

***Multiple Hands on the Wheel:***  
**Empirically Modeling Partial Delegation and Shared Control  
of Monetary Policy in the Open and Institutionalized Economy**

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**ABSTRACT:** Previous work showed that, when partially autonomous central banks (CBs) and politically responsive governments share monetary-policy-making control, inflation occurs as a convex combination of the rates that would have occurred if the government fully controlled monetary policy and if, instead, the CB had full control. Thus, the anti-inflation effects of CB autonomy and conservatism (CBA) depend on *all* political-economic variables to which CBs and governments would respond differently and, *vice versa*, the degree of CBA mutes the inflation effects of all such variables. This paper extends that logic of shared policy-control to open political economies under differing exchange-rate regimes and degrees of international financial exposure. When domestic monetary authorities fully commit to fixed exchange-rates, they effectively delegate domestic inflation-control to foreign authorities. Similarly, in small, financially open economies, domestic policymakers must match domestic to foreign inflation to avoid massive exchange-rate pressures under any exchange regime. The new implications extend intuitively from the closed-economy case. Broadly, the domestic-inflation effects of pegs and financial exposure depend on each other and on many other institutional and structural characteristics of the domestic *and foreign* political economies, and, *vice versa*, the domestic-inflation effects of domestic and foreign political-economic conditions depend on exchange regimes and degrees of financial openness at home and abroad. The paper then shows how to model such complexly interactive hypotheses empirically compactly and substantively meaningfully and demonstrates that the postwar inflation records of 21 developed democracies decidedly favor such specifications over less-theoretically-informed linear or linear-interactive alternatives. The conclusion illustrates several specific examples of this general result and discusses potential applications of this approach to other instances of shared policy-control.

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**ABSTRACT:** Previous work showed that, when partially autonomous central banks (CBs) and politically responsive governments share monetary-policy-making control, inflation occurs as a convex combination of the rates that would have occurred if the government fully controlled monetary policy and if, instead, the CB had full control. Thus, the anti-inflation effects of CB autonomy and conservatism (CBA) depend on *all* political-economic variables to which CBs and governments would respond differently and, *vice versa*, the degree of CBA mutes the inflation effects of all such variables. This paper extends that logic of shared policy-control to open political economies under differing exchange-rate regimes and degrees of international financial exposure. When domestic monetary authorities fully commit to fixed exchange-rates, they effectively delegate domestic inflation-control to foreign authorities. Similarly, in small, financially open economies, domestic policymakers must match domestic to foreign inflation to avoid massive exchange-rate pressures under any exchange regime. The new implications extend intuitively from the closed-economy case. Broadly, the domestic-inflation effects of pegs and financial exposure depend on each other and on many other institutional and structural characteristics of the domestic *and foreign* political economies, and, *vice versa*, the domestic-inflation effects of domestic and foreign political-economic conditions depend on exchange regimes and degrees of financial openness at home and abroad. The paper then shows how to model such complexly interactive hypotheses empirically compactly and substantively meaningfully and demonstrates that the postwar inflation records of 21 developed democracies decidedly favor such specifications over less-theoretically-informed linear or linear-interactive alternatives. The conclusion illustrates several specific examples of this general result and discusses potential applications of this approach to other instances of shared policy-control.

## **I. Introduction**

When responsive governments share monetary-policy control with autonomous central banks, money growth *cum* inflation will reflect a convex combination of their preferences (Franzese 1999).<sup>1</sup> I extend that intuition here to explore the effects of varying exchange-rate regimes and differing degrees of international financial exposure in open and institutionalized political economies.

For initial expositional purposes, suppose that inflation,  $\pi$ , in a closed economy is given by:

$$\pi = C \cdot \pi_c(\mathbf{X}_c) + (1 - C) \cdot \pi_g(\mathbf{X}_g) \quad (1)$$

with  $C$  the degree (0-1) of central bank (CB) autonomy from government in monetary policymaking and  $\pi_c$  and  $\pi_g$  the inflation that would prevail if CB or government, respectively, had full monetary-policy control. CB policies may respond somewhat to some political-economic factors,  $\mathbf{X}_c$ , but are more-usually assumed unresponsive, leaving  $\pi_c$  just some constant low inflation-rate. Contrarily, the

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<sup>1</sup> Lohmann (1992) shows (1) to be equilibrium inflation in a model where governments appoint central bankers and must pay cost,  $c$ , to replace them, but emphasizes its normative implications for optimal degrees of  $c$ , i.e., of CBA, without exploring its (implicit) highly interactive positive implications. (1) is also suggested as theoretical motivation for, but not empirically implemented in, Jonsson (1995) and Bleaney (1996).

monetary policies of responsive authorities (e.g., democratic governments), and so  $\pi_g$ , will react to political-economic factors,  $\mathbf{X}_g$ . Since  $\pi_c(\mathbf{X}_c)$  generally differs from  $\pi_g(\mathbf{X}_g)$ , the core theoretical and empirical conclusion of **(1)** is that the anti-inflation impact of CB autonomy and conservatism (CBA) is not constant, as previously estimated, but varies depending on *all* aspects of the political-economic environment,  $\mathbf{X} \equiv (\mathbf{X}_c \cup \mathbf{X}_g)$ , to which government and CB would respond differently. *Vice versa*, the effect of *any* such factor,  $x \in \mathbf{X}$ , depends on the degree of CBA.<sup>2</sup> Modeling such complexly interactive contentions by standard linear-interactive techniques would require  $2^{k+1}$  independent-variable terms, with  $k$  the number of elements in  $\mathbf{X}$ . Franzese (1999), however, showed how to apply **(1)** to model these contentions far more compactly and intuitively, estimated such models for domestic inflation in 18 developed democracies post-Bretton Woods (1972-90), and demonstrated the substantive and statistical dominance of that specification over standard linear-additive and linear-interactive models.

However, variations in exchange-rate regimes and in international financial exposure during and after Bretton Woods would have altered degrees to which domestic monetary authorities, CBs or governments, retained domestic-inflation control. Such considerations suggest extending **(1)** thus:

$$\pi = \begin{cases} P \cdot E \cdot C \cdot \pi_1(\mathbf{X}_1) + P \cdot E \cdot (1 - C) \cdot \pi_2(\mathbf{X}_2) + P \cdot (1 - E) \cdot C \cdot \pi_3(\mathbf{X}_3) + P \cdot (1 - E) \cdot (1 - C) \cdot \pi_4(\mathbf{X}_4) \\ (1 - P) \cdot E \cdot C \cdot \pi_5(\mathbf{X}_5) + (1 - P) \cdot E \cdot (1 - C) \cdot \pi_6(\mathbf{X}_6) + (1 - P) \cdot (1 - E) \cdot C \cdot \pi_7(\mathbf{X}_7) + (1 - P) \cdot (1 - E) \cdot (1 - C) \cdot \pi_8(\mathbf{X}_8) \end{cases} \quad (2)$$

$E \in (0..1)$  and  $P \in (0..1)$  denote degrees of international financial exposure and of exchange-rate-peg commitment. The eight potentially different functions,  $\pi_i(\mathbf{X}_i)$ , describe how inflation responds to various political-economic factors,  $\mathbf{X}_i$ , that affect the monetary policies of the relevant authorities under that combination of international and domestic institutions. E.g.,  $\pi_1(\mathbf{X}_1)$  describes the inflation response to conditions  $\mathbf{X}_1$  when an autonomous CB fully controls domestic monetary policy ( $C=1$ ), fully commits to an exchange-rate peg ( $P=1$ ), and faces full international financial exposure ( $E=1$ ).

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<sup>2</sup> Franzese (1999) noted two broader implications. (1) Because their political-economic environments differ, some country-times will find CBA more advantageous on anti-inflationary grounds than others. (2) Institutional effects are usually contextual in this way, generally depending on the wider configuration of the entire political-economy. Analogous implications emerge regarding exchange-rate regimes and financial exposure in the open economy.

To presage, the conclusions will be analogous to those derived in the closed-economy case. The domestic-inflation effects of exchange-rate pegs and financial exposure generally depend on the *sets* of political-economic variables,  $\mathbf{X}_i$  and  $\mathbf{X}_j$ , to which the relevant monetary authorities would respond differently under international and domestic institutional-structural conditions  $i$  than the *potentially different* relevant authorities would respond under institutional-structural conditions  $j$ . *Vice versa*, the domestic-inflation effects of domestic *and foreign* political-economic conditions generally depend on exchange-rate regimes, financial exposure, CBA, and other political-economic conditions at home and abroad. For example, the domestic-inflation effects of exchange-rate pegs depend on domestic and peg-country(ies)'s degrees of CBA and international financial exposure, exchange regimes, and on the set of political-economic conditions to which the convex combination of CB and government in each country would respond under its exchange regime and exposure.

Thus, multiple hands share control of the domestic-inflation-policy wheel according to the degrees of exchange-rate-peg commitment, of international financial exposure, and of CBA. Such shared control implies that domestic and foreign monetary-policy institutions and political-economic conditions *all interact* to determine domestic inflation. As in the closed-economy case, typical linear-interactive models would now require up to  $2^{N(k+1)}$  independent-variable terms, with  $N$  the number of countries linked by exchange-rate pegs or financial exposure, to capture such highly interactive contentions empirically. Available data could not possibly estimate so many coefficients on such highly correlated terms precisely, and, even if they did, substantive and theoretical meaning would be virtually impossible to distill from such a complex specification. Thankfully, very basic economic theory will suggest strong restrictions on model specification that will facilitate statistically precise and substantively revealing coefficient estimates; and these coefficients relate simply and directly to the many interactions implied by the multiple hands on the domestic-inflation-policy wheel in open and institutionalized economies. Again, evidence decidedly favors such theoretically-informed interactive

specifications over less-theoretically-informed linear or linear-interactive alternatives.

The analysis unfolds thus. Section II elaborates theoretical derivation of **(1)** in non-exposed economies under flexible exchange rates:  $P=E=0$ . In this case, that considered by Franzese (1999), **(2)** reduces to its last two terms, i.e., to **(1)**. The section then specifies inflation-determination under full domestic CB or government policy-control:  $\pi_r(\mathbf{X}_r)=\pi_c(\mathbf{X}_c)$  or  $\pi_g(\mathbf{X}_g)=\pi_g(\mathbf{X}_g)$ . Section III extends the model to the entire set of possible international institutional-structural conditions,  $P\in(0..1)$  and  $E\in(0..1)$ , and specifies domestic-inflation determination,  $\pi_i(\mathbf{X}_i)$ , under these conditions. Section IV derives a compact empirical model to reflect those theoretical considerations and estimates it and standard linear and linear-interactive alternatives from a time-series-cross-section of annual GDP-deflator inflation-rates in 21 developed democracies in the postwar era (1957-90). The conclusions, discussed specifically in Section V and generalized to other instances of shared policy control in Section VI, extend logically from the flexible-exchange-rate, financially-insulated case in Franzese (1999). Broadly, the domestic-inflation effects of domestic and foreign CBA, international-financial exposure, and exchange-rate regimes depend (compactly and intuitively) on each other and on many other political-economic conditions of the foreign and domestic political economies (and *vice versa*).

## **II. Inflation in Financially Insulated Economies with Flexible Exchange-Rates and Varying Degrees of Central Bank Autonomy and Conservatism**

In highly exposed economies, international considerations will dominate domestic monetary-authorities' policy aims. Fixed exchange-rates will likewise require that domestic authorities dedicate policy to maintaining monetary-growth parity. Under flexible exchange-rates in financially-insulated economies, though, domestic policymakers retain full control of monetary policy and may direct it to their domestic purposes. In this environment, inflation depends in the first place on who controls monetary policymaking, politically responsive governments or autonomous, conservative CBs.

Political scientists and economists both define CBA as the degree of monetary-policymaking autonomy of a conservative CB from current political authority (incumbent government) and

broadly agree that it reduces inflation.<sup>3,4</sup> From political science, CBs are policy-implementing bureaucracies led by financial experts socialized to or coming from populations with hawkishly anti-inflationary preferences. Governments, especially in democracies, are, contrarily, more responsive to wider sets of societal preferences. Thus, effective monetary-authority delegation from government to CB simply and directly reduces inflation. From economics, monetary policymaking raises *time-inconsistencies* that induces inflationary biases in responsive policy. Credible monetary-authority delegation to an autonomous, conservative CB serves as a commitment device circumventing time-inconsistency and the resulting inflationary bias, so CBA reduces inflation. I will adopt a standard economic exposition here for its familiarity and illustrative clarity, and to demonstrate that even institutionally-sparse neoclassical models conclude that the inflation effects of CBA and, by extension, exchange-rate pegs and international exposure depend on the broader political-economic environment within which the relevant monetary authorities interact. The argument in no way depends on this expositional choice.<sup>5</sup>

**Appendix I** details the standard neoclassical argument summarized here. In an economy with nominal and real rigidities,<sup>6</sup> monetary authorities have incentives to create *surprise* inflation to lower real wages and so spur employment. However, wage bargainers know this incentive and incorporate its inflationary consequences into their settlements. In rational-expectations equilibrium,

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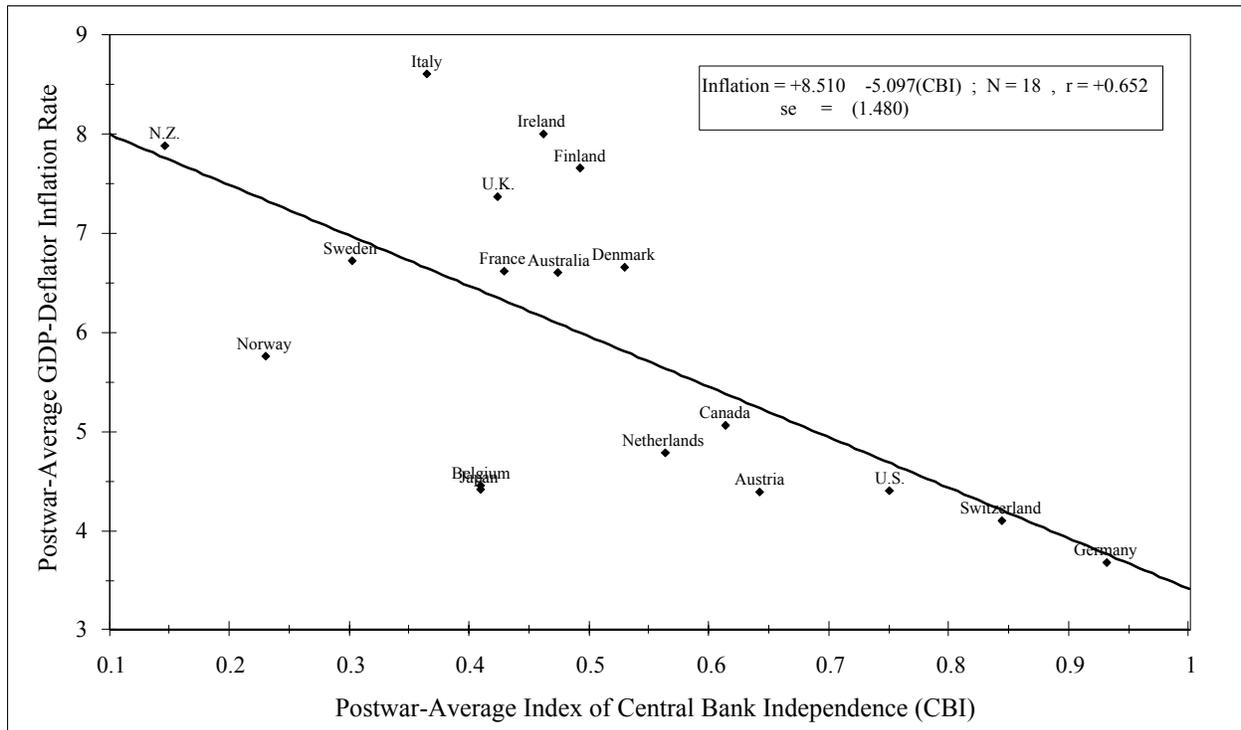
<sup>3</sup> Modern neoclassical economics of CBA and monetary policy develops in Kydland and Prescott (1977), Bade and Parkin (1982), Barro and Gordon (1983ab), Rogoff (1985, 1989), Alesina (1988), Grilli et al. (1991), Lohmann (1992), Cukierman (1992), Alesina and Summers (1993), Persson and Tabellini (1994), Cukierman (1996), Eijffinger and De Haan (1996). Cukierman (1992) compiles and advances theory and empirics; Eijffinger and De Haan (1996) offer an excellent, briefer survey of theory and evidence and Cukierman (1996) a non-technical introduction. Political science work is more variegated, but Hirsch and Goldthorpe (1978), Beck (1984), Woolley (1984, 1985), Lindberg and Maier (1985), Goodman (1989, 1991, 1992), Mayer (1990), and Kennedy (1991) could provide an introduction.

<sup>4</sup> That CBA reduces inflation is not quite universally agreed. Posen (1995ab), e.g., makes the fairly common counter-claim that CBA is epiphenomenal, itself caused by anti-inflationary forces that truly produce the low inflation. Either standard economic or political-science view underlying the present argument requires, contrarily, that institutions, specifically CBA, matter. The evidence here and in Franzese (1999) overwhelmingly supports that conclusion.

<sup>5</sup> I especially take no stand here on the model's prediction that CBA has no real (employment, output) effects on average; recent theory and empirics strongly challenge that claim (Hall 1994, Franzese 1994; Hall and Franzese 1998, Iversen 1998, Cukierman and Lippi 1999, Franzese 2000b, Iversen and Soskice 1999; Franzese 2000a reviews).

<sup>6</sup> Ball and Romer (1990) show appreciable real monetary-efficacy requires real and nominal rigidities. Nominal wage (Lucas and Rapping 1969) or price (Mankiw 1985) contracting plus wage-price bargaining (e.g., Layard et al. 1991; Calmfors 1993), and/or *near-rationality* (Akerloff and Yellen 1985), would suffice.

monetary policy cannot systematically surprise bargainers, so real wages and, thus, employment are unaffected on average while inflation is high. If, contrarily, monetary authorities could credibly commit to refrain from inflationary surprises, bargainers could agree to smaller increases without fear. Thus, credible commitment reduces inflation without affecting real wages, and so employment, on average (but see note 5). Institutionalizing some autonomy from political authority for a conservative CB produces such credible conservatism, so CBA reduces inflation.<sup>7</sup>



**Figure 1:** A Typical Bivariate, Linear-Additive Regression of Inflation on Central Bank Autonomy and Conservatism

That CBA generally reduces inflation has received extensive empirical support. Typically, postwar-average inflation in some countries is linearly related to an index of their degree of CBA as in **Figure 1**. Occasionally, controls are added and/or the data are temporally disaggregated, but rarely have CBA-inflation relationships been estimated as other than linear-additive.<sup>8</sup> Thus, CBA-and-inflation *empirics* have implicitly assumed a fixed negative impact on inflation per increment in

<sup>7</sup> Cukierman (1992) gives fuller treatment. Summarizing radically, credible commitment (a) lowers inflation and, with incomplete information, (b) sacrifices monetary stabilization policy but (c) entails no other real costs on average. Conclusion (c) is now contested (see note 5), but (a) and (b) are nearly noncontentious (but see note 4).

