soskice (1990a) has an index of economy-wide coordination but this explicitly conflates labor and employer organization and anyway exists for only 10 OECD countries. Nonetheless, as a sensitivity test, a scaled-average index for labor organization was substituted for LO with little effect.

indices for CBI, we propose the following measurement methodology. We recode each of the indices (for the countries in which each is available) on a zero-one scale and then average them (unweighted). This serves two purposes; one, it should help reduce whatever measurement error is present in the individual indices (if such errors are independent of the dependent variable and independent or better yet negatively correlated between authors), and two, it increases the number of countries for which coding is available. The data are shown in Table 2.

Table 2: Indices of Central-Bank Independence

	AC LVAU	AC QVAU	GMT POL	GMT ECO	BP	CBI
US	.5017		5	7	3	.6737
JA	.1376		1	5	3	.3453
GE	.6572	1	6	7	4	.8286
FR 50	.2000	.65	2	5	2	.2677
FR 60	.2313					.3822
FR 70	.1131					.3243
IT	.2322	.76	4	1	1.5	.3550
UK 50	.2332	.60	2	2		.3656
UK 60	.4763					.4871
UK 70	.3088					.4034
CA	.4566		4	7	2	.5666
AU 50	.6750		3	6		.6562
AU 70	.5806					.6090
BE 50	.1763	.53	1	6	2	.3327
BE 70	.1888					.3390
DE	.4499	.70	3	5	2	.5253
FI	.2358	.75				.4455
GR 50	.5413		2	2		.4254
GR 60	.4988					.4041
GR 70	.5103					.4099
IR	.3379	.51	3	4		.4186
NE	.4228		6	4	2	.5367
NO 50	.1158				2	.2913
NO 60	.1366					.3017
PO			1	2		.2262
SP 50	.1163		2	3	1	.2148
SP 60	.1006					.2070
SP 80	.2069					.2601
SW	.2725				2	.3696
SZ 50	.5317		5	7	4	.7456
SZ 80	.5729					.7663
AL	.3055	.73	3	6	1	.4294
NZ 50	.1469		0	3	1	.1895
NZ 60	.2686					.2504

* Sources: AC= Cukierman (1992); GMT= Grilli, Masciandaro, and Tabellini (1991); BP= Bade and Parkin (1982). The indices are constant over time except as noted (e.g., Spain's LVAU index is .1163 in the 50's, .1006 in the 60's and 70's, and .2069 in

the80's)

The data for the proportion of workers in the public (GOV) and industrial (IND) sector were obtained from OECD Historical Statistics. Government expenditure and exports plus imports as a percent of GDP are from the Penn World Table Mark V (Somers and Heston). Data for unemployment (UE) are the decade averages of (natural) logged unemployment from Layard, Nickell, and Jackman (1991). Finally, data for oil dependency are the average of net oil imports as a percentage of total inland supply in the years 1974-1979 from Annual Oil Statistics (1984).

We propose to estimate an equation of the following form:

$$\begin{aligned} UE = & b_0 + b_1 \text{CONTROLS} + b_2 \text{COV} + b_3 \text{BO} + b_4 \text{LO} \\ & + b_5 \text{IND} + b_6 \text{EXIM} + b_7 \text{GOV} + b_8 \text{GY} \\ & + b_9 \text{CBI} + b_{10} \text{CBI} * \text{BO} + b_{11} \text{CBI} * \text{LO} \\ & + b_{12} \text{CBI} * \text{IND} + b_{13} \text{CBI} * \text{EXIM} \\ & + b_{14} \text{CBI} * \text{GOV} + b_{15} \text{CBI} * \text{GY} + e \end{aligned}$$

The control variables are dummy variables for each decade, one lag of the dependent variable allowed to have different coefficients for each decade²⁴, and oil dependency in the 70s allowed to have effect in both the 70s and 80s^{25,26}. The dependent variable is logged unemployment rather than non-logged for three reasons. First, the simplest way to reflect the assumption that the effects

²⁴ In all specifications attempted in this paper, the persistence of unemployment as measured by the coefficient on lagged unemployment was found to vary significantly by decade.

²⁵ The impact of the oil crises on oil dependent states was found to be more important in the 80s than the seventies.

²⁶ CONTROLS and b_1 are vectors, $b_1 \text{CONTROLS}$ is their inner product.

of our independent variables increases with the level of unemployment is to use a log-linear model. Second, OLS estimates a linear relationship which implies that negative fitted values are possible. If we log a strictly positive dependent variable, this is not a problem. Third, and merely fortuitously, residuals were more nearly normally distributed using the log-linear model, allowing us to lean less heavily on the central-limit theorem when interpreting confidence intervals and hypothesis tests. This is particularly important given the limited degrees of freedom (typically around 30).

Not surprisingly given the cross-sectional nature of our data, White's test for heteroskedasticity allowed the rejection of the null assumption of homoskedasticity. We know *a priori* that, given that our observations are averages over different numbers of years, the variance will vary by "decade" in inverse proportion to the number of years in the decade. Using simply weighted least squares (WLS) still led to rejection of homoskedasticity using White's test. Therefore, our estimation technique was to use WLS and White's heteroskedasticity-consistent standard errors.

Given the limited degrees of freedom and multicollinearity in our data and the complexity of the questions our theory asks the data to resolve it is more than usually appropriate to exercise great care in interpreting both inconclusive and (seemingly) conclusive results.²⁷ Our solution to the potential inconclusivity

²⁷ A bayesian technique for addressing the problems of limited data and multicollinearity which frequent comparative political economy has recently been suggested (Western and Jackman, 1994). Although I am not in general opposed to bayesian techniques (in fact, as we read journals we are all implicit bayesians updating our priors), I don't think the authors' suggestions would be of any

problem is to rely heavily on joint hypothesis tests and to leave open the possibility of truncating or simplifying the empirical model as suggested by the data. As for testing the robustness of seemingly conclusive results, alternative samples, indices, and models are considered in an appendix.

In this equation, we expect the lagged dependent variable to have coefficients between zero and one, and we expect to find positive coefficients on both of the oil dependency variables. The dummy variables for the 70's and 80's are both likely to have positive coefficients. Decade dummies, time-variant lagged effects, and oil-dependency are all more than usually appropriate in our model because we wish to be very careful not to associate spuriously the trends in our independent variables with those in the dependent variable.

More important for our theoretical purposes are the rest of the coefficients. Our theory leads us to expect to find that $b_2 > 0$; that is, that bargaining coverage *per se* is inconducive to wage restraint. We also expect to find that $b_3 < 0$ and $b_{10} < 0$; that is, employer coordination is conducive to wage restraint and lowers the employment costs of central-bank independence. Similarly, b_{11} should be less than zero, but, given that labor derives some benefits from nominal-wage increases as well as costs, b_4 may be

help here. First, bayesian techniques require priors which can be drawn from previous historical or theoretical work. As the hypotheses I am testing here are relatively novel and in some cases run counter to previous theory, existing literature is little guide. Second, and more generally, the technique therein proposed strikes me as suspiciously like pretending one has more observations than one indeed has. Therefore, I will present the results of more standard regression analysis and leave to the reader to bring whatever priors s/he may have to bear on their interpretation.

greater than, less than, or equal to zero. Our expectations are that b_5 , b_6 , b_{12} , and b_{13} are all less than zero as the traded sector is conducive to wage restraint and responds more favorably to the central-bank threat than does the (private) sheltered sector. We expect that b_7 and b_8 are less than zero as output is demand determined and public-sector employment is used at least in part to stave off unemployment, but b_{14} and b_{15} should be greater than zero as the public sector is the least conducive to wage restraint and responds least favorably to the central-bank's threat. Finally, b_9 may be positive or negative since, as noted in footnote 15, central-bank independence reflects both an inward shift of the Phillips curve and preferences for a point on that curve with higher unemployment and lower inflation. The resultant move in unemployment is ambiguous. These hypotheses are summarized in Table 3.

Table 3: Summary of Coefficient Hypotheses

COEFFICIENT	...ON VARIABLE	HYPOTHESIZED SIGN
b_2	BO	-
b_3	LO	+/-
b_4	IND	-
b_5	EXIM	-
b_6	GOV	-
b_7	GY	-
b_9	CBI	+/-
b_{10}	CBI*BO	-
b_{11}	CBI*LO	-
b_{12}	CBI*IND	-
b_{13}	CBI*EXIM	-
b_{14}	CBI*GOV	+
b_{15}	CBI*GY	+

We report results from the complete regression in Table 4.