<sup>8</sup> Alesina and Summers (1993) graphically summarize this approach; Eijffinger and De Haan (1996) tabulate previous specifications and findings. Some (e.g., Jonsson 1995, Simmons 1996, Clark et al. 1998, Iversen 1999, Hall and Franzese 1998, Oatley 1999, Way 2000) go beyond linear models, but all consider just one or two interactions.

the degree of CBA; i.e., the inflation effect of CBA,  $\frac{\partial \pi}{\partial CBA}$ , has been assumed constant and estimated as such by construction. **Figure 1**, e.g., estimates each +0.1 CBA to reduce inflation 0.5%.

CBA-and-inflation *theory*, however, implies a considerably different, and far more revealing, specification. Inflation depends, first, on who controls monetary policy: autonomous, conservative CBs or politically responsive governments. When CBs fully control policy, their preferred policies determine inflation:  $CBA=1 \Rightarrow \pi = \pi_c(\mathbf{X}_c)$ ; when, instead, governments fully control policy, their preferences reign:  $CBA=0 \Rightarrow \pi = \pi_g(\mathbf{X}_g)$ . More generally, scholars define (and measure<sup>9</sup>) CBA as the *degree* to which the CB enjoys autonomy from current government in conducting monetary policy. So, theory holds: to the degree the CB enjoys autonomy, it controls policy and commitment inflation,  $\pi_c(\mathbf{X}_c)$ , prevails, and, to the remaining degree that current government controls policy, discretionary inflation,  $\pi_g(\mathbf{X}_g)$ , prevails.<sup>10</sup> Therefore, realized inflation in any given country-time is some convex combination of the rates that would have occurred under full autonomy and full dependence of the CB from/on the current government, with the weight on the former increasing in CBA. Equation (1) gives the simplest case, with inflation a linear weighted-average of  $\pi_c(\mathbf{X}_c)$  and  $\pi_g(\mathbf{X}_g)$ .<sup>11</sup>

This conclusion does *not* depend on the neoclassical model; *any* model in which monetary policy affects inflation and that defines CBA as the degree of CB autonomy from current government in monetary policymaking yields some such convex-combinatorial prediction. The interactive nature of combinatorial forms then implies that *any* factor that influences government policies differently than CB policies alters CBA's inflation effects, and, *vice versa*, CBA alters (specifically, mutes) the inflation effect of *any* such factor. Formally, if inflation responds to  $\mathbf{X}_g$  and  $\mathbf{X}_c$  under full-government

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<sup>9</sup> Some measure CBA by aspects of CB law thought to affect autonomy: CB-president appointment and tenure terms, whether the CB may or must purchase government securities, etc. (e.g., Cukierman 1992:ch.19). Others use expert judgements (Bade and Parkin 1982). I average five common indices of both types. A third method uses estimated parameters of monetary-policy reaction-functions, which would introduce circularity here and so are omitted.

<sup>10</sup> Lohmann (1992), e.g., shows that, in equilibrium, monetary policies follow CB preferences to degrees given by the costs to current governments of replacing the CB and follow governments' preferences to remaining degrees.

<sup>11</sup> The convex-combination need be neither continuous nor linear, but some  $\pi = f(C) \cdot \pi_c + (1-f(C)) \cdot \pi_g$  with  $f(C)$  weakly increasing and  $0 \leq f(C) \leq 1$  will be appropriate.

and full-CB control of monetary policy respectively, then, in the linear weighted-average form of (1):

$$\begin{aligned}
\frac{\partial \pi}{\partial \mathcal{C}} &= -\left[\pi_g(\mathbf{X}_g) - \pi_c(\mathbf{X}_c)\right] = f(\mathbf{X}; \cdot) \quad \mathbf{X} \equiv \mathbf{X}_g \cup \mathbf{X}_c \\
\frac{\partial \pi}{\partial \mathcal{C}} &= (1-C) \cdot \frac{\partial \pi_g}{\partial \mathcal{C}} + C \cdot \frac{\partial \pi_c}{\partial \mathcal{C}} = g(C, \mathbf{X}; \cdot) \\
\frac{\partial \frac{\partial \pi}{\partial \mathcal{C}}}{\partial \mathcal{C}} &\equiv \frac{\partial^2 \pi}{\partial \mathcal{C}^2} = -\left[\frac{\partial \pi_g}{\partial \mathcal{C}} - \frac{\partial \pi_c}{\partial \mathcal{C}}\right] = h(\cdot)
\end{aligned} \tag{3}$$

Thus, the inflation-effect of CBA,  $\frac{\partial \pi}{\partial \mathcal{C}}$ , generally depends on all  $x \in \mathbf{X}$ . It is constant if and only if  $\pi_g(\mathbf{X}_g)$  and  $\pi_c(\mathbf{X}_c)$  differ only by a constant, i.e., *iff* CB and government policies respond to all other factors equally ( $\frac{\partial \pi_c}{\partial x} = \frac{\partial \pi_g}{\partial x} \forall x \in \mathbf{X}$ ). Conversely, the inflation effect of any other factor,  $\frac{\partial \pi}{\partial x}$ , depends on CBA unless CB and government respond to that factor equally ( $\frac{\partial \pi_c}{\partial x} = \frac{\partial \pi_g}{\partial x}$ ). Broadly then, the anti-inflationary effect of CBA depends on the full constellation of domestic political-economic institutions and conditions under which CB and government interact. If a political economy produces little inflationary pressure on government, then  $\pi_g$  hardly differs from  $\pi_c$ . Each given free reign, CB and government would do little differently, so CBA hardly matters in such country-times. If the political economy strongly pressures governments for inflation,  $\pi_g$  will far-exceed  $\pi_c$ , so CBs would act quite differently than governments. As CB policy can differ from current-government aims only so far as autonomy allows, degrees of CBA matter greatly in such country-times. Thus, quite simply, in insulated economies with floating exchange-rates, each CBA increment has larger anti-inflation impact where the domestic political-economy is otherwise more inflationary.<sup>12</sup>

More explicit specification of  $\pi_g(\mathbf{X}_g)$  and  $\pi_c(\mathbf{X}_c)$ , which describe inflation under full-CB and full-government control of monetary policy, will now clarify the effects of CBA and other political-economic factors on inflation, and how each depends on the other terms. The neoclassical model,

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<sup>12</sup>Note how this addresses Posen's issue (1995ab; see note 4) without claims of institutional epiphenomenality.

e.g., implies that anything that raises (a) governments' weight on output relative to inflation or their output or inflation target, or (b) the real-efficacy of surprise money (Phillips Curve slopes), increases  $\pi_g$ , and anything that raises (c) natural rates lowers  $\pi_g$ . Contrarily, inflation under autonomous and conservative CBs,  $\pi_c$ , is assumed lower and unaffected by other conditions. **(1)** and **(3)** then imply that realized inflation,  $\pi$ , falls proportionately from government-controlled  $\pi_g(\mathbf{X}_g)$  toward CB-controlled  $\pi_c(\mathbf{X}_c)$  as CBA rises. Thus, the anti-inflation effect of CBA,  $\frac{\partial \pi}{\partial C}$ , is greater the larger  $\pi_g(\mathbf{X}_g) - \pi_c$ , which depends in the neoclassical model on anything that affects (a), (b), or (c).

**Appendix II** formally details the many interactive predictions that emerge from **(3)** in the neoclassical context; here, I consider a subset more substantively. For example, point (a) suggests that right governments produce higher inflation,  $\pi_g$ , than left, since the latter weigh output more-heavily relative to inflation or have higher inflation or output targets. Points (b) and (c) suggest that, by altering natural rates or the real-effectiveness of surprise money (Phillips-Curve slopes), labor-market institutions also affect  $\pi_g$ . Unions with monopoly power, e.g., may push real wages above market clearing so that *union power*,  $UP$ , lowers natural rates;  $UP$  may also heighten monetary real-efficacy by increasing nominal rigidities in the economy. Contrarily, neocorporatism logic<sup>13</sup> suggests that bargaining coordination,  $BC$ , as opposed to union power without coordination, induces real-wage restraint<sup>14</sup> and so increases natural rates. Together, these imply that government-controlled inflation increases in union power,  $UP$ , and decreases in bargaining coordination,  $BC$ .

Further implications emerge readily. Greater trade exposure,  $TE$ , should lower  $\pi_g$  by reducing monetary real-efficacy (Phillips Curve slopes) (Romer 1993). Incumbents' incentives to spur

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<sup>13</sup> Headey (1970), Lange (1984), Cameron (1984), Bruno and Sachs (1987), Alogoskoufis and Manning (1988), Calmfors and Driffill (1988), Carlin and Soskice (1990), Soskice (1990), Layard et al. (1991), Calmfors (1990, 1993).

<sup>14</sup> Calmfors and Driffill (1988) argue restraint is greater at zero and full coordination and less intermediately. For simplicity, I separate this into two opposite linear relationships. *Union power*,  $UP$ , as defined by Cukierman (1992) and measured here by union density, increases market power and so reduces restraint. *Bargaining coordination*,  $BC$ , as defined by Soskice (1990) and measured here as in Hall and Franzese (1998), internalizes bargaining externalities and so increases restraint. Carlin and Soskice (1990), Soskice (1990), and Layard et al. (1991) similarly, and empirically successfully, disaggregate the Calmfors-Driffill curve.

the economy for electoral advantage should produce higher  $\pi_g$  in post-election years,  $EY$ , given their higher weights on or targets for output pre-election (Nordhaus 1975, Tufte 1978). Politically potent financial-sector opposition to inflation,  $FS$ , should reduce  $\pi_g$  by raising governments' weights on or lowering their targets for inflation (Posen 1995ab).  $\pi_g$  may decrease with aggregate wealth,  $AW$ , since governments in less-developed economies may rely more heavily on seigniorage for public revenues. In open economies, governments' incentives to resist domestic inflation diminish in the trade-weighted average inflation-rate abroad,  $\pi_a$ , and, even in closed economies,  $\pi_a$  could proxy for some set of unknown globally common factors that affect government inflation for which the other seven factors do not account.<sup>15,16</sup> All these arguments, and others could easily be added, now carry the further implication that these factors' inflation-effects are larger when CBA is lower, and, *vice versa*, that the inflation effect of CBA is greater (less) when pro-(anti-)inflationary factors are higher.

Summarizing formally, complete domestic-government control of monetary policy produces inflation,  $\pi_g$ , that depends on government partisanship, election years, union power, bargaining coordination, financial-sector strength, trade exposure, and inflation abroad:

$$\pi_g(\mathbf{X}_g) = \pi_g(GP, EY, UP, BC, AW, FS, TE, \pi_a) \quad (4)$$

If, as commonly argued or assumed, autonomous CBs simply target some low, constant inflation rate, then  $\pi_c$  is fixed (low) and does not respond to any political-economic conditions:

$$\pi_c(\mathbf{X}_c) = \bar{\pi}_c \quad (5)$$

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<sup>15</sup> Like the broader conclusion from (1), none of these specific interactive predictions depend on a neoclassical model. Hirsch and Goldthorpe (1978), Kraus and Salant (1977), Lindberg and Maier (1985), for example, offer many arguments relating trade exposure to inflation. Shared monetary-policy control generally implies realized inflation is a convex combination of  $\pi_g$  and  $\pi_c$  whatever theories used to specify them. That combinatorial form suffices to imply  $\frac{\partial \pi}{\partial \mathcal{C}}$  is not constant, as implicit in previous empirical specifications like **Figure 1**, but rather depends on *everything* that would affect inflation differently in these two polar cases, as in (3).

<sup>16</sup> I stress governments' partisan and electoral ( $GP, EY$ ) incentives, labor-market institutions and structure ( $BC, UP$ ), and socioeconomic structure ( $FS, TE, AW$ ); others might emphasize governments' stability (e.g., Cukierman et al. 1992) or outstanding stocks of nominal-obligations (e.g., Cukierman 1992:47-82).

Therefore, the anti-inflationary impact of CBA,  $\frac{\partial \pi}{\partial CBA}$ , in financially insulated economies with flexible exchange-rates ( $P=E=0$ ) depends on  $GP$ ,  $EY$ ,  $UP$ ,  $BC$ ,  $TE$ ,  $FS$ ,  $AW$ , and  $\pi_a$ , and these factors' inflation-effects, in turn, all depend on (specifically, are muted by) CBA.

Standard linear-additive empirical models, however, ignore this context-dependence of CBA effects, simply adding CBA to **(4)**'s list of (linear) inflation determinants:

$$E(\pi) = \mathbf{B}_0 + \beta_{gp}GP + \beta_{ey}EY + \beta_{up}UP + \beta_{bc}BC + \beta_{aw}AW + \beta_{fs}FS + \beta_{te}TE + \beta_{\pi a}\pi_a + \beta_c C \quad (6)$$
where  $\mathbf{B}_0$  represents intercept and time-serial controls. Appropriate empirical models to test CBA-and-inflation theory and estimate its parameters would instead embody a convex-combinatorial form like **(1)**. Assuming, as standard, that the inflationary impetuses of all other factors [those in **(4)**] are equiproportionally resisted by autonomous, conservative CBs, this gives:

$$E(\pi) = \mathbf{B}_0 + (\beta_{gp}GP + \beta_{ey}EY + \beta_{up}UP + \beta_{bc}BC + \beta_{aw}AW + \beta_{fs}FS + \beta_{te}TE + \beta_{\pi a}\pi_a) \cdot (1 - \beta_{c1}C) + \beta_{c1}C \cdot \beta_{c2} \quad (7)$$
The key parameter in **(7)** is  $\beta_{c1}$ ; its estimate will reflect the degree to which a hypothetical perfectly

autonomous CB would resist inflationary pressures emerging from other political-economic factors relative to what an equally-hypothetical government fully in control of monetary policy would do.<sup>17</sup>

Other parameters are as intuitively interpreted.  $\mathbf{B}_0 + \beta_{c1} \cdot \beta_{c2}$  gives an estimate of  $\bar{\pi}_c$ , the constant-inflation target of a (hypothetical) fully autonomous and conservative CB.<sup>18</sup>  $\beta_x$  estimates the inflation response to political-economic factor  $x \in \mathbf{X}_g$  under full government control of monetary policy; each unit increment in the degree of CBA reduces all of these effects toward zero by  $\beta_{c1}$ . Note also that the weighted-average **(7)** nests the linear-additive **(6)** within it. If **(6)** were true, we would estimate  $b_{c2} < 0$  and  $b_{c1} \approx 0$ , reducing **(7)** to **(6)**. If **(7)** is right, we will estimate  $b_{c1} \approx 1$  so that when  $C=1$ , the estimate gives the CBs target—here:  $E(\pi) = \mathbf{B}_0 + b_{c2}$ —when  $C=0$ , the estimate gives government inflation—here:  $E(\pi) = \mathbf{B}_0 + b_{gp}GP + b_{ey}EY + b_{up}UP + b_{bc}BC + b_{aw}AW + b_{fs}FS + b_{te}TE + b_{\pi a}\pi_a$ —and (c) when

<sup>17</sup>  $b_{c1} > 1$  would imply, substantively problematically, that wholly autonomous CBs more than 100% mitigate other variables' inflationary impacts. Thus, restricting  $0 \leq \beta_{c1} \leq 1$  would further improve model-specification. This can be done (but complicates exposition and so is not here), for example, by replacing  $\beta_{c1}$  with  $[1 + e^{-\beta_{c1}}]^{-1}$  (a logit function).

<sup>18</sup> To be precise,  $(b_0 + b_{c1}b_{c2}) / (1 - b_{c1} - b_{c2})$ , with constant  $b_0$  and lag coefficients  $b_{c1}$  and  $b_{c2}$ , is the relevant estimate.

$0 < C < 1$ , the estimate weighs (a) by  $b_{c1} \cdot C$  and (b) by  $1 - b_{c1} \cdot C$ . Finally, if CBA were epiphenomenal, affecting inflation in neither modality controlling for the other factors, then we would find  $b_{c1} \approx b_{c2} \approx 0$ .

A model allowing all of the factors in **(4)** to affect both governments' and CBs' desired policies, but potentially differently, gives a standard linear-interactive regression, every other factor interacted with CBA to allow it a different inflation effect depending on CBA and *vice versa*:

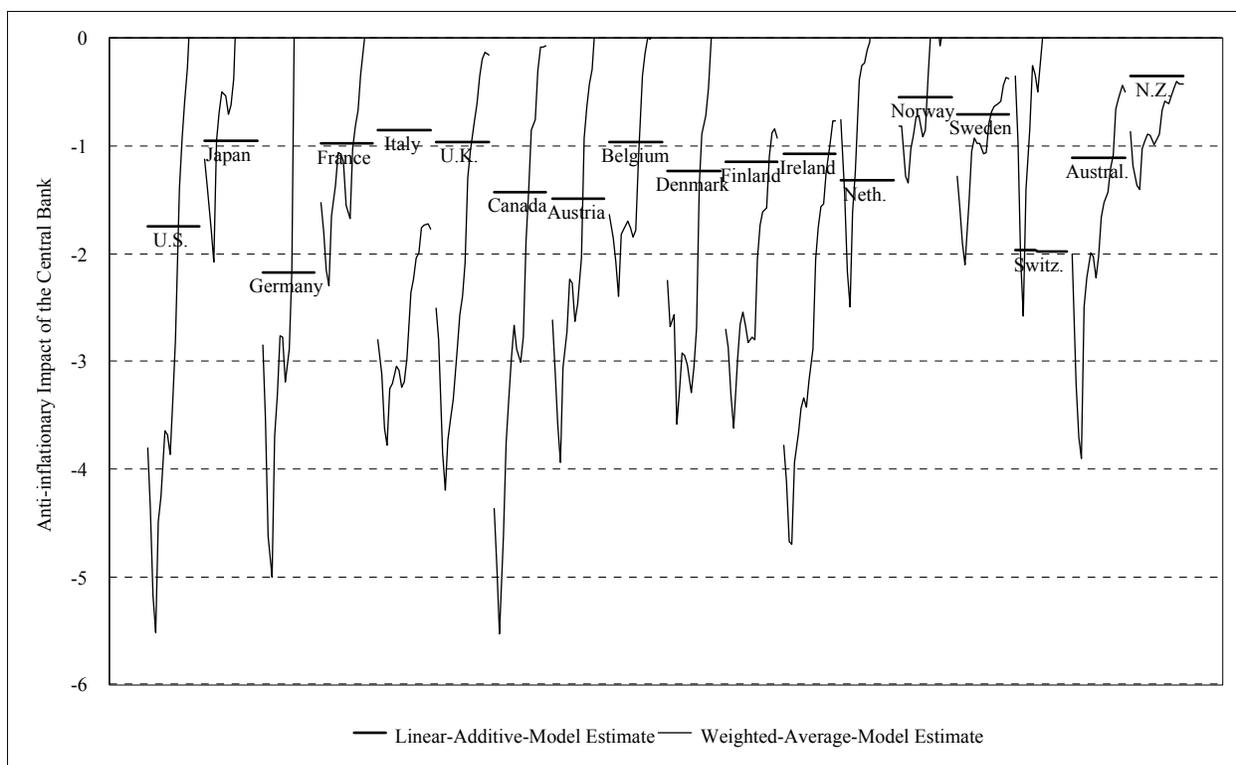
$$E(\pi) = \begin{cases} \mathbf{B}_0 + \beta_{gp} GP + \beta_{ey} EY + \beta_{up} UP + \beta_{bc} BC + \beta_{aw} AW + \beta_{fs} FS + \beta_{te} TE + \beta_{\pi a} \pi_a + \beta_{c2} C + \\ \beta_{cgp} C \cdot GP + \beta_{cey} C \cdot EY + \beta_{cup} C \cdot UP + \beta_{cbc} C \cdot BC + \beta_{caw} C \cdot AW + \beta_{cfs} C \cdot FS + \beta_{cte} C \cdot TE + \beta_{c\pi a} C \cdot \pi_a \end{cases} \quad \mathbf{(8)}$$

**(8)** nests both **(6)** and **(7)** within it. If linear **(6)** were true, all the interactive coefficients in the second row would be zero,  $b_{cx} \approx 0 \quad \forall x$ , and  $b_{c2} \leq 0$ . If the weighted-average **(7)** is correct, each interactive coefficient ( $b_{cx}$ ) would roughly equal negative its non-interactive counterpart,  $b_{cx} \approx -b_x \quad \forall x$ , reducing **(8)** to **(7)** with  $b_{c1} \approx 1$ .<sup>19</sup> The generality of **(8)** also allows some factors to influence CB and government policies the same ( $b_{cx} \approx 0, b_x \neq 0$ ); some to influence both but differently ( $b_{cx} \neq 0, b_x \neq 0, b_{cx} \neq -b_x$ ); some to affect CB policies only ( $b_{cx} \neq 0, b_x \approx 0$ ); or some to influence government policies only ( $b_{cx} \approx -b_x, b_x \neq 0$ ). When this last holds for all  $x$ , **(8)** reduces to **(7)** with  $b_{c1} \approx 1$  as already noted. Two further possibilities: any  $x$  affecting neither CB nor government policies will yield  $b_{cx} \approx 0$  and  $b_x \approx 0$ ; and, if, controlling for these  $x$ , CBA had neither linear nor linear-interactive effect on inflation, then we would find  $b_{c2} \approx 0$  and  $b_{cx} \approx 0 \quad \forall x$ . Thus, **(7)** is a constrained version of **(8)**, forcing equi-proportional reduction by the degree of CBA of all other factors' inflation-effects:  $b_x/b_{cx} = b_z/b_{cz} \quad \forall x, z$ , and, similarly, **(6)** constrains **(7)** by forcing  $b_{c1} = 0$  and **(8)** by forcing  $b_{cx} = 0 \quad \forall x$ .<sup>20,21</sup>

<sup>19</sup> More exactly, we need only find  $b_{cx}/b_x \approx b_{cz}/b_z \quad \forall x, z$  to have found support for **(7)**; see below.