Table 3: WLS Regression Model 1
Dependent Variable: Log Unemployment

Indep. Var.	Coeff.	Indep. Var.	Coeff.
COV	.9186		
(Std. Err.)	(.1914)		
<i>p</i> level	.0000		
BO	-.3935	CBIxBO	-.1056
	(.4926)		(1.0359)
	.4310		.9196
LO	.8099	CBIxLO	-2.6537
	(.6573)		(1.3278)
	.2281		.0554
IND	.0003	CBIxIND	-.1405
	(.0370)		(.0729)
	.9935		.0639
EXIM	.0414	CBIxEXIM	-.0927
	(.0191)		(.0410)
	.0386		.0317
GOV	-.1247	CBIxGOV	.2302
	(.0356)		(.0756)
	.0016		.0050
GY	-.0805	CBIxGY	.2355
	(.0518)		(.1001)
	.1310		.0259
CBI	3.6108		
	(3.2470)		
	.2756		
		SER	.2955
		Adj. R ²	.9261
		No. Obs.	50
		(Deg. Free)	28

P-levels are for two-tailed t-tests and are based on White's Heteroskedasticity-consistent standard-errors. Regression also included the controls mentioned above (for which the stated hypotheses were supported). Durbin-Watson is not applicable; Lagrange multiplier test for serial correlation could not reject zero serial correlation in the residuals.

The coefficients all support the hypotheses laid out, however significance levels are not overwhelming. With three terms each interacted with CBI this is not too surprising--correlation among the independent variables is fairly high. It is more than usually appropriate, therefore, to examine tests of joint significance. Particularly important is whether we can reject the hypothesis that CBI and the interaction terms are irrelevant (have coefficient zero); significance of these terms is the *sin qua non* of our argument that the effects of wage-bargaining institutions and central-bank independence are intimately related. We report F and Likelihood-ratio tests for the joint significance (deletion) of these terms in (from) Model 1 and for the joint significance of each institutional/structural variable and its interaction with CBI

in Table 4.

Table 4: Joint-significance tests for model 1

Variables	Test Statistic	p-Level
CBI, CBIxCOV, CBIxCOORD, CBIxGOV	F=3.74825 LR=17.2938	.0115 .0017
COV, CBIxCOV	F=3.63261 LR=9.09754	.0360 .0106
COORD, CBIxCOORD	F=12.9696 LR=27.0580	.0001 .0000
GOV, CBIxGOV	F=5.33360 LR=12.8658	.0091 .0016

Tests of joint significance certainly support the theory, but we would still like to improve our coefficient estimates. Given that the joint significance of the COORD and CBIxCOORD terms is overwhelming and that the latter is more than twice as significant individually than the former, we consider dropping the former. Doing so also improves the model in standard-error of the regression and adjusted R² terms. Finally, given (1) that both coefficients are positive, (2) that CBI is at least .2 in our sample, and (3) that the coefficient on COORD is relatively small, even if both terms ought to be retained, we do not alter our substantive conclusions by omitting it (the effect of coordination is always to lower unemployment and it does so more the more independent the central bank).

In the preferred model (Model 1a), once again all the coefficients support our hypotheses and are now more precisely estimated. The joint significance tests, F and Likelihood-Ratio (not reported), all yielded p-levels less than .01. Still, we cannot reject at conventional levels the hypotheses that the true coefficients on CBI and CBIxCOV are (individually) zero. In short, the evidence is strong that coordination is effective in maintaining wage restraint and increasingly so in the presence of a central bank which can enforce it. The evidence is also strong that, while public-sector employment can stave off unemployment, it also exacerbates the difficulties in maintaining wage restraint. The evidence does not allow us to conclude that central banks find it easier to restrain workers covered by bargaining arrangements (controlling for coordination in bargaining) than to restrain those not covered (CBIxCOV has weak significance). In general, the

evidence is strong that central-bank independence has unemployment costs which depend on the structure of wage bargaining and the sectoral structure of the economy in the manner predicted by our theory.

Figure 1 shows the estimated impact of a one unit increase in the coverage of bargaining (*ceteris paribus*) on (log) unemployment (*i.e.*, $[d(\ln(UE))/dCOV]$) and the 80% confidence interval²⁸ around it.²⁹ As postulated, bargaining coverage increases unemployment, but this effect is attenuated the more independent the central bank. Figures 2 and 3 do the same thing for coordination (recall COORD is a negative index of coordination which incorporates the assumption that employer organization is less costly in terms of unemployment than labor organization) and government employment respectively.