<sup>20</sup> Theory or empirics could easily suggest alternative constraints on the most-general **(8)**. Franzese (1999) found **(7)** statistically dominated all such he attempted.

<sup>21</sup> Neoclassical models of inflation are no-more empirically at issue here than theoretically above. Rather, models of inflation in which conservative CBs control monetary policy to degrees measured by CBA and governments to remaining degrees [as in **(7)** or **(8)**] confront a model in which CBA has simple negatively additive inflation effects [as in **(6)**] or is epiphenomenal [**(6)** with  $b_c = 0$ ]. The empirical corrective is as general as the theoretical: *any* model in which governments and CBs respond differently to different politico-economic factors suggests **(7)** or **(8)** not **(6)**.



**Figure 2:** Linear-additive and weighted-average estimates of central banks' anti-inflationary impacts given their degree of independence and given the other politico-economic characteristics of that country-year. Estimates for each country 1972-90 are plotted from left to right. *Figure recreated from results reported in Franzese (1999).*

Franzese (1999) estimated equations like (6), (7), and (8) from annual GDP-index inflation data in 18 OECD countries during the post-Bretton Woods flexible-exchange-rate era (1972-90). He found overwhelming support for (7) or (8) over (6) and extremely strong support for (7) over (8). I.e., available data convincingly support convex-combinatorial specifications, implying CBA's inflation effect depends on many other political-economic conditions (e.g., those in (4)<sup>22</sup>) of the setting in which the CB interacts and, *vice versa*, other factors's inflation effects are all muted by CBA. He graphically summarized the *varying* anti-inflationary impact of CBA across his sample in **Figure 2**; however, his estimates applied only to the flexible-exchange-rate era and ignored the potential impact of international financial exposure. His analysis is extended in these regards below.

### **III. Inflation Under Differing Exchange-Rate Regimes, Differing Degrees of International Financial Exposure, and Differing Degrees of Central Bank Autonomy and Conservatism**

<sup>22</sup> Franzese (1999) did not include election-year indicators among the factors to which governments respond.

Section II and Franzese (1999) described inflation determination assuming that the domestic authorities, some combination of CB and government, retain full control of monetary policy and thus domestic inflation. This specified the last two terms in **(2)**. However, international financial exposure or exchange-rate commitments would restrict either domestic authority's inflation-policy control.

In highly financially integrated economies, policymakers who fail to match domestic to foreign inflation induce large capital in- or out-flows, resulting in mammoth real (with a peg<sup>23</sup>) or nominal (with a float) exchange fluctuations. In the theoretical ideal of a small and fully financially-exposed economy, in fact, the volatility would be infinite and so infinitely damaging. In that extreme, then, global financial conditions completely dominate any domestic concerns of either domestic authority. Average inflation abroad would fully determine domestic inflation. Therefore, domestic combinations of CB and government retain domestic-inflation control only to the degree their economy remains financially insulated ( $1-E; E \in \{0..1\}$ ). This specifies much more of **(2)** very simply:

$$\begin{aligned} \pi_1(\mathbf{X}_1) &= \pi_2(\mathbf{X}_2) = \pi_5(\mathbf{X}_5) = \pi_6(\mathbf{X}_6) = \pi_a \\ &\Rightarrow \\ \pi &= \begin{cases} E \cdot \pi_a + P \cdot (1-E) \cdot C \cdot \pi_3(\mathbf{X}_3) + P \cdot (1-E) \cdot (1-C) \cdot \pi_4(\mathbf{X}_4) \\ + (1-P) \cdot (1-E) \cdot C \cdot \overline{\pi_c} + (1-P) \cdot (1-E) \cdot (1-C) \cdot \pi_g(\mathbf{X}_g) \end{cases} \end{aligned} \quad (9)$$

Similarly, if domestic authorities opt to peg to a (basket of) foreign currency(ies), and do so fully effectively, they completely sacrifice domestic monetary autonomy. Purchasing-power-parity implies that, to maintain exchange-rate pegs, domestic policymakers must match peg-countries' inflation rates. If they allowed domestic inflation to deviate from peg-country rates, domestic prices would drift from foreign prices, which is economically unsustainable because it implies infinite arbitrage gains and losses on traded goods. Likewise, interest-parity conditions obligate domestic authorities seeking fixed exchange-rates to match domestic and peg-country nominal-interest rates, net of risk-premium differentials, which also forces them to match peg-country inflation. Therefore,

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<sup>23</sup> Exchange controls would be required to sustain a peg with differing domestic and peg-country inflation.

either condition suffices to specify the rest of **(2)**. Under fully-fixed exchange-rates ( $P=1$ ):

$$\begin{aligned} \pi_3(X_3) &= \pi_4(X_4) = \pi_p \\ &\Rightarrow \\ \pi &= E \cdot \pi_a + P \cdot (1 - E) \cdot \pi_p + (1 - P) \cdot (1 - E) \cdot C \cdot \overline{\pi_c} + (1 - P) \cdot (1 - E) \cdot (1 - C) \cdot \pi_g(X_g) \end{aligned} \tag{10}$$

with  $\pi_p$  inflation in the peg country or the basket-weighted-average of inflation in the peg countries.

In sum, domestic policymakers retain full control of domestic inflation only in financially insulated economies. Furthermore, their domestic autonomy allows them to respond to domestic political-economic conditions only if they forsake exchange-rate pegs. At the other extremes: in fully financially exposed economies ( $E=1$ ), domestic authorities must direct monetary policy to match domestic to global inflation to avoid mammoth real or nominal exchange fluctuations; and, in non-fully-exposed countries attempting to peg exchange-rates ( $P=1$ ), domestic authorities must dedicate monetary policy to matching domestic inflation to peg countries' inflation to sustain that peg.

Note how each of the above cases describes partial monetary-policy delegation from domestic governments and therefore implies multiple interaction effects. In insulated economies ( $E=0$ ) with flexible-exchange-rates ( $P=0$ ), CBA implies partial monetary-authority delegation from domestic governments to their CBs ( $C \in 0..1$ ), yielding the *two-hands-on-the-wheel* case discussed in Franzese (1999) and Section II. Partial delegation to CBs implies that the inflation effects of all factors to which government and CB respond differently depend on degrees of CBA and *vice versa*. Financial exposure,  $E \in 0..1$ , or exchange-rate pegs,  $P \in 0..1$ , also entail partial delegation. To defend exchange-rate pegs, domestic CB and government must delegate inflation control to the monetary authorities of (a) peg county(ies), itself (themselves) some convex combination of CBs and governments under some degree of financial exposure or exchange-rate fixity. Likewise, to the degree domestic CB and government allow or cannot prevent free international financial access to their current and capital account ( $E \in 0..1$ ), they effectively delegate monetary authority to exposure-weighted sets of foreign

authorities, who, again, may themselves be partially exposed or exchange-rate committed. Thus, in general, the domestic-inflation effects of all foreign (\*) and domestic political-economic factors ( $C, P, E, \mathbf{X}$  and  $C^*, P^*, E^*, \mathbf{X}^*$ ) depend on foreign and domestic institutions of monetary-policy control ( $C, C^*$ ), exchange-rate regimes ( $P, P^*$ ), degrees of international financial exposure ( $E, E^*$ ), and other political-economic conditions at home and abroad ( $\mathbf{X}, \mathbf{X}^*$ ). Formally:

$$\begin{aligned}
\pi &= E \cdot \pi_a + (1-E) \cdot \left\{ P \cdot \pi_p + (1-P) \cdot \left[ C \cdot \bar{\pi}_c + (1-C) \cdot \pi_g(\mathbf{X}_g) \right] \right\} \\
\Rightarrow \\
\frac{\partial \pi}{\partial E} &= \pi_a(P^*, E^*, C^*, \mathbf{X}^*, \pi_a^*) - \left\{ P \cdot \pi_p(P^*, E^*, C^*, \mathbf{X}^*, \pi_p^*) + (1-P) \cdot \left[ C \cdot \bar{\pi}_c + (1-C) \cdot \pi_g(\mathbf{X}_g) \right] \right\} \\
\frac{\partial \pi}{\partial P} &= (1-E) \cdot \left\{ \pi_p(P^*, E^*, C^*, \mathbf{X}^*, \pi_p^*) - \left[ C \cdot \bar{\pi}_c + (1-C) \cdot \pi_g(\mathbf{X}_g) \right] \right\} \\
\frac{\partial \pi}{\partial C} &= (1-E) \cdot \left\{ (1-P) \cdot \left[ \bar{\pi}_c - \pi_g(\mathbf{X}_g) \right] \right\} \\
\frac{\partial \pi}{\partial \mathbf{x}} &= (1-E) \cdot \left\{ (1-P) \cdot \left[ (1-C) \cdot \frac{\partial \pi_g}{\partial \mathbf{x}} \right] \right\} \\
\frac{\partial \pi}{\partial \mathbf{z}^*} &= E \cdot \frac{\partial \pi_a}{\partial \mathbf{z}^*} + (1-E) \cdot \left\{ P \cdot \frac{\partial \pi_p}{\partial \mathbf{z}^*} + (1-P) \cdot \left[ (1-C) \cdot \frac{\partial \pi_g}{\partial \pi_a} \cdot \frac{\partial \pi_a}{\partial \mathbf{z}^*} \right] \right\}
\end{aligned} \tag{11}$$

where  $\mathbf{Z}^*$  refers to the vector of foreign variables, ( $C^*, P^*, E^*, \mathbf{X}^*$ ), and  $z^*$  to an element of  $\mathbf{Z}^*$ .

The first line of **(11)** compactly rewrites **(2)** to reflect our theoretical additions. In financially insulated economies with flexible exchange-rates and autonomous CBs ( $P=E=0, C=1$ ), domestic inflation is just the domestic-CB target,  $\pi_c$ . In insulated economies with flexible exchange-rates and dependent CBs ( $P=E=C=0$ ), domestic inflation is what politically responsive domestic-government would produce,  $\pi_g(\mathbf{X}_g)$ . In insulated economies with fixed exchange-rates ( $P=1, E=0$ ), peg country inflation,  $\pi_p$ , fully determines domestic inflation; the degree of domestic CBA and other domestic conditions do not matter in this case. In small, fully financially-exposed economies ( $E=1$ ), average inflation abroad,  $\pi_a$ , fully determines domestic inflation; domestic CBA, exchange-rate regimes, and other conditions do not matter in this case.

The next five lines of **(11)** show the highly context-dependent domestic-inflation effects of

all foreign and domestic political-economic institutions and conditions:  $E$ ,  $P$ ,  $C$ ,  $x$ , and  $z^*$ . **(11)** also models several mechanisms of international transmission of inflation effects: *via* exchange-rate pegs and  $\pi_p$ , *via* financial exposure and  $\pi_a$ , and *via* domestic-government responses to  $\pi_a$ . For example, if France is partially pegged to the US dollar, exposed to global financial flows, and has a less-than-fully autonomous CB, then French inflation responds to the US and other countries' degrees of CBA and international financial exposure and their broader political-economic conditions, which include each country's domestic-inflation dependence on inflation abroad (which, in turn, depend on still other countries' conditions) *via* all three mechanisms. This, I believe, reflects a core contention of much classic and modern comparative and international political economy: the effects of political-economic conditions and institutions are highly contextual, depending on many other political-economic conditions and institutions at home and abroad.

Can we model such highly interactive predictions as empirically compactly and theoretically and substantively meaningfully as in the simpler fully-flexible-exchange-rate, financially-insulated case given in **(1)**? One must certainly hope so because **(11)** implies that the domestic inflation-effect of virtually every foreign and domestic political-economic factor depends on nearly all other foreign and domestic factors, which would be impossible to model empirically and to interpret substantively without further theoretical input. Even assuming all  $N$  governments in some sample respond to the same  $k$  political-economic factors in the same ways, and that all  $N$  CBs target the same constant inflation, introducing exchange-rate pegs and international financial exposure would require  $2^{N(k+1)}$  terms to model in the usual linear-interactive way.<sup>24</sup> Happily, one can capture all the theoretically-implied interactive effects of one- and multi-currency exchange-rate pegs and international financial exposure far more compactly and intuitively using the theoretically informed first line of **(11)**.

#### **IV. A Compact, Intuitive Empirical Model of Inflation in Open, Institutionalized**

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<sup>24</sup> Even adopting the constrained model of domestic inflation under flexible exchange-rates and financially-insulated economies suggested in Franzese (1999) would still require  $(k+2) \cdot 2^N$  terms.

## Economies

The standard approach to modeling empirically the inflation effects of exchange-rate regimes,  $P$ , financial exposure,  $E$ , and central bank autonomy and conservatism,  $C$ , simply adds  $C$ ,  $E$ , and  $P$  to some list of other determinants of inflation: e.g., government partisanship, post-election-year indicators, union power, bargaining coordination, aggregate wealth, financial-sector strength, trade exposure, and inflation abroad. Analogous to **(6)**, this standard, linear-additive model would be:

$$E(\pi) = \mathbf{B}_0 + \beta_{gp} GP + \beta_{ey} EY + \beta_{up} UP + \beta_{bc} BC + \beta_{aw} AW + \beta_{fs} FS + \beta_{te} TE + \beta_{\pi_a} \pi_a + \beta_c C + \beta_{sp} SP + \beta_{mp} MP \quad (12)$$

where  $SP$  and  $MP$  indicate the presence of a single-currency ( $SP=1$ ) or multi-currency or *basket* ( $MP=1$ ) exchange-rate-peg commitment.  $SP=MP=0$  implies a floating-rate regime.

However, not only does domestic inflation depend on degrees of  $P$ ,  $E$ ,  $C$ , all factors to which governments respond,  $\mathbf{X}_g = \{GP, EY, UP, BC, AW, FS, TE\}$ , and two forms of foreign inflation,  $\{\pi_a, \pi_p\}$ , but the inflation effect of each of these is *not* constant. Theory shows the effects of all 12 variables to vary with levels of the others. Standard linear-interactive methods for modeling such interactive statements would require estimating  $2^v$  coefficients, with  $v$  the number of unique variables. Our 11 would require 2048!<sup>25</sup> Even assuming the response of government inflation to political-economic factors,  $\pi_g(\mathbf{X}_g)$ , is strictly linear (no  $x_i \in \mathbf{X}_g$  interacts with  $x_j \in \mathbf{X}_g$ ), and even ignoring multi-country-peg and  $N^{\text{th}}$ -country complications, allowing each of the eight domestic political-economic factors in  $\mathbf{X}_g$  has a different effect under each combination of  $P$ ,  $E$ , and  $C$ , which would require  $2^3 \cdot 8 = 64$  terms:

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<sup>25</sup> Linear-interactive models of the broadest interpretation of “the effect of each  $x$  depends on all others” yield  $2^{11} = 2048$  unique combinations of products of subsets of the 11 unique  $x$ , each likely extremely-highly correlated yet requiring a separate coefficient. Even allowing the effects to depend only linearly on others (e.g., the effect of  $C$  may depend on  $P$  and  $E$  but not on  $P \cdot E$ ), a linear-interactive model would require 55 (i.e.,  $K!/2(K-2)!$ ) coefficient estimates on very-highly correlated terms. These calculations and those in the text all exclude intercepts and time-serial controls from the interactive set, thereby implicitly assuming them equal under all institutional-structural configurations.

$$E(\pi) = \mathbf{B}_0 + \begin{cases} E \cdot P \cdot C \cdot [\beta_{gp1}GP + \beta_{ey1}EY + \beta_{up1}UP + \beta_{bc1}BC + \beta_{aw1}AW + \beta_{fs1}FS + \beta_{ie1}TE + \beta_{\pi1}\pi_a] \\ E \cdot P \cdot (1 - C) \cdot [\beta_{gp2}GP + \beta_{ey2}EY + \beta_{up2}UP + \beta_{bc2}BC + \beta_{aw2}AW + \beta_{fs2}FS + \beta_{ie2}TE + \beta_{\pi2}\pi_a] \\ E \cdot (1 - P) \cdot C \cdot [\beta_{gp3}GP + \beta_{ey3}EY + \beta_{up3}UP + \beta_{bc3}BC + \beta_{aw3}AW + \beta_{fs3}FS + \beta_{ie3}TE + \beta_{\pi3}\pi_a] \\ (1 - E) \cdot P \cdot C \cdot [\beta_{gp4}GP + \beta_{ey4}EY + \beta_{up4}UP + \beta_{bc4}BC + \beta_{aw4}AW + \beta_{fs4}FS + \beta_{ie4}TE + \beta_{\pi4}\pi_a] \\ (1 - E) \cdot (1 - P) \cdot C \cdot [\beta_{gp5}GP + \beta_{ey5}EY + \beta_{up5}UP + \beta_{bc5}BC + \beta_{aw5}AW + \beta_{fs5}FS + \beta_{ie5}TE + \beta_{\pi5}\pi_a] \\ (1 - E) \cdot P \cdot (1 - C) \cdot [\beta_{gp6}GP + \beta_{ey6}EY + \beta_{up6}UP + \beta_{bc6}BC + \beta_{aw6}AW + \beta_{fs6}FS + \beta_{ie6}TE + \beta_{\pi6}\pi_a] \\ E \cdot (1 - P) \cdot (1 - C) \cdot [\beta_{gp7}GP + \beta_{ey7}EY + \beta_{up7}UP + \beta_{bc7}BC + \beta_{aw7}AW + \beta_{fs7}FS + \beta_{ie7}TE + \beta_{\pi7}\pi_a] \\ (1 - E) \cdot (1 - P) \cdot (1 - C) \cdot [\beta_{gp8}GP + \beta_{ey8}EY + \beta_{up8}UP + \beta_{bc8}BC + \beta_{aw8}AW + \beta_{fs8}FS + \beta_{ie8}TE + \beta_{\pi8}\pi_a] \end{cases} \quad (13)$$

(13) is the natural extension of the common practice of interacting exposure or exchange regimes with some (usually one) domestic political-economic factors whose effects pegs or exposure are expected to modify. However, pegs and exposure logically must dampen *all* domestic factors' effects as (13) allows, but obtaining precise coefficient estimates for 64 highly correlated linear-interaction terms is extremely unlikely, and even if found they would defy substantive interpretation. This gloomy arithmetic no-doubt dissuaded empirical researchers from exploring the rich substantive potential of the many interactions they theoretically suspected. Here, however, theory can and should inform the empirical analysis, suggesting specification refinements that may enable more precise and substantively-revealing estimates of the many interactive effects suspected.

Equation (11) applied only the simplest, virtually non-contentious, economic arguments to summarize inflation-determination in open and institutionalized economies under different exchange regimes and varying degrees of international financial exposure and CBA much more succinctly than in (2). Assuming the arguments that reduced (2) to (11) are correct, and continuing to assume  $\pi_g(\mathbf{X}_g)$  strictly linear, theory suggests these particular highly interactive propositions reduce to an equation requiring only 14 unique coefficient estimates (plus intercept(s) and time-serial controls<sup>26</sup>):

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<sup>26</sup>The controls in  $\mathbf{B}_0$  are assumed unaffected by regime, institutional, and structural conditions. If they differed across  $P$ ,  $E$ , and  $C$ , they would increase the number of coefficient-estimates required by three times their number in (14) but by eight times in (13) and by many more times in alternative specifications of highly interactive propositions.

$$E(\pi) = \mathbf{B}_0 + \beta_e E \cdot \beta_{\pi^*} \pi_a + (1 - \beta_e E) \cdot \left\{ \left[ \left( \beta_{gp} GP + \beta_{ey} EY + \beta_{up} UP + \beta_{bc} BC + \beta_{aw} AW + \beta_{fs} FS + \beta_{te} TE + \beta_a \pi_a \right) \right] \right. \\ \left. \cdot \left[ (1 - \beta_{c1} C) + \beta_{c1} C \cdot \beta_{c2} \right] \right. \\ \left. \cdot \left[ (1 - \beta_{sp} SP - \beta_{mp} MP) + \beta_{sp} SP \cdot \beta_{\pi^*} \pi_{sp} + \beta_{mp} MP \cdot \beta_{\pi^*} \pi_{mp} \right] \right\} \quad (14)$$

While (14) may first look complicated, it actually reflects our theoretical expectations quite compactly, intuitively, and substantively meaningfully. The expression inside parentheses in the top line is our model of inflation under full domestic-government control of inflation policy,  $\pi_g(\mathbf{X}_g)$ . It determines inflation to the degree the domestic CB is dependent (the  $(1 - \beta_{c1} C)$  term in line two), exchange rates are flexible ( $(1 - \beta_{sp} SP - \beta_{mp} MP)$  in line three), and the economy is financially insulated ( $(1 - \beta_e E)$  preceding the braces). Similarly, the expression in square brackets is inflation under full domestic-authority control, which CBs and governments share as estimated by  $(1 - \beta_{c1} C) \cdot \pi_g(\mathbf{X}_g) + \beta_{c1} C \cdot \pi_c$ . It holds to the degree exchange rates are flexible,  $(1 - \beta_{sp} SP - \beta_{mp} MP)$ , and the economy is insulated,  $(1 - \beta_e E)$ . In braces lies our model of inflation in fully financially insulated economies, which weighs domestic-authority inflation by  $(1 - \beta_{sp} SP - \beta_{mp} MP)$ , inflation in a single peg-country,  $\pi_{sp}$ , by  $\beta_{sp} SP$ , and basket-weighted-average inflation in multi-country pegs,  $\pi_{sp}$ , by  $\beta_{mp} MP$ . Lastly, the outermost terms indicate that inflation abroad determines domestic inflation to the degree the domestic economy is financially exposed,  $\beta_e E \cdot \pi_a$ , and domestic authorities and their exchange-rate commitments determine domestic inflation to the remaining degree,  $(1 - \beta_e E)$ .

**Appendix III** gives data definitions, sources, and descriptive statistics, so I introduce terms more briefly here, stressing the intuitive substantive interpretation of their associated coefficients.  $SP=1$  indicates single-currency pegs for countries involved in the Bretton Woods system and a few other such pegs in the sample.<sup>27</sup>  $MP=1$  indicates multi-country basket-type pegs, mostly for members of various precursors to EMU and the *Euro (snake, tunnel, EMS)* but  $MP$  arrangements among Scandinavian, Teutonic, and Benelux countries also existed. The estimated coefficients on  $SP$  and

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<sup>27</sup> In the Bretton Woods era, most OECD countries pegged to the US dollar or to effectively dollar-denominated IMF SDR's. Ireland, Australia, Spain, and New Zealand pegged to the British pound over similar periods.

$MP$ ,  $b_{sp}$  and  $b_{mp}$ , directly reflect the degrees to which single- and multi-currency pegs, while they remained official policy,<sup>28</sup> prevented domestic conditions from affecting inflation outcomes. Quinn's index of current- and capital-account openness, rescaled to  $E \in \{0..1\}$ , measures international financial exposure.<sup>29</sup> Its coefficient,  $b_e$ , reflects the degree to which financial exposure so measured constrains domestic monetary authorities from controlling domestic inflation autonomously or pegging their exchange rate.  $C$  averages five common indices of CBA, rescaled  $C \in \{0..1\}$ . Its coefficient,  $b_{c1}$ , reflects the degree to which a hypothetical perfectly autonomous CB ( $C=1$ ) would reduce domestic-authority responses to all factors,  $\mathbf{X}_g$ . Its other cofactor,  $b_{c2}$ , combines with time-series controls,  $\mathbf{B}_\theta$ , to give the estimated constant-inflation target of conservative CBs.<sup>30</sup>

The other coefficients are as intuitive, reflecting the inflation effect of their cofactor under full domestic-government control of policy.  $GP \in \{0..10\}$  indexes government partisanship left to right.  $EY$  is a post-election-year indicator. Union density (members/labor-force) proxies union power:  $UP \in \{0..1\}$ .  $BC \in \{0, .25, .5, .75, 1\}$  subjectively indexes degree of bargaining coordination. Financial-sector employment-share proxies its political strength:  $FS \in \{0..1\}$ . GDP deflators measure inflation:  $\pi = x\%$ ; inflation abroad,  $\pi_a = x\%$ , is average inflation in the other countries that sample-year, each weighted by its share of OECD exports+imports.<sup>31</sup>  $\pi_{mp}$  uses basket currency-weights where available and trade-weighted<sup>32</sup> inflation among the other basket countries where not.  $\pi_{sp}$  is just inflation in that single peg currency. All foreign-inflation averages and weights exclude the domestic country. The data are annual from 1957-90 inclusive, and cover 21 developed democracies

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<sup>28</sup> The indices equal one only for country-years where the peg was official policy as recorded by IMF *IFS*.

<sup>29</sup> Deep gratitude to Dennis Quinn for the data; see Quinn and Inclan (1997) for their details. N.b.,  $E$  differs strongly from the *trade* exposure,  $TE$ , to which governments respond:  $TE = \{(\text{exports} + \text{imports}) / (2 \cdot \text{GDP})\} \cdot \{1 - \text{GDP}^*\}$  where  $\text{GDP}^*$  is that country's share of OECD total GDP so that  $TE \in (0..1)$ .

<sup>30</sup> N.b., coefficients on trade-weighted or peg-weighted inflation abroad,  $b_{\pi^*}$ , are equal outside of  $\mathbf{X}_g$  because  $\pi^*$  fully determines domestic inflation under perfect exposure,  $b_e E = 1$ , or pegging,  $b_{\pi^*} \mathcal{P} = 1$ . Thus, estimated *long-run* coefficients on each inflation-abroad should equal one:  $b_{\pi^*} / (1 - \rho) \approx 1$ , where  $\rho$  is the sum of lag coefficients.

<sup>31</sup> Ideally, trade-weighted inflation-abroad would use weights reflecting each country's trading pattern. Using foreign countries' share of OECD trade is far simpler and improves upon a non-weighted average.

<sup>32</sup> Using basket-countries' portion of OECD-trade only in the denominator of the weight.

insofar as possible.<sup>33</sup>

**Table 1** compares estimation results from three alternative models:<sup>34</sup> the standard linear **(12)**; the very general linear-interactive **(13)**, which follows **(2)** to allow each  $x \in \mathbf{X}_g$  different inflation effect under all combinations of  $P$ ,  $E$ , and  $C$ ; and the convex-combinatorial **(14)**, which applies the constraints theory suggests on **(2)** and **(13)**. Note first that the simple linear **(12)** performs reasonably well, explaining an adjusted 72% of the variance, 95% of what **(13)** or **(14)** explain, while producing quite sensible, reasonably precise, and readily interpretable coefficient estimates. E.g., by **(12)**, each 0.1 greater CBA lowers inflation  $0.16 \pm \%$ ; each 10% greater union density raises inflation  $0.22 \pm \%$ . However, **(12)** also finds no discernible effect of exchange regimes or international exposure, which seems substantively odd.<sup>35</sup> Plus, **(12)** assumes all these effects non-contextual while theory clearly demonstrates the opposite. Still, absent strong theoretical and empirical grounds to abandon it, the linear model's simplicity and basic empirical strength of **(12)** would argue strongly for it.

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<sup>33</sup> CBA measures are unavailable post-1990 across these countries, limiting the sample. Non-democratic periods in Greece, Portugal, and Spain are also excluded. See **Appendix IV** for further methodological details.

<sup>34</sup> Each model was estimated with and without country fixed-effects (LSDV, LS). Time-invariant  $BC$  dropped from **(12)** and **(13)** in LSDV. All substantive conclusions were robust, so I discuss only LS to avoid that complication.

<sup>35</sup> The coefficients are jointly insignificant as well.

**Table 1: Alternative Models of Inflation in 21 OECD Democracies, 1957-90**

Independent Variable	Linear-Additive Model (12)	Linear-Interactive Model (13)								Theory-Informed Model (14)	
		<i>P=1</i>	<i>P=0</i>	<i>P=1</i>	<i>P=0</i>	<i>P=1</i>	<i>P=0</i>	<i>P=1</i>	<i>P=0</i>		
		<i>E=1</i>	<i>E=1</i>	<i>E=0</i>	<i>E=0</i>	<i>E=1</i>	<i>E=1</i>	<i>E=0</i>	<i>E=0</i>		
		<i>C=1</i>	<i>C=1</i>	<i>C=1</i>	<i>C=1</i>	<i>C=0</i>	<i>C=0</i>	<i>C=0</i>	<i>C=0</i>		
Intercept	+0.80 (6.1)	+5.93 (8.40)								<b>+5.53</b> (.30)	
$\pi_{t-1}$	<b>+0.65</b> (.05)	<b>+0.51</b> (.06)								<b>+0.55</b> (.05)	
$\pi_{t-2}$	-0.03 (.04)	<b>-0.10</b> (.04)								<b>-0.12</b> (.04)	
$\mathbf{X}_g$ (The factors to which domestic governments respond)	GP	<b>-0.14</b> (.08)	+0.39 (.80)	-0.09 (1.29)	<b>-3.37</b> (1.31)	-1.37 (8.16)	-0.15 (.47)	-0.30 (.97)	<b>+1.82</b> (.74)	-0.39 (4.68)	<b>-0.60</b> (.30)
	EY	<b>+0.59</b> (.30)	+0.75 (.80)	-2.06 (2.31)	+0.50 (3.07)	-0.88 (14.67)	-2.31 (1.56)	<b>+6.03</b> (3.46)	+1.87 (1.81)	+3.81 (6.88)	<b>+2.60</b> (1.32)
	UP	<b>+2.19</b> (.74)	<b>-16.59</b> (6.43)	+9.51 (17.42)	-3.82 (13.91)	-2.46 (59.24)	<b>+33.95</b> (7.64)	+2.44 (15.92)	-11.88 (13.56)	-3.32 (37.49)	<b>+16.2</b> (4.61)
	BC	<b>-1.36</b> (.41)	+4.38 (3.50)	<b>+11.27</b> (5.33)	+6.02 (4.91)	-39.11 (30.32)	<b>-15.61</b> (3.97)	-11.69 (9.79)	+2.20 (3.86)	+9.27 (23.64)	<b>-10.7</b> (2.35)
	AW	+0.13 (.71)	-0.76 (1.15)	-2.37 (1.51)	+1.94 (1.43)	<b>+13.70</b> (5.37)	-0.56 (1.10)	-0.66 (1.38)	-2.24 (1.91)	-3.43 (2.35)	<b>+1.18</b> (.49)
	FS	<b>-0.15</b> (.10)	<b>-0.86</b> (.36)	<b>+2.00</b> (.96)	<b>+2.11</b> (.79)	<b>-11.13</b> (4.61)	+0.55 (.36)	-1.64 (1.26)	-1.00 (.71)	+4.63 (3.90)	<b>-1.09</b> (.30)
	TE	-0.04 (.99)	<b>+31.74</b> (14.33)	<b>-50.21</b> (25.31)	-54.49 (39.85)	+50.81 (176.99)	<b>-37.33</b> (14.87)	<b>+104.56</b> (30.40)	+48.70 (33.74)	-120.5 (103.79)	<b>-8.23</b> (4.92)
	$\pi_a$	<b>+0.39</b> (.07)	+0.24 (.14)	<b>+0.89</b> (.52)	-0.07 (.59)	-4.01 (3.94)	<b>+0.89</b> (.31)	+0.18 (.78)	<b>+0.98</b> (.33)	+2.65 (2.58)	<b>+0.64</b> (.24)
E	+0.29 (.75)	—								<b>+0.44</b> (.14)	
SP	-0.33 (.49)	—								<b>+1.04</b> (.05)	
MP	-0.37 (.38)	—								<b>+0.22</b> (.12)	
$\pi_{sp}, \pi_{mp}, \pi_a$	—	—								<b>+0.59</b> (.07)	
C	<b>-1.62</b> (.68)	—								<b>+1.03</b> (.11)	
$\bar{\pi}_c$	—	—								<b>-0.59</b> (1.18)	
Obs. ( $^{\circ}$ Free)	<b>660 (645)</b>	<b>660 (593)</b>								<b>660 (643)</b>	
$\bar{R}^2$ (S.E.R.)	<b>.72 (2.48)</b>	<b>.75 (2.31)</b>								<b>.76 (2.30)</b>	
D-W	<b>1.91</b>	<b>2.03</b>								<b>1.96</b>	

NOTES: Estimation by NLS or OLS with Newey-West robust variance-covariance matrix. Standard errors in parentheses. Coefficients significant at the .10 level or better in bold; coefficients of implausible sign or magnitude in italics.

Linear-interactive (13), contrarily, is an obvious empirical flop, clearly suffering from excess, highly correlated variables. Its 67 terms explain only 5% more than do (12)'s 15, and only 21 of 67 obtain even .10 significance, while 37 receive implausibly large or signed coefficients, including 15 statistically significant ones. One highly significant coefficient proclaims, e.g., that, in a financially open economy with flexible exchange-rate and dependent CB, a 10% higher trade exposure *raises*

inflation 10%: Dutch relative to US trade-openness implies +40% ( $\pm 12\%$ ) inflation! In an insulated economy with flexible exchange-rate and autonomous CB, the trade difference would induce +20% ( $\pm 70\%$ ) inflation! Textbook indication of unstable estimates due to severe multicollinearity: clearly, standard linear-interaction methods will simply not allow exploration of so many highly interactive propositions in samples like those common in comparative and international political economy.

Theoretically informed **(14)**, contrarily, provides greater adjusted explanatory power,  $\bar{R}^2 \approx .76$ , and much more precise and substantively interpretable estimates (see below). All its estimates are significant  $p < .10$ , most at much lower levels (only  $b_{mp}$  at  $p \approx .08$  and  $b_{aw}$  at  $p \approx .09$  at  $p > .05$ ). None have implausible signs or magnitudes. Remarkably, despite requiring only 17 coefficients, just two more than **(12)** and fifty less than **(13)**, it explains almost as much as **(13)**. F-tests of  $\Delta R^2$  show **(14)** explains statistically *insignificantly* ( $p \approx .35$ ) less than **(13)**.<sup>36</sup> The linear **(12)** does nowhere near as well statistically, being easily rejected ( $p \ll .01$ ) as a constraint on **(14)** and also explaining statistically significantly less than the cumbersome **(13)** ( $p < .01$ ). Thus, theoretically-informed **(14)** quite clearly dominates uniformed **(12)** and **(13)** statistically; its substantive dominance is even more glaring.

Model **(14)**'s estimates provide strong evidence for *all* the theoretically predicted interactions between exchange regimes, financial exposure, central bank autonomy, and other aspects of domestic and foreign political economies, yet it does so quite parsimoniously and meaningfully. E.g., each 0.1 greater financial exposure on the Quinn scale brings domestic inflation 4.4% ( $b_e \approx .44$ ) of the way from what it would have been absent exposure toward average inflation abroad. Thus, the highest financial exposure on this scale ( $E=I$ ) reduces domestic-authority control of inflation by about 44%, whether domestic authorities would have used that autonomy to maintain a peg ( $SP=I$  or  $MP=I$ ), to hit a CB target ( $C=I$ ), or to respond to domestic political-economic conditions ( $C=0$ ).<sup>37</sup>

<sup>36</sup> Strictly, Wald tests should be employed with merely consistent variance-covariance matrices. The coefficient restrictions that produce **(14)** from **(13)** are not straightforward though, so I rely on the  $\Delta R^2$  tests to approximate.