These estimates do not allow us to speak to the two remaining hypotheses derived from the argument. One, we have argued that business organization should be more conducive to wage restraint than labor organization--this was assumed in model 1 not shown; and two we have also argued that the sectors could be ranked in terms of their willingness/ability to deliver wage restraint from traded to non-traded to public. We will attempt to address these statements below, but first let us consider what the present results indicate about the functioning of corporatism and central-bank independence in the OECD in the 60s, 70s, and 80s.

To examine the implications of these estimates for our theory, consider Figure 4; it plots the estimated *total* impact of each country's central-bank independence on unemployment in the 52 country-decades in our sample. Given that we have controlled for

²⁸ The 80% interval is shown so that the bands represent the minimum and maximum values for which a one-sided t-test at the .10 level would allow rejection. Such a weak test of the effects at each level of the relevant interaction term was chosen because the significance tests reported for the regression have already established that the effects plotted are significant at a much higher level when taken across the whole sample.

²⁹ The weak significance of the interaction term is revealed in the fact that it is possible to draw a slightly positively sloped line within the confidence interval.

OECD-wide movements in unemployment by decade through the dummy variables, for the (time-variant) persistence of unemployment through the lagged dependent variable terms, and for the impact of oil-dependency in the 70s and 80s, we are confident that these results are not merely descriptive. The fact that the unemployment cost generally increases from the 60s to the 70s to the 80s does not reflect simply that unemployment itself generally showed this trend: that effect would be captured by the decade dummies and the lags. It does not reflect some increasing effect of oil-dependency that happened to be correlated with our theoretical variables as that would instead be reflected in the two oil dependency variables. Finally, it cannot be some spurious correlation with time-varying autocorrelation as that too has been controlled. What the results do reflect is that the unemployment costs of central-bank independence were higher the larger the public sector and lower the more coordinated wage bargaining and (perhaps) the broader the coverage of wage bargaining.

More specifically, what Figure 4 shows is that the US and Canada have paid much for the anti-inflationary rigor of their central banks, that particularly Sweden and Denmark but also the other corporatist economies (Austria, Finland, and Norway) have experienced swiftly rising costs, and that Germany, Switzerland, and Japan have all in fact benefitted in terms of unemployment as well as inflation from their central-bank independence, all of which is in accordance with our previous discussion.

We may also want to see how much anti-inflationary bite each country was getting for the price. To do so, we need to estimate the relationship between inflation and central-bank independence (with the appropriate controls). Now, if central banks care little or nothing for output, then they can and will always achieve low inflation simply by applying whatever restraint is necessary, ignoring the cost. That would imply either that none of the interactions should be significant, or possibly that the more conducive the economy was to autonomous wage-restraint the less the central bank would have to do. If the latter is the case, we should expect negative coefficients on CBI and COORD, and positive coefficients on COV, CBIxCOORD, and GOV with CBIxGOV and CBIxCOV

indeterminate. If on the other hand, they do care significantly about output as well as inflation, they will concede some inflation in the face of an economy whose structure is not conducive to wage restraint. We would still expect coefficients of the same sign on our wage-bargaining institution variables and interactions, but the negative coefficients would be smaller in absolute value. As it turns out, the evidence for interactive effects (not reported), were not overwhelmingly significant. On the other hand, the evidence was not against interactive effects in the direction predicted, so it is possible that given the limited data and correlation among the independent variables we simply could not attain the required efficiency in our estimates.³⁰ Still, in the interest of comparability with previous research and since we do not have strong priors on the existence of interaction effects on inflation, we were content to estimate a regression of inflation on just CBI and the usual controls.³¹ That regression yielded a coefficient of -6.65 (standard error 2.40 and p level .008) which we will call the inflation benefit of central-bank independence.

Using that estimate, it is interesting to ask what the total unemployment costs and inflation benefits of CBI are, who is getting the most "bang per buck", and how this has changed in the past three decades. Figures 5 and 6 present the our estimated answers to these questions. From Figure 5, we can conclude that, in general, you get what you pay for. That is, the countries that were paying the most in terms of unemployment were also getting the most in terms of (low) inflation. However, the trade-off is avoided in Germany and Switzerland and is less evident in Austria,

³⁰ We estimated inflation models analogous to each of the unemployment models presented. The qualitative summary applies to them all.

³¹ Another reason for employing the simpler regression was that more complicated versions continually estimated large (significant) positive effects of CBI in Switzerland. Perhaps, the relationship is highly non-linear near zero inflation. Alternatively or simultaneously, the sectoral structure of the Swiss economy (particularly its very low government employment) and its strong employer organization and weak labor organization may have conspired to "overdetermine" low inflation thereby allowing the Swiss central-bank to be expansionary.

the Netherlands, Finland and Japan. This may be interpreted as implying that the standard employment-inflation trade-off curve exists but that the institutional and sectoral structure of the economy shifts that curve, allowing more favorable trade-offs where coordination is high and public-sector employment is low.

Also five countries, according to Cukierman's (1992) time-varying CBI index, changed their central bank's independence over these decades. Switzerland and Spain between the 70s and 80s and Belgium and Norway between the 60s and 70s increased it while Austria decreased it between the 60s and 70s. All experienced increases in unemployment costs simultaneous with this change, but these were mostly not due to the increase in central-bank independence (at the time of the change, $d(\ln(UE))/dCBI \approx 0$) but rather the concurrent increases in public-sector employment. Our estimates indicate that if public-sector employment had remained constant, Switzerland would have lowered inflation and unemployment by raising CBI. Austria would have raised both by lowering CBI. Spain, Belgium, and Norway should all have seen little unemployment effects and garnered just the inflation benefit.

Figure 6 is perhaps the most useful as it enables us to pinpoint which countries, representing as they do various sectoral and bargaining structures, find it the most difficult to achieve wage restraint. It measures the ratio of the (log) unemployment costs to (non-logged) inflation benefits.³² Here the effects of the growing public sector are most evident. This trend was making it more costly for all the corporatist countries, but particularly Sweden, to restrain wages. This shows up less clearly for Norway and Sweden in Figure 4, showing the total unemployment cost, simply because their CBI is so low. The difficulty in restraining wages was rising swiftly in these countries. That it did not translate into as great a rise in unemployment at the time probably reflected the fact that inflation was not combatted very much. Our guess is that these countries made increasing use of the depreciation outlet

³² It is also $(1/6.65) * [d(\ln(UE))/dCBI]$ or the inverse of the per unit inflation benefit of CBI times the per unit (log) unemployment cost.

over this period. However, later (post sample) when they abandoned that outlet, they were to face the burgeoning difficulties.³³

We now turn to our attempt to sort out the differences between business organization and labor organization and between the traded and non-traded sector. The regression models are the same as before except that COORD has been replaced by our B02 and L02 scores (see above) and that the proportion of the labor force in industry (IND) and services (SERV) along with their interactions with CBI have been added. Industrial employment is taken to be a proxy for traded-sector and the service-sector for non-traded. Unfortunately, the new interactions are inevitably correlated among themselves and with CBIXCOV and CBIXGOV. Moreover, B02 and L02 are somewhat correlated as are the various sectoral employment measures. If that weren't enough, our measures of industrial and service-sector employment, even if perfectly accurate, are still only proxies and therefore not exact measures of traded and non-traded sector employment. Our solution to these problems, once again, was to rely heavily on joint significance tests and to eliminate variables which were clearly insignificant individually.³⁴ The estimated models, which have the same controls as before, are presented in Table 5 (the note to Table 3 applies here as well).

³³ An interesting question is what drove these countries to shift emphasis to inflation in the 90s. We will discuss one possible explanation in the appendix: increasingly integrated financial markets made the depreciation cure for domestic competitiveness loss less palatable.

³⁴ The variables to be deleted were deleted in every possible order; it made no qualitative difference.