<sup>37</sup> N.b.,  $b_{a^*}/(1-\rho) \approx I$ , with  $\rho$  the sum of coefficients on lags, and  $\beta_{a^*}/(1-\rho) = I$  is not close to rejected ( $p \approx .79$ ),

Single-currency pegs were even more impressively constraining. The estimate  $b_{sp} \approx 1$  implies such pegs *fully* (100%) reduce the impact of domestic CBA and other political-economic conditions on domestic inflation. One must recall, however, that this estimate reflects the effectiveness of such pegs *only while they remain official policy*. Sufficient domestic political-economic pressures against pegs likely results in their official renunciation. Still, at least while remaining official policy, single-currency pegs amount to full delegation of domestic monetary authority to peg-country authorities. Multi-country, basket-type exchange commitments, contrarily, were much less effective even while they remained the official policy, constraining domestic monetary authorities only by about 22% ( $b_{sp} \approx .22$ ). Substantively, this suggests that the complexity and inherent opacity of such basket pegs allows domestic authorities around four times the autonomy that crisp single-currency pegs do.<sup>38</sup>

The results also echo Franzese's (1999) finding that CBA strongly reduces domestic political-economic influences on inflation by reducing direct government control of monetary policy. Here, that reduction occurs to the degree international financial exposure and exchange commitments have not already constrained domestic autonomy. The estimate  $b_{e1} \approx 1$  implies 1% ( $\pm .06$ ) less government autonomy for each .01 on the CBA scale, suggesting that the most autonomous CBs in the sample, the Swiss and German, nearly fully resisted domestic governments' monetary responsiveness.<sup>39</sup>

All these estimates are substantively intuitive and reasonable. Each also implies many interactive effects as the estimated equation shows completely (standard-errors in superscripts):

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implying that fully effective pegs ( $b_p SP=1$  or  $b_p MP=1$ ) or fully constraining financial exposure ( $b_e E=1$ ) would bring domestic inflation exactly equal to  $\pi_{sp}$ ,  $\pi_{mp}$ , or  $\pi_a$  respectively in the long run.

<sup>38</sup> Estimates of this ratio and the efficacy of exposure and pegs are robust to alternative plausible specifications.  $b_{sp}/b_{mp}$  estimates range from about 3 to 5, and  $b_{e1}$ ,  $b_{sp}$ ,  $b_{mp}$ , and  $b_{e1}$  between .3-.5, .8-1, .15-.35, and .9-1.25 respectively.

<sup>39</sup> The estimates also indicate a hypothetical fully conservative and autonomous CB target of  $\hat{\pi}_c = \frac{b_0 + b_{e1} b_{e2}}{1 - b_1 - b_2} \approx 0\%$ , but the standard error on that estimate is sizable:  $s.e.(\hat{\pi}_c) \approx \sqrt{\{V_b(\hat{\pi}_c)\}V(\hat{b})\{V_b(\hat{\pi}_c)\}} \approx 2.3\%$ .

$$E(\pi) \approx \left( \begin{array}{l} .53^{.30} + .55^{.05} \pi_{t-1} - .12^{.04} \pi_{t-2} + .44^{.14} E \cdot \pi_a + \\ (1 - .44^{.14} E) \left\{ \begin{array}{l} 1.0^{.05} SP \cdot .59^{.07} \pi_{sp} + .22^{.12} MP \cdot .59^{.07} \pi_{mp} + \\ (1 - 1.0^{.05} SP - .22^{.12} MP) \left[ \begin{array}{l} 1.0^{.11} C (-.59^{.12}) + \\ (1 - 1.0^{.11} C) \left( \begin{array}{l} -.60^{.30} GP + 2.6^{1.3} EY + 16^{4.6} UP - 11^{2.4} BC \\ + 1.2^{.49} AW - 1.1^{.30} FS - 8.2^{4.9} TE + .64^{.24} \pi_a \end{array} \right) \end{array} \right\} \end{array} \right) \quad (15)$$

This equation can be differentiated to isolate the interactive effect of each factor,  $E$ ,  $SP$ ,  $MP$ ,  $C$ , and  $x \in \mathbf{X}_g$ . E.g., the estimated domestic-inflation effect of committing to an exchange-rate peg is:

$$E\left(\frac{d\pi}{dP}\right) = (1 - .44E) b_p \cdot \left\{ .59 \pi_p - [(1 - C) \cdot (-.6GP + 2.6EY + 16UP - 11BC + 1.2AW - 1.1FS - 8.2TE + .64\pi_a) - .59C] \right\} \quad (16)$$

with  $b_p = b_{mp} \approx .22$  and  $\pi_p = \pi_{mp}$  for  $P = MP$ , and  $b_p = b_{sp} \approx 1$  and  $\pi_p = \pi_{sp}$  for  $P = SP$ . Thus, the effect of an exchange-rate peg depends directly on the domestic political economy's degrees of exposure,  $E$ , CB conservatism and autonomy,  $C$ , and political-economic pressures on the government,  $\mathbf{X}_g$ , including average inflation abroad,  $\pi_a$ . The effect of a peg also depends on inflation in the peg country(ies),  $\pi_p$ , of course. *Via* these last two factors,  $\pi_a$  and  $\pi_p$ , the domestic inflation effect of exchange-rate regimes depends indirectly on everything determining foreign inflation rates, including foreign exchange-rate regimes, international financial exposure, CBA, and political-economic conditions.

Similarly, the domestic-inflation effect of international financial exposure is estimated as:

$$E\left(\frac{d\pi}{dE}\right) = .44 \cdot \left( \pi_a - \left\{ b_p P \cdot .59 \pi_p + (1 - b_p P) \cdot [(1 - C) \cdot (-.6GP + 2.6EY + 16UP - 11BC + 1.2AW - 1.1FS - 8.2TE + .64\pi_a) - .59C] \right\} \right) \quad (17)$$

which depends directly on average inflation abroad and domestic exchange-rate regimes, CBA, and political-economic conditions, and, through three indirect links, on foreign levels of these variables.

Lastly, the estimated effects of CBA and other domestic political-economic conditions are given by:

$$E\left(\frac{d\pi}{dC}\right) = (1 - .44 \cdot E) \cdot \left\{ (1 - b_p P) \cdot [(1 - C) \cdot (-.6GP - 2.6EY - 16UP + 11BC - 1.2AW + 1.1FS + 8.2TE - .64\pi_a) - .59] \right\} \quad (18)$$

$$E\left(\frac{d\pi}{dx}\right) = (1 - .44E) \cdot \left\{ (1 - SP - .22MP) \cdot [(1 - C) \cdot b_x] \right\} \quad (19)$$

In sum, the domestic-inflation effects of CBA, exchange-rate regimes, international financial

exposure, and all other political-economic conditions  $x \in \mathbf{X}_g$ , generally depend on the levels of each other at home and abroad. Theoretically, this is perhaps an unobjectionable claim. That variation in the organization and distribution of interests and the configuration of political-economic institutions at home and abroad interact to shape policy choices and outcomes is a familiar theme in comparative and international political economy (C&IPE), one especially emphasized in more-qualitative studies (e.g., Katzenstein 1985, Gourevitch 1986, and Hall 1986), and in the recent “Varieties of Capitalism” literature (e.g., Hall and Soskice 2001). More remarkable is that, by applying available theory more explicitly to empirical specification, we *can* obtain quite reasonable, acceptably precise and, above all, substantively meaningful quantitative estimates of these many predicted interaction effects, even in the very limited samples common in C&IPE. Moreover, in clarifying and quantifying the multiple interactions that more-qualitative studies identify, such theoretically informed empirical models can also confirm their suspicion that non-interactive or less-theoretically-informed interactive analyses might mislead about the highly contextual effects of foreign and domestic interests and institutions.

## **V. Substantive Interpretation of Specific Estimation Results**

Consider, for example, the inflation effects of domestic political-economic conditions such as government partisanship. The linear model **(12)** would suggest that each 1 point rightward on the *GP* index—for reference, US Democrats and Republicans are 2.8 and UK Labour and Conservatives 4.9 units apart—would induce a barely significant ( $p \approx .08$ ) and substantively small  $0.14 \pm \%$  inflation reduction, under any configuration of foreign and domestic institutions and conditions. Theoretically uninformed linear-interactive **(13)** suggests, correctly, that the impact depended on the configuration of foreign and domestic institutions and conditions, but its estimates are difficult to interpret and statistically and substantively suspect. For example, **(13)** claims that each 1-unit rightward *GP* shift, under fully autonomous CB, fixed exchange-rate, and financially

non-exposed conditions would reduce inflation -3.4% (s.e.  $\approx 1.3$ ), implying a suspiciously large 16.7% inflation difference by governing party in the UK! It also suggests that, under fixed exchange rates, fully dependent CB, and full financial insulation, 1-point rightward shifts in *GP* raises inflation 1.8% (s.e.  $\approx .74$ ), implying an +8.8% from Labour to Tory! Thus, the linear-interactive **(13)** concludes nonsensically that reducing CBA under fixed exchange-rates and financial insulation shifts right-partisan governments from having suspiciously strong anti-inflation effect to having suspiciously strong pro-inflation effect.

Meanwhile, the theoretically informed **(14)** suggests, much more intuitively and sensibly, that a 1-unit rightward GP shift reduces inflation -.6% (s.e.  $\approx .3$ ) where domestic governments retain full control of domestic inflation policy, implying a reasonable -2.4% inflation difference Labour to Tory. Moreover, domestic-government inflation control, and so this partisanship effect, is dampened 10% (s.e.  $\approx 1\%$ ) for each 0.1 greater CBA (for comparison: approximately the spacing in the rising series Portugal-Norway-Italy-Ireland-Holland-Austria-US-Switzerland-Germany). The net partisan effect emerging from this combination of domestic CB and government is dampened a further 22% (s.e.  $\approx 12\%$ ) if they have committed to a basket exchange-regime, say EMS. Finally, the international financial exposure of the domestic economy dampens the remaining partisan effect 4.4% further (s.e.  $\approx 1.4\%$ ) per .1 on the *E* index. Moreover, every other domestic political-economic influence on government policy is identically dampened by CBA, pegs, and financial exposure. For example, the increase in average international financial exposure among these 21 countries from .33 in 1955 to .86 in 1990 reduced domestic autonomy about  $(.86-.33)\cdot.44\approx 23\%$  on average. This implies a 23% reduction in the impact of government partisanship *and* in the effects of exchange commitments *and every* domestic political-economic condition to which CBs and governments respond differently.

**Figure 3** illustrates the different partisan cycles estimated by the linear and theoretically informed models, assuming a five-year cycle between Labour and Tory governments. The

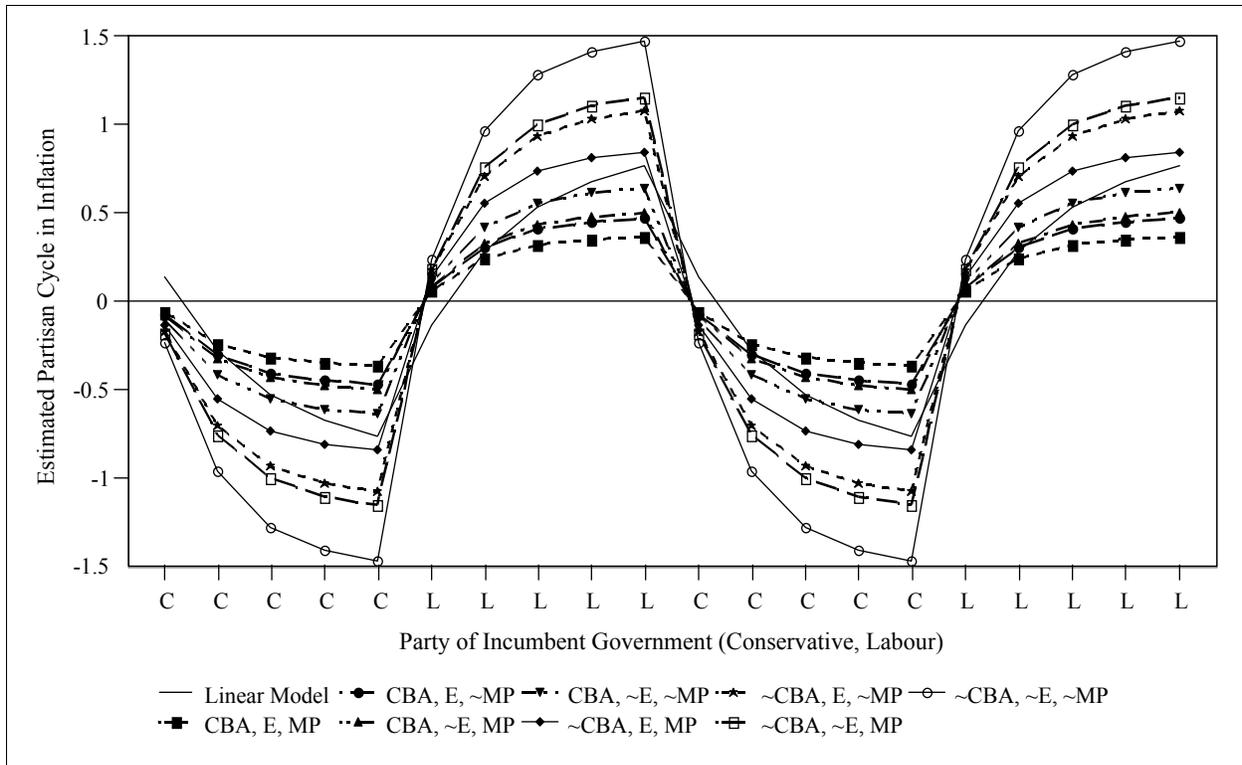
theoretical model reveals cycles of most-pronounced amplitude at low (i.e., sample mean minus one standard deviation) CBA ( $C=.26$ ), low international financial exposure ( $E=.43$ ), and absent an exchange-rate peg ( $SP=MP=0$ ). Cycles become less pronounced as each increases, with the dampening effect of single-country pegs greatest, that of CBA next, then of financial exposure, and of multi-country pegs least. The partisan-inflation-cycle amplitude is 2 points larger where domestic governments retain great autonomy ( $C, E,$  and  $MP$  low) than where they retain little ( $C, E,$  and  $MP$  high).<sup>40</sup> The linear model incorrectly assumes, and so estimates, invariant partisan inflation-cycles of magnitude  $1.5\pm\%$ .

The estimates indicate no inflation cycles in response to partisanship under single-currency pegs; nor, for that matter, do any other domestic political-economic conditions have effect. Instead, under such pegs, and less a dampening by domestic financial exposure, domestic inflation responds to *peg-country* partisanship and other political-economic conditions, as dampened by *peg-country* CBA, exchange regime, and financial exposure. Similar though lesser international transmission of cycles and other effects occur where political economies are linked by financial exposure or basket pegs. Three coefficients,  $b_e$ ,  $b_{mp}$ , and  $b_{sp}$ , reflect these international transmission of inflation effects very simply and directly, estimating 44%, 22%, and 100% transmission rates respectively.<sup>41</sup> Contrarily, the linear model virtually ignores international transmission, only partially and indirectly subsuming it in its coefficient on inflation abroad, and the linear-interactive model obscures such transmission effects in a mass of nearly incomprehensible and highly imprecise coefficient estimates.

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<sup>40</sup> **Table 1** shows the relevant coefficients significant, so **Figure 4** omits confidence intervals to reduce clutter.

<sup>41</sup> Some of the transmission incurs instantaneously, more accumulates over time as implied by the dynamic structure estimated in the coefficients on lagged inflation.

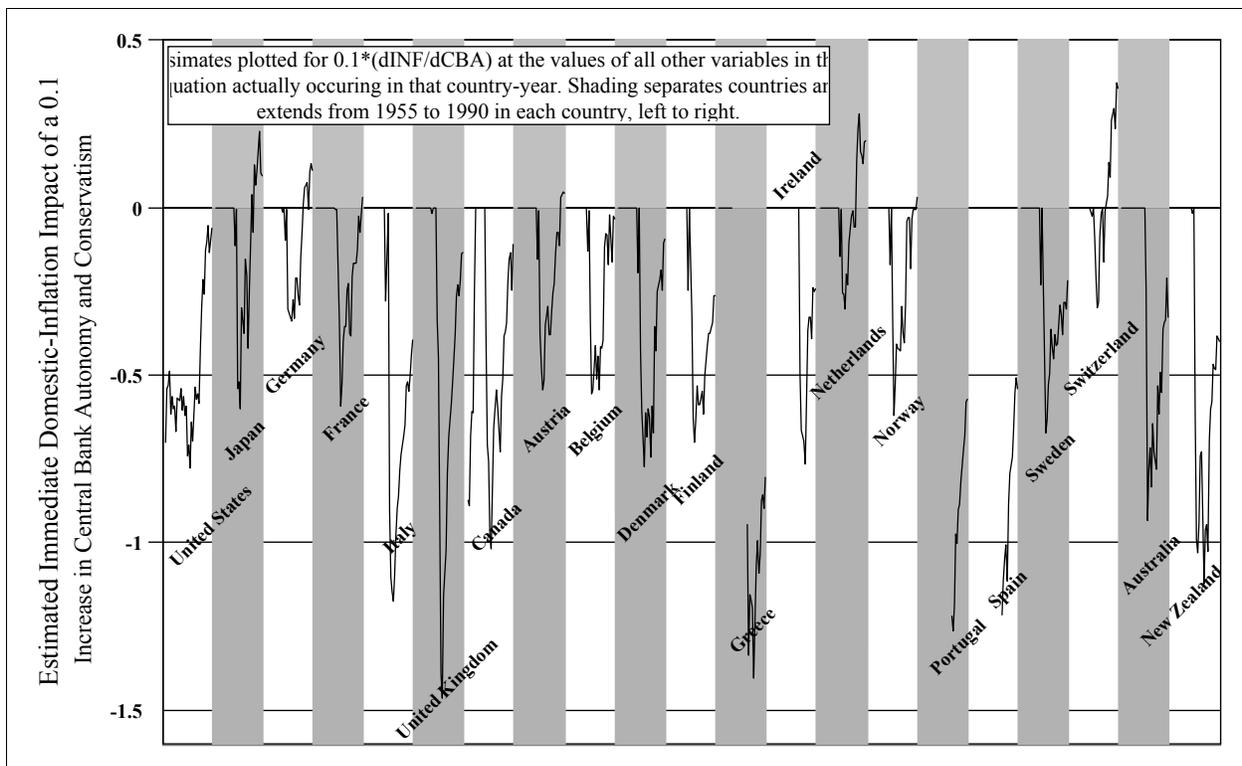


**Figure 3:** Estimated Partisan Cycles in the Linear & Theoretically Informed Models at High & Low CBA, E, & MP

The linear model also incorrectly estimates domestic CBA to reduce inflation 0.16% per 0.1 on the *C* scale regardless of other domestic and foreign political-economic conditions. The linear-interactive model does register highly contextual inflation effects for CBA, as theory suggests, but buries them in an indecipherable mass of 64 interaction terms. Equation (18) above showed the more interpretable results of the theoretical model. Substantively, the anti-inflationary impact of CBA, which is greater the more inflationary pressures the domestic political economy puts on government, is dampened by exchange-rate commitments (100% by single- and 22% by multi-currency pegs), and then further dampened by financial exposure (4.4% per tenth of the Quinn scale). **Figure 4** illustrates that, indeed, the anti-inflationary effects of CBA varied considerably with these other conditions in the sample.<sup>42</sup> Most notably, with a single-currency peg in effect, as under Bretton Woods for most countries, CBA has no more effect than any other domestic political-

<sup>42</sup>The estimates occasionally suggest CBA adds to inflation. This occurs when estimated government responses to domestic political-economic conditions would have produced lower inflation than the estimated bank target ( $0\% \pm 2\%$ ).

economic condition. In the post Bretton Woods era, the results concur with Franzese (1999), showing the anti-inflationary bite of CBA to have diminished greatly as domestic political economies became more anti-inflationary.<sup>43</sup> **Table 2** also illustrates the main additional result here. As Franzese (1999) demonstrated, the anti-inflation effect of CBA increases dramatically as inflationary pressures on governments increase (reading left-to-right across blocks). Here, single-currency pegs completely eliminate that effect (top row), multi-country pegs reduce it somewhat (comparing last to penultimate row), and international financial exposure reduces it considerably (reading left-to-right within blocks).