**Table 5: OLS Regression Models 2 and 3
Dependent Variable Log of Unemployment**

INDEP. VAR.	MODEL 2	MODEL 2a	MODEL 3	MODEL 3a
COV	.6806	.6451	.9310	.6332
(Std. Err.)	(.4596)	(.2135)	(.5109)	(.1538)
<i>p</i> level	.1473	.0045	.0778	.0002
BO2	.5726	.5847	.1994	
	(.4737)	(.4378)	(.6024)	
	.2346	.1899	.7428	
LO2	1.2614	1.3028	1.9567	1.6986
	(.9247)	(.7292)	(1.1348)	(.8529)
	.1810	.0822	.0943	.0543
GOV	-.1443	-.1446	-.2279	-.1991
	(.0441)	(.0430)	(.0736)	(.0600)
	.0023	.0018	.0041	.0021
CBI	3.0280	2.9513	15.6170	10.4865
	(2.6528)	(2.5243)	(8.7218)	(4.7512)
	.2612	.2498	.0828	.0340
CBIxCOV	-.0725		-.4734	
	(.8471)		(1.0240)	
	.9323		.6470	
CBIxBO2	-2.8342	-2.8612	-2.0525	-1.5022
	(1.2312)	(1.1280)	(1.5442)	(.3333)
	.0272	.0156	.1932	.0001
CBIxLO2	-3.0872	-3.1804	-4.4012	-3.7899
	(2.0769)	(1.6182)	(2.5051)	(1.7593)
	.1459	.0569	.0885	.0382
CBIxGOV	.3133	.3139	.4712	.4043
	(.0951)	(.0929)	(.1610)	(.1274)
	.0022	.0017	.0063	.0031
IND			.0141	
			(.0504)	
			.7816	
SERV			.0768	.0605
			(.0393)	(.0295)
			.0592	.0478
CBIxIND			-.1155	-.0913
			(.1030)	(.0317)
			.2704	.0064
CBIxSERV			-.1707	-.1211
			(.0983)	(.0732)
			.0921	.1069
Adj. R ²	.8665	.8701	.8748	.8834
Sd. Er. Reg.	.3696	.3646	.3579	.3453
N (°Free)	52 (36)	52 (37)	52 (32)	52 (35)

The joint significance tests for models 2 and 3 are presented in table 6.

Table 6: Joint Significance Tests for Models 2 and 3

VARIABLES	MODEL 2	MODEL 3
CBI, CBIXCOV, CBIXBO2 CBIXLO2, CBIXIND CBIXSERV, CBIXGOV		F (p)=2.4 (.05) LR (p)=21.7 (.003)
CBI, CBIXCOV, CBIXBO2 CBIXLO2, CBIXGOV	F (p)=4.8 (.002) LR (p)=26.4 (.0001)	
COV, CBIXCOV	F (p)=6.1 (.005) LR (p)=15.1 (.0005)	F (p)=6.8 (.004) LR (p)=18.4 (.0001)
BO2, CBIXBO2	F (p)=13.2 (.0001) LR (p)=28.6 (.0000)	F (p)=11.7 (.0002) LR (p)=28.6 (.0000)
LO2, CBIXLO2	F (p)=1.8 (.18) LR (p)=5.0 (.08)	F (p)=1.6 (.22) LR (p)=4.9 (.08)
GOV, CBIXGOV	F (p)=7.7 (.002) LR (p)=18.5 (.0001)	F (p)=5.4 (.009) LR (p)=15.2 (.0005)
IND, CBIXIND		F (p)=1.9 (.16) LR (p)=6.0 (.05)
SERV, CBIXSERV		F (p)=1.7 (.20) LR (p)=5.2 (.07)

The conclusions reached in the more simple model 1 are, in general, not qualitatively altered in these more complicated models. One exception is that whatever interactive effect bargaining coverage *per se* might have with central-bank independence, while still in the hypothesized direction, is now too imprecisely estimated to distinguish from zero (or perhaps it is in fact zero). As regards the new findings, somewhat surprisingly, it appears to be the case that while it is true, as we have argued, that business organization and traded-sectors are more conducive to wage restraint than labor organization and non-traded-sectors respectively, central-bank independence, if anything mitigates this difference (*i.e.*, the interactions of the central bank with labor and the sheltered sector are (insignificantly) more favorable than that with employers and the traded sector). We cannot reject the hypotheses, though, that the coefficients on CBIXLO and CBIXBO are equal and that the coefficients on CBIXIND and CBIXSERV are equal in either of the models³⁵.

Figures 7 and 8 graph the effects of BO and LO on (log) unemployment as a function of CBI along with their 80% confidence intervals in model 2a. Figure 9 graphs the difference between the

³⁵ Wald tests, not reported, could not reject the null that the coefficients were equal at anything approaching conventional significance levels.

effects of L02 and B02 along with its 80% confidence interval. The difference is positive, as predicted, and marginally significant over most of the sample range. However, it appears to narrow (insignificantly) rather than expand as CBI increases. Figure 10 plots the effect of GOV. Figures 11, 12, and 13 are analogous to figures 4, 5, and 6, but use the estimates from model 2a. In general, qualitatively these results are similar. When compared with the estimates from model 1, the corporatist countries appear to have fared somewhat better in terms of the unemployment costs of CBI, and those countries with high coverage but little coordination of bargaining appear to have fared somewhat worse. Neither of these changes are very great. The rest are essentially unchanged.