**Figure 4:** Estimated First-Year Domestic-Inflation Impact of 0.1 Increase in CBA in 21 Countries, 1957-90

<sup>43</sup> He suggests trends in trade exposure, financial-sector size, and union density account for this anti-inflationary shift in popular pressures on governments in developed democracies. He also notes that recent moves to increase CBA have occurred as the anti-inflation bite of CBA had decreased radically, arguing that this is because such institutional changes occur not when they would have most effect economically, but when they are most supported politically, which is exactly when governments would be most anti-inflationary themselves and so CBA has *least* effect.

**Table 2: Estimated First-Year Effect of .1 Increase in CBA as a Function of E, P, and  $\pi(X_g)$**

Inflation Under Full Domestic Government Control [ $\pi(X_g)$ ]	$\pi(X_g) = 2.00$			$\pi(X_g) = 6.00$			$\pi(X_g) = 10.00$		
	0.40	0.65	0.90	0.40	0.65	0.90	0.40	0.65	0.90
International Financial Exposure [E]									
Exchange-Rate Regime [P]									
SP=1	-0.00 <sup>.01</sup>								
MP=1	-0.17 <sup>.07</sup>	-0.15 <sup>.05</sup>	-0.12 <sup>.04</sup>	-0.43 <sup>.08</sup>	-0.37 <sup>.06</sup>	-0.31 <sup>.06</sup>	-0.68 <sup>.11</sup>	-0.59 <sup>.10</sup>	-0.50 <sup>.10</sup>
SP=MP=0	-0.21 <sup>.09</sup>	-0.19 <sup>.07</sup>	-0.16 <sup>.05</sup>	-0.54 <sup>.07</sup>	-0.47 <sup>.05</sup>	-0.40 <sup>.05</sup>	-0.87 <sup>.06</sup>	-0.76 <sup>.06</sup>	-0.64 <sup>.09</sup>

NOTES: “First-year effect” means before the estimated dynamics unfold. Standard errors noted in superscripts.<sup>44</sup>

Likewise, linear (12) assumes and so estimates the effects of all domestic political-economic conditions to be non-contextual while linear-interactive (13) finds context-dependent effects, but all difficult to interpret, most insignificant, and many substantively nonsensical. As Table 3 illustrates, the theoretically informed model produces very sensible and interpretable results that reveal the highly contextual nature of all these effects. In general, the impact of each domestic factor is greatest when CBA and international financial exposure are low and the currency floats. From there, CBA, pegs, and international financial exposure dampen each effect as we have seen above.

<sup>44</sup> Standard errors for these conditional effects, being non-linear in coefficients,  $\mathbf{B}$ , and variables,  $x$ , and so given approximately by  $\left\{ \left[ \frac{d^2y}{dB^2} \right] \nu[B] \left[ \frac{d^2y}{dB^2} \right] \right\}^5$ , can be tedious to calculate in some software. A sometimes simpler expedient recognizes that, for any  $Z \sim F_{l,n-k}$ ,  $Z^{.5} \sim t_{n-k}$  and that  $\frac{dy}{dx} / s.e. \left( \frac{dy}{dx} \right) \sim t_{n-k}$  so the estimated standard error of a non-linear effect is also  $a/f$  where  $f$  is the square root of the F-statistic for the Wald test that the effect is zero and  $a$  is the estimated effect.

**Table 3: Estimated First-Year Domestic-Inflation Effect of Political-Economic Conditions to Which Governments Respond, as Function of CBA, E, and P**

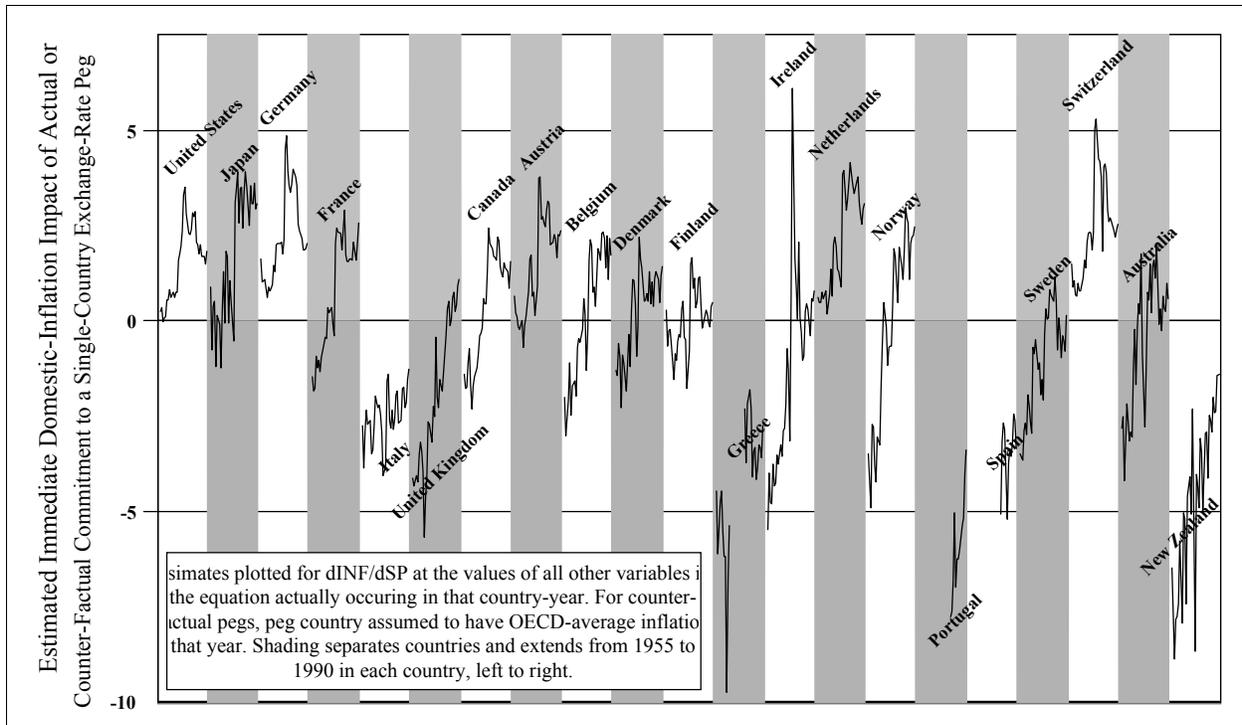
	<i>E=0.40</i>			<i>E=0.65</i>			<i>E=0.90</i>		
	<i>SP=MP=0</i>	<i>MP=1</i>	<i>SP=1</i>	<i>SP=MP=0</i>	<i>MP=1</i>	<i>SP=1</i>	<i>SP=MP=0</i>	<i>MP=1</i>	<i>SP=1</i>
<b><i>Estimated Impact of 1-Unit Rightward Shift in Government Partisanship (<math>d\pi/dGP</math>)</i></b>									
<i>CBA = 0.26</i>	-0.359 <sup>.17</sup>	-0.281 <sup>.15</sup>	-0.000 <sup>.02</sup>	-0.311 <sup>.15</sup>	-0.243 <sup>.13</sup>	-0.000 <sup>.02</sup>	-0.262 <sup>.12</sup>	-0.206 <sup>.11</sup>	-0.000 <sup>.01</sup>
<i>CBA = 0.46</i>	-0.257 <sup>.12</sup>	-0.202 <sup>.10</sup>	-0.000 <sup>.01</sup>	-0.223 <sup>.10</sup>	-0.174 <sup>.09</sup>	-0.000 <sup>.01</sup>	-0.188 <sup>.09</sup>	-0.147 <sup>.08</sup>	-0.000 <sup>.01</sup>
<i>CBA = 0.66</i>	-0.156 <sup>.07</sup>	-0.122 <sup>.06</sup>	-0.000 <sup>.01</sup>	-0.135 <sup>.06</sup>	-0.106 <sup>.05</sup>	-0.000 <sup>.01</sup>	-0.114 <sup>.05</sup>	-0.089 <sup>.05</sup>	-0.000 <sup>.01</sup>
<b><i>Estimated Impact of a Post-Election Year (<math>d\pi/dEY</math>)</i></b>									
<i>CBA = 0.26</i>	+1.563 <sup>.79</sup>	+1.224 <sup>.61</sup>	+0.000 <sup>.09</sup>	+1.352 <sup>.69</sup>	+1.059 <sup>.53</sup>	+0.000 <sup>.07</sup>	+1.142 <sup>.60</sup>	+0.894 <sup>.47</sup>	+0.000 <sup>.06</sup>
<i>CBA = 0.46</i>	+1.120 <sup>.57</sup>	+0.877 <sup>.44</sup>	+0.000 <sup>.06</sup>	+0.970 <sup>.50</sup>	+0.759 <sup>.39</sup>	+0.000 <sup>.05</sup>	+0.819 <sup>.44</sup>	+0.641 <sup>.34</sup>	+0.000 <sup>.05</sup>
<i>CBA = 0.66</i>	+0.678 <sup>.37</sup>	+0.531 <sup>.29</sup>	+0.000 <sup>.04</sup>	+0.587 <sup>.32</sup>	+0.459 <sup>.25</sup>	+0.000 <sup>.03</sup>	+0.495 <sup>.28</sup>	+0.388 <sup>.22</sup>	+0.000 <sup>.03</sup>
<b><i>Estimated Impact of 10% Increase in Union Density (<math>0.1 \cdot d\pi/dUP</math>)</i></b>									
<i>CBA = 0.26</i>	+0.98 <sup>.25</sup>	+0.76 <sup>.18</sup>	+0.00 <sup>.05</sup>	+0.84 <sup>.21</sup>	+0.66 <sup>.16</sup>	+0.00 <sup>.04</sup>	+0.71 <sup>.19</sup>	+0.56 <sup>.14</sup>	+0.00 <sup>.04</sup>
<i>CBA = 0.46</i>	+0.70 <sup>.18</sup>	+0.55 <sup>.13</sup>	+0.00 <sup>.04</sup>	+0.61 <sup>.15</sup>	+0.47 <sup>.11</sup>	+0.00 <sup>.03</sup>	+0.51 <sup>.14</sup>	+0.40 <sup>.10</sup>	+0.00 <sup>.03</sup>
<i>CBA = 0.66</i>	+0.42 <sup>.13</sup>	+0.33 <sup>.10</sup>	+0.00 <sup>.02</sup>	+0.37 <sup>.11</sup>	+0.29 <sup>.08</sup>	+0.00 <sup>.02</sup>	+0.31 <sup>.10</sup>	+0.24 <sup>.08</sup>	+0.00 <sup>.02</sup>
<b><i>Estimated Impact of 0.25 Increase in Bargaining Coordination (<math>0.25 \cdot d\pi/dBC</math>)</i></b>									
<i>CBA = 0.26</i>	-1.61 <sup>.30</sup>	-1.26 <sup>.21</sup>	-0.00 <sup>.08</sup>	-1.39 <sup>.26</sup>	-1.09 <sup>.19</sup>	-0.00 <sup>.07</sup>	-1.17 <sup>.25</sup>	-0.92 <sup>.19</sup>	-0.00 <sup>.06</sup>
<i>CBA = 0.46</i>	-1.15 <sup>.20</sup>	-0.90 <sup>.15</sup>	-0.00 <sup>.06</sup>	-1.00 <sup>.18</sup>	-0.78 <sup>.13</sup>	-0.00 <sup>.05</sup>	-0.84 <sup>.18</sup>	-0.66 <sup>.14</sup>	-0.00 <sup>.04</sup>
<i>CBA = 0.66</i>	-0.70 <sup>.15</sup>	-0.55 <sup>.12</sup>	-0.00 <sup>.03</sup>	-0.60 <sup>.13</sup>	-0.47 <sup>.11</sup>	-0.00 <sup>.03</sup>	-0.51 <sup>.13</sup>	-0.40 <sup>.10</sup>	-0.00 <sup>.03</sup>
<b><i>Estimated Impact of Unit Increase in ln(real GDP per Capita) (<math>d\pi/dAW</math>)</i></b>									
<i>CBA = 0.26</i>	+0.71 <sup>.27</sup>	+0.56 <sup>.20</sup>	+0.00 <sup>.04</sup>	+0.62 <sup>.23</sup>	+0.48 <sup>.17</sup>	+0.00 <sup>.03</sup>	+0.52 <sup>.20</sup>	+0.41 <sup>.15</sup>	+0.00 <sup>.03</sup>
<i>CBA = 0.46</i>	+0.51 <sup>.20</sup>	+0.40 <sup>.15</sup>	+0.00 <sup>.03</sup>	+0.44 <sup>.17</sup>	+0.35 <sup>.12</sup>	+0.00 <sup>.02</sup>	+0.37 <sup>.14</sup>	+0.29 <sup>.11</sup>	+0.00 <sup>.02</sup>
<i>CBA = 0.66</i>	+0.31 <sup>.13</sup>	+0.24 <sup>.10</sup>	+0.00 <sup>.02</sup>	+0.27 <sup>.11</sup>	+0.21 <sup>.08</sup>	+0.00 <sup>.01</sup>	+0.23 <sup>.09</sup>	+0.18 <sup>.07</sup>	+0.00 <sup>.01</sup>
<b><i>Estimated Impact of 1% Increase in Financial-Sector Employment-Share (<math>d\pi/dFS</math>)</i></b>									
<i>CBA = 0.26</i>	-0.66 <sup>.18</sup>	-0.52 <sup>.12</sup>	-0.00 <sup>.03</sup>	-0.57 <sup>.16</sup>	-0.45 <sup>.11</sup>	-0.00 <sup>.03</sup>	-0.48 <sup>.15</sup>	-0.38 <sup>.11</sup>	-0.00 <sup>.03</sup>
<i>CBA = 0.46</i>	-0.47 <sup>.13</sup>	-0.37 <sup>.09</sup>	-0.00 <sup>.02</sup>	-0.41 <sup>.12</sup>	-0.32 <sup>.08</sup>	-0.00 <sup>.02</sup>	-0.35 <sup>.11</sup>	-0.27 <sup>.08</sup>	-0.00 <sup>.02</sup>
<i>CBA = 0.66</i>	-0.29 <sup>.10</sup>	-0.22 <sup>.07</sup>	-0.00 <sup>.01</sup>	-0.25 <sup>.09</sup>	-0.19 <sup>.06</sup>	-0.00 <sup>.01</sup>	-0.21 <sup>.08</sup>	-0.16 <sup>.06</sup>	-0.00 <sup>.01</sup>
<b><i>Estimated Impact of 10% Increase in Trade Exposure (<math>.1 \cdot d\pi/dTE</math>)</i></b>									
<i>CBA = 0.26</i>	-0.50 <sup>.28</sup>	-0.39 <sup>.19</sup>	-0.00 <sup>.03</sup>	-0.43 <sup>.23</sup>	-0.34 <sup>.16</sup>	-0.00 <sup>.02</sup>	-0.36 <sup>.19</sup>	-0.28 <sup>.14</sup>	-0.00 <sup>.02</sup>
<i>CBA = 0.46</i>	-0.36 <sup>.19</sup>	-0.28 <sup>.13</sup>	-0.00 <sup>.02</sup>	-0.31 <sup>.16</sup>	-0.24 <sup>.11</sup>	-0.00 <sup>.02</sup>	-0.26 <sup>.14</sup>	-0.20 <sup>.09</sup>	-0.00 <sup>.01</sup>
<i>CBA = 0.66</i>	-0.22 <sup>.11</sup>	-0.17 <sup>.08</sup>	-0.00 <sup>.01</sup>	-0.19 <sup>.10</sup>	-0.15 <sup>.07</sup>	-0.00 <sup>.01</sup>	-0.16 <sup>.08</sup>	-0.12 <sup>.06</sup>	-0.00 <sup>.01</sup>
<b><i>Estimated Impact of 1% Increase in Average Inflation Abroad (<math>d\pi/d\pi_a</math>)</i></b>									
<i>CBA = 0.26</i>	+0.49 <sup>.14</sup>	+0.41 <sup>.13</sup>	+0.11 <sup>.05</sup>	+0.50 <sup>.12</sup>	+0.43 <sup>.11</sup>	+0.17 <sup>.07</sup>	+0.52 <sup>.10</sup>	+0.46 <sup>.10</sup>	+0.24 <sup>.09</sup>
<i>CBA = 0.46</i>	+0.38 <sup>.10</sup>	+0.32 <sup>.09</sup>	+0.11 <sup>.04</sup>	+0.41 <sup>.08</sup>	+0.36 <sup>.08</sup>	+0.17 <sup>.06</sup>	+0.44 <sup>.08</sup>	+0.39 <sup>.08</sup>	+0.24 <sup>.08</sup>
<i>CBA = 0.66</i>	+0.27 <sup>.06</sup>	+0.24 <sup>.06</sup>	+0.11 <sup>.04</sup>	+0.32 <sup>.06</sup>	+0.28 <sup>.06</sup>	+0.17 <sup>.06</sup>	+0.36 <sup>.06</sup>	+0.33 <sup>.06</sup>	+0.24 <sup>.08</sup>

NOTES: As in Table 2.

The exception is average inflation abroad, which, recall, impacts domestic inflation in two ways. First, domestic governments' incentives to resist inflation diminish as foreign inflation rises, so even those that retain autonomy respond to inflation abroad. Under flexible exchange-rates or basket pegs, domestic CBA mutes this government response as it does all others, so the positive effect of foreign on domestic inflation generally diminishes in CBA (reading down the first two columns

of each block in the last three rows). Second, through exposure to global financial flows, inflation abroad also influences domestic inflation directly, whoever controls domestic policy and regardless of whether they try to peg. This sort of international transmission, of course, increases in domestic financial exposure. This mechanism appears most clearly under single-currency pegs (the third, sixth, and ninth columns of the last three rows) because domestic autonomy is zero under such pegs, so only the impact of financial exposure to foreign inflation registers, having the effect of replacing peg-country with global inflation as the sole determinant of domestic inflation.

The theoretical model also allows direct exploration of the effects of international financial exposure and exchange-rate pegs whereas the linear **(12)** finds no such effects and linear-interactive **(13)** obscures them. As **(16)** and **(17)** show, these international-transmission effects depend primarily on the difference between what inflation would have been domestically without pegging or exposure and what inflation is in the peg country ( $SP=I$ ), peg countries ( $MP=I$ ), or globally ( $E=I$ ). Simply: the greater is hypothetical domestic inflation relative to the relevant foreign-inflation, the more anti-inflationary are pegs or exposure. As we have seen, this implies that the effects of exchange regimes and of financial exposure depend on virtually all foreign and domestic political-economic conditions and institutions. **Table 4** summarizes the estimated effects more succinctly utilizing counter-factual inflations at home and abroad, labeling foreign and domestic inflation  $\pi_p(\mathbf{Z}_p^*)$  and  $\pi(C, \mathbf{X}_g)$  explicitly to remind of their dependence on a wide array of foreign and domestic political-economic factors.



**Figure 5:** Estimated First-Year Domestic-Inflation Impact of Actual or Counter-Factual SP in 21 Countries, 1957-90

**Table 4: Estimated First-Year Domestic-Inflation Effect of Single-Currency Exchange-Rate Peg (SP) as Function of Difference between Domestic and Peg-Country Inflation and of E**

	$E=.40$			$E=.65$			$E=.90$		
$\pi(C, X_g) =$	2	6	10	2	6	10	2	6	0
2	-0.67 <sup>.14</sup>	-3.96 <sup>.41</sup>	-7.25 <sup>.71</sup>	-0.58 <sup>.14</sup>	-3.43 <sup>.53</sup>	-6.28 <sup>.96</sup>	-0.49 <sup>.15</sup>	-2.90 <sup>.68</sup>	-5.30 <sup>1.2</sup>
$\pi_p(Z_p^*) = 6$	+1.29 <sup>.41</sup>	-2.01 <sup>.43</sup>	-5.30 <sup>.66</sup>	+1.11 <sup>.34</sup>	-1.74 <sup>.42</sup>	-4.59 <sup>.78</sup>	+0.94 <sup>.34</sup>	-1.47 <sup>.44</sup>	-3.87 <sup>.94</sup>
10	+3.24 <sup>.71</sup>	-0.05 <sup>.60</sup>	-3.34 <sup>.72</sup>	+2.81 <sup>.64</sup>	-0.04 <sup>.52</sup>	-2.89 <sup>.70</sup>	+2.37 <sup>.69</sup>	-0.04 <sup>.44</sup>	-2.44 <sup>.73</sup>

**NOTES:** As in Table 2; plus, standard errors assume hypothetical  $\pi_p$  and  $\pi(C, X_g)$  known without error.

**Table 4** demonstrates that greater financial exposure weakens the effects of exchange-rate pegs (reading across blocks); this is because exposure reduces domestic autonomy from the global economy, which peg-maintenance may require. Highly financially exposed economies cannot sustain narrow pegs that require deviation of domestic inflation from global conditions. Quite intuitively, **Table 4** also shows (reading bottom-left to top-right within blocks) that pegs produce more anti-inflationary bite when domestic inflation would have been high relative to peg-country inflation, i.e., when the domestic political economy generates greater inflationary pressures on government and/or its CB is less autonomous than in the peg country. Notice that exchange-rate pegs can be inflationary

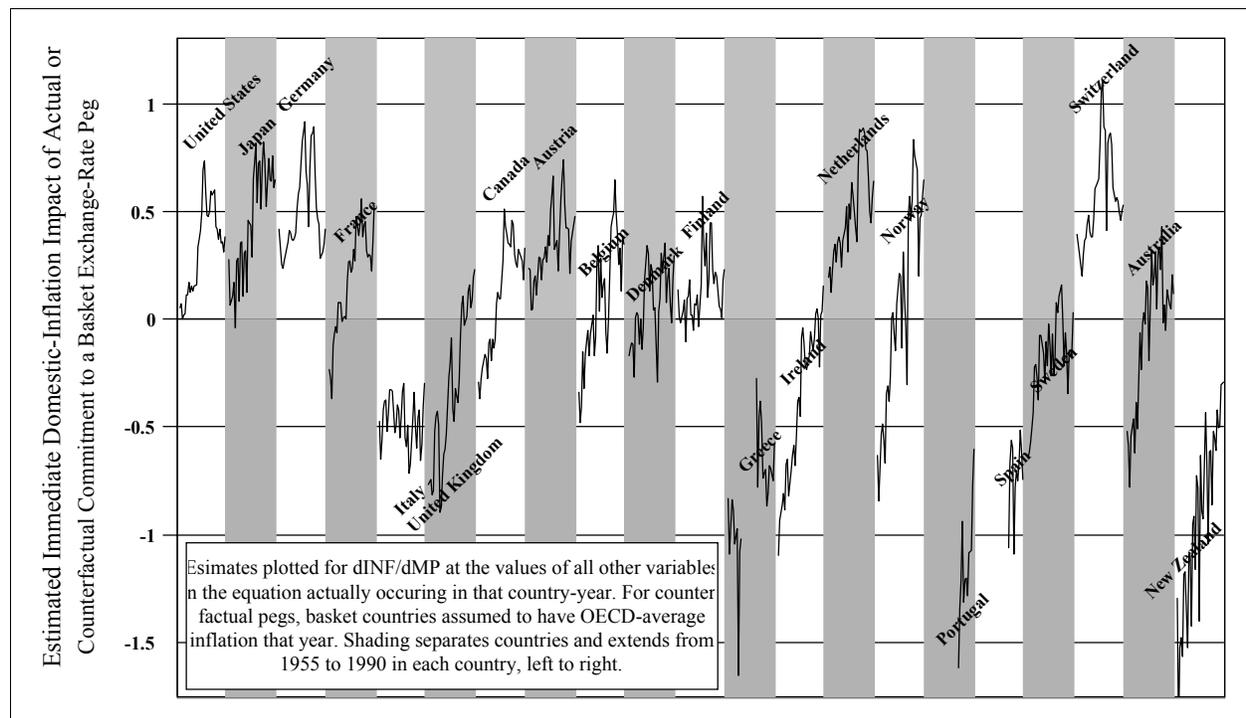
when the opposite holds. Indeed, **Figure 5** plots the estimated effect of actual (or counterfactual) single-currency pegs given inflation in the (assumed) peg country and domestic political economic conditions, showing that such pegs were or would have been inflation fairly often in this sample.

**Table 5** and **Figure 6** illustrate analogous results for multi-country pegs.

**Table 5: Estimated First-Year Domestic-Inflation Effect of Multi-Currency Peg (MP) as Function of Difference between Domestic and Peg-Countries' Inflation and of  $E$**

	$E=.40$			$E=.65$			$E=.90$		
$\pi(C, X_g) =$	2	6	10	2	6	10	2	6	0
$\pi_p(Z_p^*) = 2$	-0.15 <sup>.09</sup>	-0.86 <sup>.50</sup>	-1.57 <sup>.91</sup>	-0.13 <sup>.08</sup>	-0.74 <sup>.43</sup>	-1.36 <sup>.79</sup>	-0.11 <sup>.07</sup>	-0.63 <sup>.38</sup>	-1.15 <sup>.69</sup>
$\pi_p(Z_p^*) = 6$	+0.28 <sup>.18</sup>	-0.44 <sup>.26</sup>	-1.15 <sup>.67</sup>	+0.24 <sup>.15</sup>	-0.38 <sup>.23</sup>	-1.00 <sup>.58</sup>	+0.20 <sup>.13</sup>	-0.32 <sup>.20</sup>	-0.84 <sup>.51</sup>
$\pi_p(Z_p^*) = 10$	+0.70 <sup>.42</sup>	-0.01 <sup>.13</sup>	-0.73 <sup>.44</sup>	+0.61 <sup>.37</sup>	-0.01 <sup>.11</sup>	-0.63 <sup>.38</sup>	+0.51 <sup>.32</sup>	-0.01 <sup>.09</sup>	-0.53 <sup>.33</sup>

NOTES: As in Table 4.

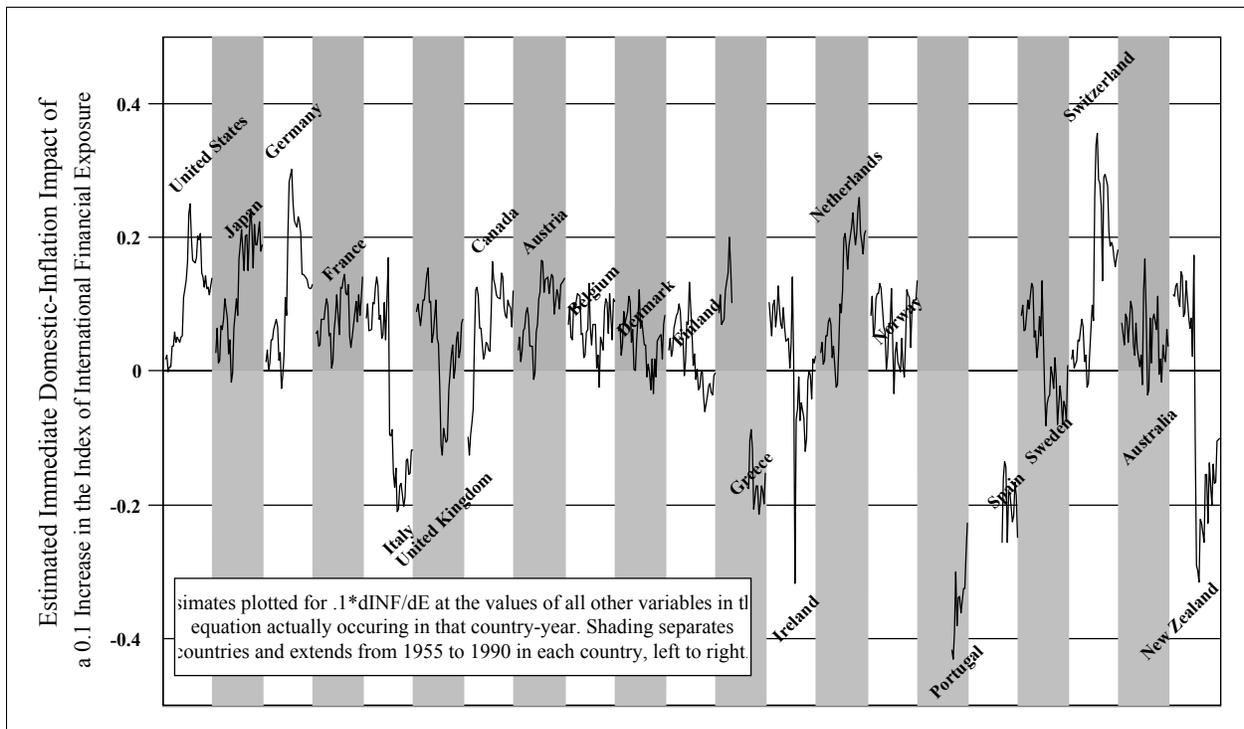


**Figure 6:** Estimated Immediate Domestic-Inflation Impact of Actual or Counter-Factual MP in 21 Countries, 1957-90

Notice from these figures that the inflation effects of exchange-rate pegs have generally been drifting positively, especially among countries recently moving to tighten or create exchange-rate commitments. As Franzese (1999) noted regarding *CBA*, countries seem to seek to institutionalize anti-inflationary rigor precisely when it would have least impact. Institutional change seems to occur, not when it would have most effect economically, but when it is most supported politically, which,

at least in these inflation-outcome cases, is exactly when it has *least* effect. Thus, arguments that delegation of domestic political monetary authority to autonomous, conservative CBs or to more-conservative foreign authorities is needed now to combat inflation seem unsustainable. More likely, we are simply observing anti-inflation forces using their current political strength to institutionalize conservative biases in monetary policy. Less-anti-inflation forces would likely act similarly, seeking to institutionalize leftish or de-institutionalize conservative biases, when they gain advantage, which will be precisely when conservatism would have had most anti-inflation effect.

Finally, **Figure 7** plots the estimated effect of a .1 increase in international financial exposure across these 21 countries and 34 years at the levels of all other variables actually obtaining in those country-years. It, too, can be positive or negative and has varied dramatically.



**Figure 7:** Estimated First-Year Domestic-Inflation Impact of 0.1 Increase in  $E$  in 21 Countries, 1957-90

## VI. Conclusions and Generalizations

This paper demonstrates that international financial exposure, exchange-rate commitments, and central bank autonomy each implies partial monetary-policy delegation from current domestic

government. *CBA* implies delegation to the domestic CB; exchange-rate pegs entail delegation from that domestic combination of CB and government to peg-country authorities; and financial exposure hinders domestic-authorities' autonomy, whether they would use it to achieve domestic aims or to maintain pegs, effectively delegating to the sum of all foreign monetary authorities. Thus, multiple hands share control of the domestic-inflation wheel in the open and institutionalized economy, and that, finally, implies that domestic and foreign financial exposure, exchange regimes, *CBA*, and other political-economic conditions all generally interact to determine domestic inflation.

Thus, the domestic-inflation effects of international financial exposure, exchange-rate regime, *CBA*, and all other political-economic conditions, generally depends on each others' levels at home and abroad. This echoes a core theme of classic and modern comparative and international political economy (Katzenstein 1985, Gourevitch 1986, Hall 1986, Hall and Soskice 2001 most recently): the organization and distribution of interests and configuration of political-economic institutions at home and abroad *all interact* to shape domestic policies and outcomes. This paper advances that core agenda by showing how to apply theory more explicitly to empirical specifications to obtain sensible, intuitive, precise, and substantively revealing quantitative estimates of many such interaction effects, even in the limited data available to comparative and international political economists. In this case, the multiple interactions identified in such studies were successfully clarified and quantified, and, as results in the above two sections testify, the theoretically-informed empirical model with those interactions confirmed the suspicion that non-interactive or less-general interactive analyses have misled about the highly contextual inflation-effects of foreign and domestic interests and institutions.

This paper also supports Franzese's (1999) findings regarding the interaction of domestic CB and government, clarifying that this interaction has most observable domestic-inflation impact where exchange regimes and financial exposure least constrain domestic authorities. Moreover, parallel to his findings regarding *CBA*, the anti-inflation effects of exchange-rate pegs seem generally to have

diminished as structural trends in trade exposure, labor markets, and elsewhere pushed the balance of domestic interests more strongly against inflation—*before* many countries moved to strengthen such commitments. This adds further circumstantial evidence to his conjecture that institutional change occurs not when it would have most economic effect, but when it has most political support, which, at least in this inflation-policy case, is exactly when it has least economic impact. We seem to observe institutional “reform” toward anti-inflationary rigor as anti-inflation forces ascend politically and seek to use that rising strength to institutionalize conservatism. Likewise, institutional “reform” in opposite directions will likely occur when less-anti-inflationary forces rise, which will be exactly when conservatism would have had most anti-inflation impact.<sup>45</sup>

Finally, the approach to empirical modeling of shared policy-control introduced here and in Franzese (1999) also opens exciting avenues for further research in this and other substantive venues.

First, researchers need only know how the left-hand-side outcome would be determined under hypothetical extremes of key parameters to model those parameters rather than assume them constant as done here. For example,  $\beta_p$ , exchange-rate-commitment efficacy, should vary predictably with other political-economic conditions and institutions, and we know what inflation would occur under hypothetical full-commitment-efficacy (peg-currency inflation). Thus, one could, e.g., allow trade and financial exposure, and perhaps federalism, *FED*, or divided government, *DG*, (see Lohmann XXXX, Bernhard XXXX), to moderate peg-efficacy and model and evaluate that hypothesis directly simply by substituting  $f(TE, E, FED, DG)$  for  $\beta_p$  in model (14) to produce:

$$E(\pi) = \mathbf{B}_0 + \beta_e E \cdot \beta_{\pi^*} \pi_a + (1 - \beta_e E) \left\{ \left[ \left( \beta_{gp} GP + \beta_{ey} EY + \beta_{up} UP + \beta_{bc} BC + \beta_{aw} AW + \beta_{fs} FS + \beta_{te} TE + \beta_a \pi_a \right) \right] \right. \\ \left. \left[ \cdot (1 - \beta_{c1} C) + \beta_{c1} C \cdot \beta_{c2} \right] \right. \\ \left. \left[ \cdot \{ 1 - f(TE, E, FED, DG) \} P \right] + f(TE, E, FED, DG) P \cdot \beta_{\pi^*} \pi_{mp} \right\} \quad (20)$$

---

<sup>45</sup> *Reform* goes in quotation marks because, as Franzese (2001) demonstrates, such institutional changes have generally produced ambiguous, small, or non-existent efficiency effects but unambiguous and large distribution effects.

Exploring such extensions will require practical tradeoffs however. As parameterization realism and sophistication increase, theoretically-informed models like **(20)** come increasingly to resemble more-unconstrained interactive models like **(13)**, with all their estimation and interpretation problems.<sup>46</sup>

Second, more broadly, researchers can also apply this approach to other arenas of shared policy-control. Notice, for example, that the arguments behind **(1)** and **(3)** apply to virtually any principal-agent (i.e., delegation) situation. In general, such situations are problematic because, if each had full control, agents would act according to some function,  $y_1=f(\mathbf{X})$ , while principals would act differently,  $y_2=g(\mathbf{Z})$ . Some institutional and other environmental conditions are then usually argued to determine the monitoring, enforcement, and other costs,  $c$ , principals must incur to force agents to enact  $g(\mathbf{Z})$  instead of  $f(\mathbf{X})$ . In such situations, realized policy,  $y$ , will typically be given by some  $y=k(c)f(\mathbf{X})+[1-k(c)]g(\mathbf{Z})$  with  $0 \leq k(c) \leq 1$  and  $k(c)$  weakly increasing. Thus, effects of  $c$  generally depend on  $\mathbf{X}$  and  $\mathbf{Z}$ , and those of each  $x \in \mathbf{X}$  and  $z \in \mathbf{Z}$  generally depend on  $c$ . Empirical applications of principal-agent models seem to have frequently missed this point. Moving beyond delegation to other shared policy-control situations, researchers might also fruitfully apply this approach to study the relative weight in policy control, for example, of executive and legislative branches in (semi-)presidential systems, or of different chambers in multicameral systems, or of prime-, cabinet-average-, cabinet-median-, and portfolio-ministers in parliamentary systems, or of committees or cabinets and legislature floors or backbenchers or oppositions, or, even, of the degree to which elected representatives act legislatively as if they represent the residents of their electoral district, those therein who support them, or their national-party's or some other constituency (see, e.g., Levitt 19XX for a similar approach to this last problem).

Finally, even more generally, researchers can apply similar non-linear approaches to any situation in which some factor or set of factors modify the impact of several others proportionately,

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<sup>46</sup> More-technical but less-substantively-exciting potential advances also exist. One could, for example, use nonlinear functions  $f(TE, E)$  bounded between zero and one (e.g., logit functions) to improve model specification further.

thereby bringing many more of their highly interactive theoretical propositions under empirical scrutiny than perhaps previously thought possible. Indeed, institutions often operate in this way. For example, institutions that foster greater party discipline may induce legislators to behave less (geographically) distributively and more (class/ideological) redistributively, implying a proportionate modification in their response to a range of political economic conditions (see, e.g., Franzese and Nooruddin 1999 for an inroad). Similarly, institutions that facilitate voter participation tend to broaden the distribution of interests represented in the electorate and so that influence policy, again suggesting the effect of many political-economic conditions on government policies will be modified proportionately by such electoral institutions (see, e.g., Franzese 2001: ch. 2).