Figures 14-23 present the results of model 3a graphically with figures 14-16 analogous to figures 7-9 of model 2a. Comparing figure 16 with figure 9, model 3a makes it clearer that the difference between the effects of L02 and B02 decreases as CBI increases. That difference is larger at low CBI and absent at very high CBI. Similarly, the significance of this difference is somewhat greater (less) at low (high) CBI. The sectoral effects are presented in figures 17-20. As predicted, government employment interacts least favorably with CBI, but, similar to the L02-B02 comparison, the sheltered-sector interaction with CBI is (insignificantly) more favorable than the traded-sector. Here, however, we can more easily reject the hypothesis that the total effect of SERV on unemployment is equal to that of IND over most of the sample range. Thus, our ranking of employer and labor organization, and of the sectors appears to be correct if we allow the possibility that independent central banks might mitigate the differences. In terms of our theory, if it is true that central-bank independence mitigates the difference between labor and business organization (recall the difference in interaction term coefficients is insignificant), it must be the case that employment is more heavily weighted in labor's value function than is output in the employer's and/or that the link between output and employment is stronger than that between output and profits. Similarly, if the (insignificant) difference between the interaction effects of service and traded-sectors is trusted, then

it must be the case that the greater weight of domestic demand in sheltered-sector demand than in traded-sector demand dominates the differences in the relative-price and product-real-wage effects of appreciation when the effects of the central bank threat are at issue. Figure 20 graphs the effect of government employment. The estimates are nearly identical (slightly larger and less significant) with those represented in figure 10. Finally, figures 21-23 are analogous to figure 4-6 and 11-13, presenting the estimated impact of CBI in model 3a. By minimum standard error of the regression standards, model 3a and figures 14-23 are our preferred estimates.

V. Conclusion

We have argued that central-bank independence is not output neutral, but rather that its effects were contingent upon the sectoral structure of the economy and the institutions of wage bargaining. We have also argued that the ability of various institutional forms of wage bargaining to deliver wage restraint depends upon the credibility and dedication of the monetary authority to opposing inflation and also upon the sectoral structure of the economy. These claims have received considerable support from the data.³⁶ However, in the future we should like to obtain direct evidence that the effects posited and evidenced of institutional and sectoral structure on unemployment do in fact arise through the effect of the former on wage restraint and that of wage-restraint on unemployment. A potentially fruitful direction for this future empirical research follows from Carlin and Soskice (1990) and Layard, Nickell, and Jackman (1991). They point out that, in general, the wage which can be bargained by unions, or indeed workers individually, depends critically on the level of unemployment in the economy. At completely full employment, workers should be able to bargain a relatively high

³⁶ We did not attempt an interaction of the bargaining structure with sectoral structure, since degrees of freedom would fast evaporate while multicollinearity would continue to multiply, but the evidence is at the least not inconsistent with the latter claim.

wage because the potential of losing a job is not so threatening as, under such conditions, new work is generally easy to find. At low levels of employment the opposite is true. Thus, we can plot the maximum bargainable-real-wage (MBRW) in real-wage-employment space (it will be upward sloping). Now, in such a framework, wage-restraint amounts to settling for a wage below the MBRW. If one is willing to assume that any institutional and sectoral structure provides less wage-restraint the closer one is to absolutely full employment, there being minimal or no cost to a worker of excessive wage-demands, and more at lower employment (*i.e.*, that institutionally and sectorally induced wage-restraint is proportional to the amount of wage-restraint unemployment itself would induce), then these estimated curves should be more steeply sloped the more conducive the institutional structure to wage restraint. We could, therefore, estimate real-wage-employment relations as has been done by Layard, Nickel, and Jackman (1991), and Alogoskoufis and Manning (1988), and others, and test whether the institutional and economic structures argued to be conducive to wage restraint do indeed produce it. That is, we would expect steeper estimated-curves in economies with high autonomous propensity to wage restraint. It is interesting to note that these authors have usually found a significant positive relations between coordination and wage-restraint and a significant negative correlation between this slope and unemployment. Thus, there is at least some indication that wage-restraint is indeed the mechanism by which coordination affects unemployment. It remains to be seen, however, if the rest of our results arise from the same mechanism.

Appendix: Fixed Exchange-Rates

Let us consider the important case in which the exchange rate is credibly fixed to a (low inflation) foreign currency. As is well known, monetary-policy autonomy is sacrificed when a fixed exchange-rate is the goal. Formally:

$$(18) \quad i = i^* + \rho$$

where i^* is the foreign interest rate and ρ is the risk premium. The rest of the model is as in the text except that the exchange-rate is fixed (for simplicity at zero (log of one)). The commitment to a fixed exchange-rate has removed the ability of the central bank to threaten interest-rate hikes when either wage settlements or government spending are excessive. We can reread equations 10-14, dropping all the terms containing di/dW :

$$(19) \quad \frac{dV_j^{uT}}{dW_j^u} = V_\omega^u(1-ba_j) - V_{Y1}^u(A') - V_{Y2}^u(B')$$

$$(20) \quad \frac{dV_j^{fT}}{dW_j^u} = -V_\omega^f - V_{Y1}^f(A') - V_{Y2}^f(B')$$

$$(21) \quad \frac{dV_j^{uS}}{dW_j^u} = V_\omega^u(1-ba_j) - V_{Y1}^u(A') + V_{Y2}^u(B')$$

$$(22) \quad \frac{dV_j^{fS}}{dW_j^u} = -V_\omega^f(1-a_j) - V_{Y1}^f(A') + V_{Y2}^f(B')$$

$$(23) \quad \frac{dV_k^{uP}}{dW_k^u} = V_\omega^u + V_Y^u \left(\frac{dG}{dW_j^u} \right)$$

where:

$$(24) \quad A' = \sigma_\theta a_j - \sigma_i \frac{d \frac{dp^d}{dt}}{dW_j^u}$$

$$(25) \quad B' = a_j$$

Removing the ability to threaten interest-rate hikes has also removed the ability of the central bank to constrain the bargaining units. They are left to their own autonomous disposition to offer/demand it. If it is going to work, then, the commitment to a fixed exchange-rate works because it is a commitment by the government not to bail out private-sector firms that have granted too high wages with exchange-rate depreciation. Therefore, the

anti-inflation efficacy of fixing the exchange rate to a low-inflation currency comes mostly from addressing the employer side of the bargaining table and particularly the traded sector. We would argue, therefore, that this is (at least in part) why the recent commitment to fix the exchange-rate in countries characterized by centralized bargaining with powerful unions has been accompanied by political moves to empower employers and to decentralize (disempower) unions. We could add that moves to strengthen the traded-goods sector on both sides of the bargaining table and to weaken the public sector would further increase the potential for wage restraint, thereby diminishing the output/employment costs of the anti-inflationary rigor while increasing its effectiveness.³⁷

The remaining question, of course, is "Why have so many countries recently opted to fix the exchange-rate?" As we have argued and as the econometric evidence has clearly shown, the wage-pressure in most countries was building over the past three decades which were typically characterized by large and growing public-sector employment and extensive if not increasing wage-bargaining. These pressures were periodically allowed to escape in many countries through exchange-rate depreciation. Given the growing integration of financial markets and perhaps a shift in preferences by policy-makers and/or the public toward low inflation and away from low unemployment, this escape hatch was becoming less palatable exactly as it was becoming increasingly necessary. The remaining options were cut public-sector employment, credibly

³⁷ Note the difference between the argument made by Iverson (1993) and the one made here. Since di/dW is zero when the exchange-rate is pegged, the monetary authority cannot be running the threat game posited in previous sections. Rather, we argue that the fixed exchange-rate is a commitment not to bail out employers and the traded sector. This economic difference has important political consequences because it impinges critically on the relative power of unions and firms and the various sectors. Therefore, we conclude that an independent central-bank and an exchange rate pegged to a currency managed by one, even if equally credible, are not functionally equivalent. Phrased differently, Germany is different, both politically and economically, from countries pegged to its currency because, as the N th country, it retains monetary autonomy.

delegate authority to a more independent central-bank, and/or announce an exchange-rate target. Apparently, the first option was politically out of the question; the second would have been hard to do, especially quickly, and was largely already accomplished in some (e.g., Austria and Denmark). That left the exchange-rate target as the only other option--not necessarily, we might note the least costly one in unemployment terms.

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