The approach is not *panacea* of course. It does require that researchers know well how policy would be determined under the hypothetical extremes of key parameters and that the inputs to these policy-response functions very empirically in sample, and it gains empirical leverage and produces truly revealing estimates of those parameters only to the degrees they do so.<sup>47</sup> For example, the estimate  $b_{c,l}$  here and in Franzese (1999) reflects the degree to which a unit increase in the *CBA* index mutes governmental inflation-policy responses to domestic political-economic conditions only so well as the *CBA* index (linearly) gauges autonomy and conservatism, as the linear-weighted-average form of **(1)** reflects the way *CBA* (so-measured) mutes domestic-government inflation-policy control, and as the models of  $\pi_c(\mathbf{X}_c)$  and  $\pi_g(\mathbf{X}_g)$  reflect true CB and government behavior. More strictly speaking,  $b_{c,l}$  measures the degree to which  $\pi_c(\mathbf{X}_c)$  becomes a better linear prediction of inflation outcomes than  $\pi_g(\mathbf{X}_g)$  as *CBA* increases, which will reflect the effectiveness of *CBA* in restraining political responses to inflation pressures only so well as  $\pi_c(\mathbf{X}_c)$ ,  $\pi_g(\mathbf{X}_g)$ , and **(1)** are specified. Still, many important substantive problems in positive political science, especially in comparative and international political economy, involve multiple-hands-wheels or similar multiple-interaction-inducing aspects, and this

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<sup>47</sup> For example, empirical leverage in estimating something like **(2)** derives from how different are the functions  $\pi_i(\mathbf{X}_i)$  in sample. Here, they differed greatly since three were just some inflation rate abroad,  $\pi_a$ ,  $\pi_{mp}$ ,  $\pi_{sp}$ , one a constant,  $\pi_c$ , and one a linear function of eight variables (seven unique to that function),  $\pi_g(\mathbf{X}_g)$ .

approach seems to offer a theoretically, methodologically, and empirically promising way to address those issues more fruitfully than has been done before.

## **Appendix I: The Standard Neoclassical Model of Credible Commitment and**

### **Inflation**

The now-standard neoclassical argument<sup>1</sup> begins by specifying the preferences,  $V^g(\cdot)$ , of the discretionary monetary-policymaker (i.e., the government):

$$V^g = -\left[\frac{1}{2}A_g(N_g^T - N)^2 + \frac{1}{2}(\pi_g^T - \pi)^2\right] \quad (21)$$

Governments dislike employment,  $N$ , and inflation,  $\pi$ , deviations from targets,  $N_g^T$  and  $\pi_g^T$ ,<sup>2</sup> and weigh employment relative to inflation by  $A_g$ . Lower  $N_g^T$ ,  $\pi_g^T$ , or  $A_g$  correspond to conservatism. Next, nominal and real economic rigidities imply that unexpected inflation increases employment,  $N$ , beyond natural rate,  $N_n$ , giving the economy as an expectations-augmented Phillips Curve:

$$N = N_n + \alpha(\pi - \pi^e) \quad (22)$$

$\pi^e$  is expected inflation, and  $\alpha$  is the efficacy of surprise money in increasing employment (i.e., the Phillips Curve slope).<sup>3</sup> Finally, substituting (22) into (21), maximizing with respect to  $\pi$ , and then applying rational expectations (equating  $\pi^e$  to  $\pi$ ) produces *discretionary equilibrium inflation*:<sup>4</sup>

$$\pi_d^* = \pi_g^T + A_g \alpha (N_g^T - N_n) \quad (23)$$

$\pi_d^*$  obtains when governments with preferences (21) face economies given by (22) and fully control inflation.<sup>5</sup> Note the inflationary bias: equilibrium inflation exceeds even government targets

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<sup>1</sup> This review follows Cukierman (1992) chapter 3: “The Employment Motive for Monetary Expansion.” Any or any combination of “motives” (chapters 4-5, 7) would suffice here.

<sup>2</sup> This function implies governments dislike too high (low) employment (inflation): highly unrealistic. One can assume arbitrarily high (low) targets to avoid this absurdity. Partisan differences then appear solely as variations in  $A_g$ .

<sup>3</sup> Here, surprise inflation raises employment by lowering real wages, which raises labor demand, which raises employment if it is demand-constrained. Expected inflation affects no real variables in neoclassical models (cf. note 5).

<sup>4</sup> I.e., assuming no uncertainty and that policy authorities directly control inflation: merely simplifying assumptions in the standard neoclassical framework.

<sup>5</sup>  $\pi_d^*$  involves only parameters the public knows with certainty ( $\pi_g^T$ ,  $A_g$ ,  $\alpha$ ,  $N_g^T$ ,  $N_n$ ), so expected inflation ( $\pi^e$ ) equals actual inflation ( $\pi_d^*$ ) and employment ( $N$ ) does not deviate from its natural rate ( $N_n$ ) in equilibrium. This is the real side of the neoclassical argument (about which see note 5).

$\pi_d^* > \pi_g^T$  [n.b.:  $A_g > 0$ ,  $\alpha > 0$ ,  $(N_g^T - N_n) > 0$ ]. Governments cannot achieve the lower inflation desired *ex ante* because announced targets are inconsistent with what, having utility **(21)** and facing economy **(22)**, they would do if the public actually believed them. Thus the time-inconsistency: if the public expects the target,  $\pi_g^T$ , then even benevolent governments would create greater inflation, trying to exploit **(22)**. Knowing this, the public would never expect  $\pi_g^T$ . Only  $\pi_d^*$  is rational both for public to expect given government preferences and for government to produce given public expectations.

Equilibrium inflation could be lower only if governments could somehow credibly commit to a lower rate. Delegating monetary-policy authority to CBs serves as such a commitment device to the degree the CB is constructed to have more conservative preferences than political authorities (Rogoff 1985) and the political or economic costs of altering the terms of delegation are constructed to be prohibitive (Lohmann 1992). If delegation were full and completely credible, then equilibrium inflation would reflect the CB's preferences:

$$\pi_c^* = \pi_b^T + A_b \alpha (N_b^T - N_n) \quad (24)$$

$\pi_b^T$ ,  $N_b^T$ , and  $A_b$  are analogous to  $\pi_g^T$ ,  $N_g^T$ , and  $A_g$ . *Commitment* inflation,  $\pi_c^*$ , is lower than  $\pi_d^*$  because the CB is known (a) to control monetary policy fully and (b) to be more conservative than the government:  $N_b^T \leq N_g^T$ ,  $\pi_b^T \leq \pi_g^T$ , and/or  $A_b \leq A_g$ , with at least one strict inequality.

To illustrate, suppose CBs target low, constant inflation ( $\pi_b^T = \bar{\pi}_c$ ) and place no weight on employment ( $A_b = 0$ ); then commitment inflation would be  $\pi_c^* = \pi_b^T = \bar{\pi}_c$ .<sup>6</sup> To achieve this, the CB law would have to be written to endow the CB with these preferences and with sufficient autonomy to pursue them. E.g., the CB president could be paid for achieving a pre-set target inflation ( $\pi_b^T = c$ ) without regard to real outcomes ( $A_b = 0$ ), and some parliamentary super-majority could be required

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<sup>6</sup> This is a common assumption in the literature, another is that the parameters of the bank's utility are what a benevolent social planner capable of credible commitment would have them be (see Walsh 1995). The theoretical analysis in the text does not hinge on this assumption, but the empirical work there does assume a simple constant-target.

to over-ride the bank or change bank law.<sup>7</sup> If that majority were known impossible to obtain, then the CB's autonomy would be perfectly credible, and equilibrium inflation would be  $\pi = \pi_c^* = \pi_b^T = \bar{\pi}_c$ . If monitoring and over-riding the CB or the CB law were instead known to be economically and politically costless, then monetary policy would effectively remain fully in government control, so equilibrium inflation would be  $\pi = \pi_d^* = \pi_g^T + A_g \alpha (\mathcal{N}_g^T - \mathcal{N}_g) > \bar{\pi}_c$ .

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<sup>7</sup> Current New Zealand bank law is the closest empirical approximation to this pedagogical example.

**Appendix II: Formal Statements of the Predictions of CBA-and-Inflation Theory in the Standard Neoclassical Model: The Non-Exposed, Flexible-Exchange-Rate Case**

The first-order predictions of the theory of CBA and inflation in this simple case are that inflation decreases in  $C$  and  $N_n$ , and increases in  $\pi_b^*$ ,  $\pi_g^*$ ,  $\alpha$ ,  $A_b$ ,  $A_g$ ,  $N_g^*$ , and  $N_b^*$ . Anything that affects these parameters will likewise affect inflation, in accordance with the following relationships:

<b>First-Order Predictions of the Theory of CBA and Inflation</b>		
The Inflation effect of...		
...central bank autonomy	$\frac{\partial \pi}{\partial C} = -[\pi_d^* - \pi_c^*] = -[\pi_g^T - \pi_c^T + A_g \alpha (N_g^T - N_n) - A_b \alpha (N_b^T - N_n)] < 0.$	
...the government's inflation target	$\frac{\partial \pi}{\partial \pi_g^T} = 1 - C \geq 0.$	
...the bank's inflation target	$\frac{\partial \pi}{\partial \pi_b^T} = C \geq 0.$	
...the government's weight on employment relative to inflation	$\frac{\partial \pi}{\partial A_g} = \alpha(1 - C)(N_g^T - N_n) \geq 0.$	
...the bank's weight on employment relative to inflation	$\frac{\partial \pi}{\partial A_b} = \alpha C(N_b^T - N_n) \geq 0.$	
...the government's employment-rate target	$\frac{\partial \pi}{\partial N_g^T} = \alpha(1 - C)A_g \geq 0.$	
...the bank's employment-rate target	$\frac{\partial \pi}{\partial N_b^T} = \alpha C A_b \geq 0.$	
...the natural rate of employment	$\frac{\partial \pi}{\partial N_n} = -\alpha[A_g - C(A_g - A_b)] \leq 0.$	
...monetary real-eficacy (i.e., slope of the Phillips Curve)	$\frac{\partial \pi}{\partial \alpha} = C A_b (N_b^T - N_n) + (1 - C) A_g (N_g^T - N_n) \geq 0.$	

The second-order predictions are that each of these parameters affects inflation in a way that depends on at least one of the others. Thus, the inflation effect of *any* political-economic institutional or other factor that impacts  $C$ ,  $N_n$ ,  $\pi_b^*$ ,  $\pi_g^*$ ,  $\alpha$ ,  $A_b$ ,  $A_g$ ,  $N_g^*$ , or  $N_b^*$  depends on some other political, economic, institutional, or structural characteristics in that environment that also impacts these factors. Formally, these second-order predictions can be listed as cross-derivatives:

<b>Second-Order (Interactive) Predictions of the Theory of CBA and Inflation</b>		
Statement	Converse	Formal Expression
The inflation effect of $C$ depends on the government's inflation-rate target.	The inflation effect of the government's inflation-rate target depends on $C$ .	$\frac{\partial^2 \pi}{\partial C \partial \pi_g^T} \equiv \frac{\partial^2 \pi}{\partial \pi_g^T \partial C} = -1$

The inflation effect of $C$ depends on the bank's inflation-rate target.	The inflation effect of the bank's inflation-rate target depends on $C$ .	$\frac{\frac{\partial \pi}{\partial C}}{\frac{\partial \pi}{\partial \pi_b^T}} \equiv \frac{\frac{\partial \pi}{\partial \pi_b^T}}{\mathcal{X}} = 1$
The inflation effect of $C$ depends on the government's weight on employment.	The inflation effect of the government's weight on employment depends on $C$ .	$\frac{\frac{\partial \pi}{\partial C}}{\mathcal{A}_g} \equiv \frac{\frac{\partial \pi}{\partial A_g}}{\mathcal{X}} = -\alpha(N_g^T - N_n) < 0$
The inflation effect of $C$ depends on the bank's weight on employment.	The inflation effect of the bank's weight on employment depends on $C$ .	$\frac{\frac{\partial \pi}{\partial C}}{\mathcal{A}_b} \equiv \frac{\frac{\partial \pi}{\partial A_b}}{\mathcal{X}} = \alpha(N_b^T - N_n) \geq 0$
The inflation effect of $C$ depends on the government's employment-rate target.	The inflation effect of the government's employment-rate target depends on $C$ .	$\frac{\frac{\partial \pi}{\partial C}}{\mathcal{N}_g^T} \equiv \frac{\frac{\partial \pi}{\partial N_g^T}}{\mathcal{X}} = -A_g \alpha < 0$
The effect of $C$ on inflation depends on the bank's employment-rate target.	The effect of the bank's employment-rate target on inflation depends on $C$ .	$\frac{\frac{\partial \pi}{\partial C}}{\mathcal{N}_b^T} \equiv \frac{\frac{\partial \pi}{\partial N_b^T}}{\mathcal{X}} = A_b \alpha \geq 0$
The effect of $C$ on inflation depends on the natural rate of employment.	The effect of the natural rate of employment on inflation depends on $C$ .	$\frac{\frac{\partial \pi}{\partial C}}{\mathcal{N}_n} \equiv \frac{\frac{\partial \pi}{\partial N_n}}{\mathcal{X}} = \alpha(A_g - A_b) > 0$
The effect of $C$ on inflation depends on the slope of the Phillips Curve.	The effect of the slope of the Phillips Curve on inflation depends on $C$ .	$\frac{\frac{\partial \pi}{\partial C}}{\partial \alpha} \equiv \frac{\frac{\partial \pi}{\partial \alpha}}{\mathcal{X}} = -[A_g(N_g - N_n) - A_b(N_b - N_n)] < 0$

### **Appendix III: Data Definitions, Sources, and Descriptive Statistics**

This appendix describes all data used in the text. Except as noted, data are annual 1955-1990 in US, Japan, Germany, France, Italy, UK, Canada, Austria, Belgium, Denmark, Finland, Greece, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Australia, and New Zealand.

**$\pi$ : GDP-Deflator Inflation (x%).** Taken from Layard, *et al.* (1991).

**GP: Government Partisanship (0-10).** Previous *expert* codes (see, e.g., Laver and Schofield 1990) of party left-right positions are used to measure the average of government members' partisan positions. Available codes for each party are rescaled 0-10 left-to-right and then averaged. France's Communists are the sample's farthest left government participant at  $1.4 \pm$ ; Japan's Liberal Democrats are farthest right at  $8.9 \pm$ . US Democrats and Republicans are  $4.8 \pm$  and  $7.6 \pm$ . A government's position averages its members' party positions. In simple parliamentary systems, cabinet members used. US governments' position are  $\frac{1}{3}$  the president and  $\frac{1}{3}$  each the senate and house average. The French V<sup>th</sup> Republic and Finnish positions are  $\frac{1}{2}$  each the president and cabinet average. In country-years with more than one government in office, each is weighted by the proportion of the year it held office.

**EY: Post-Election-Year Indicator (0...1...):** Variable sums to 1 over the 365 days following a lower-house election. Cumulative if more than one election within a year. Finnish and French V<sup>th</sup> presidential and parliamentary elections each considered  $\frac{1}{2}$  an election. US presidential and house elections are each  $\frac{1}{3}$ . The whole senate election is considered  $\frac{1}{3}$ , so each biennium is  $\frac{1}{3}(\frac{1}{3}) = \frac{1}{9}$ .

**UP: Union Power (0-1).** Union-member share of labor force; Golden and Wallerstein (1995).

**BC: Wage/Price Bargaining Coordination (0-1).** Hall and Franzese's (1999) subjective index; varies only by country: US 0, Japan .75, Germany .75, France .25, Italy .25, UK

0, Canada 0, Austria 1, Belgium .5, Denmark .75, Finland .75, Greece 0; Ireland 0, Netherlands .5, Norway 1, Portugal .25; Spain 0, Sweden 1, Switzerland .75, Australia .25, New Zealand .25.

**AW: Aggregate Wealth ( $\ln(\text{thousands})$ ):** Natural log of real GDP *per capita* in thousands of 1985 US dollars by the chain method, from Penn World Tables (1996).

**FS: Financial-Sector Employment-Share (x%).** Finance, insurance, banking, and real estate employment as percent of total; from OECD National Accounts Volume II, Detailed Tables.

**TE: Trade Exposure (0-2).**  $\{^{1/2}(\text{exports}+\text{imports})/\text{GDP}\} \cdot (1-\text{GDP}^*)$ , where  $\text{GDP}^*$  is that country's share of OECD total real GDP; from IMF IFS CD-ROM, 6/96.

**$\pi_a$ : Inflation Abroad (x%).** Average inflation ( $\pi$ ) in the *other* countries in that sample-year, weighted by share of OECD real GDP.

**CBA: Central Bank Autonomy and Conservatism (0-1).** The average of the five most commonly used indicators of CBA: LVAU and QVAU from Cukierman (1992), EC and POL from Grilli, *et al.* (1991), and the original Bade and Parkin (1982) index. [*N.b.*, Alesina's commonly-cited index is based on this last source (personal communications).] As Cukierman's LVAU (potentially) varies by "decade": 1950-9, 1960-72, 1973-9, 1980-9, so too does the average. In fact, though, fully 96.6% of the variance in LVAU is cross-national since CBA rarely changes over time in the sample. The source indices are linearly rescaled 0-1, and then the available rescaled measures are averaged.

**SP: Single-Currency-Peg Indicator (0,1).** Equals 1 if that country-year characterized by an exchange-rate peg to a single other country's currency, from IMF IFS print editions, various years.

**MP: Multi-Currency-Peg Indicator (0,1).** Equals 1 if that country-year characterized by an exchange-rate peg to a basket of other countries' currencies, from IMF IFS print editions.

**$\pi_p$ : Peg-Country's or Countries' Inflation (x%).** Inflation in the peg country for  $SP=1$  or basket-weighted-average inflation in the *other* countries in the basket if or  $MP=1$ .

**E: International Financial Exposure (0-1).** Sum of Quinn and Inlan (1997) indices of current and capital account liberal-openness, rescaled to 0-1.

#### **Appendix IV: Methodological Notes**

All models estimated by nonlinear least-squares (NLS) or OLS. NLS parameter estimates are found numerically as analytic solutions may not exist; estimated coefficient variance-covariance matrices differ accordingly (Greene 1997:453-8). Local optima and flat regions can plague NLS optimization; therefore, multiple parameter starting values were attempted. The reported results give the least sums of squared errors, and those optima were reached from any reasonable starting values.

In OLS models, even with two lags of inflation, residual-correlation tests found significant, though small, remaining residual-correlation. For comparability, I retain the two lags and employ Newey-West autoregressive-and-heteroskedasticity-consistent covariance-matrices (truncation at six lags) in NLS and OLS. This should also aid regarding contemporaneous correlation (see below).

Beck and Katz (1996) show feasible generalized least-squares estimates of error-covariance structures that allow contemporaneous correlation perform poorly in data sets of these proportions. They advise heteroskedasticity-and-contemporaneous-correlation consistent variance-covariance matrices (panel-corrected standard-errors: PCSE's). Since NLS settings complicate implementation of PCSE's, I rely on  $\pi^a$  to bring contemporaneous correlation into the systematic component in all models for comparability. Especially with  $\pi^a$  as a regressor, Newey-West covariance-matrices should aid further regarding what contemporaneous correlation may remain in the stochastic component.

Interactive models usually assume coefficients on some variables are *deterministic* functions of others. Western (1997) argues *probabilistic* interactive relations are substantively and statistically more sensible, and illustrates Bayesian techniques appropriate for such random-coefficient models. His suggestions apply here and complement the present approach that stresses theoretically derived

restrictions on the interactions considered. Bayesian techniques would also especially suit evaluation of several possible models between most-unconstrained and most-constrained models. I advocate combining these approaches but, emphasizing simplicity, employ only more familiar techniques here.

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