Endogenous Stabilization in Open Democracies

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Abstract

In the new Keynesian theory of endogenous stabilization governments react quickly to lean against the macroeconomic wind. In open economies policymaking is complicated by concern about the trade balance. We extend the political business cycle model by assuming that governments have objectives with respect to macroeconomic performance with respect three indicators (growth, inflation and the net exports), but are constrained by an augmented Phillips curve and the inverse relation between net exports and domestic output. As long as adaptive expectations replace rational ones, econometric tests support this characterization of the political-economic equilibrium, and suggest how it is conditioned by political ideology and central bank independence.

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1. Introduction

Macroeconomic stabilization is fundamentally political: Kalecki (1943) warned that Keynesian governments would be tempted to manipulate economic policies to gain political support and to suppress the working class. Recent modeling has focused on the different inflation targets of different political parties and governments, and the relative independence of central bankers. This paper investigates these models using recent measurements of political ideology and central bank independence in an econometric model of endogenous stabilization.

Empirical application of these ideas confronts the fact that the theoretical literature has invariably modeled closed economies, while all available observations of macroeconomic outcomes come from open economies. International trade can complicate the problem by adding a new variable, the trade balance, to the policymaker's list. In a circumstance in which stabilization logic favors a particular policy toward inflation and growth (say, activist intervention to increase growth), the government's decision may be altered by foreign trade considerations (say, lower growth to prevent a decline in net exports). We model short-run stabilization as the constrained optimization of a quadratic objective function in inflation, growth and net exports, subject to a Phillips curve and a net export function. The solution to this policy problem gives a reduced form econometric model. An examination of the post-war economic record of 18 democracies validates the value of this approach. Ideological and institutional statistics enhance our understanding of the economic data in predictable ways.

A prominent feature of the recent literature is the rational expectation assumption: economic agents use all available information to update their forecasts. This approach coheres with the notion of well-informed maximizing agents. We accommodate this convention by augmenting our Phillips curve with expectations, and by obtaining estimates of model parameters under the assumption of strongly rational inflation forecasts. However, on empirical grounds we favor a weaker version of rationality in which agents' forecasts are simply last year's inflation rate. Although such adaptive behavior may seem naïve, it may nonetheless be rational in an uncertain world.

2. Structure and objectives in a closed economy

The literature on political macroeconomics invariably invokes an augmented Phillips curve as a structural constraint on policymakers.[1] Conventionally this is an inverse relation between the unexpected inflation and the gap between actual unemployment and its "natural" level. Here we substitute the output gap for the unemployment gap in our Phillips curve,[2]

$$\pi_t = \pi_t^e + \psi y_t + \varepsilon_t \tag{1}$$

where the output gap y_t is the log deviation of real output Y_t from its "natural" level Y_t^*. ε_t defines a random inflation shock. Expected inflation is π_t^e, the forecast of a typical agent based on information available in the previous period. Since expectations should be fulfilled in the long run, this model rules out any long-run deviation from y=0. However, as long as economic agents do not fully anticipate the fiscal, monetary and other policies, governments are able to temporarily increase output at the cost of more rapid inflation.

Another essential element is an assumption about political objectives. One possibility is to suppose that the government's goals are given by a quadratic function of growth and inflation,

$$U_t = -\frac{1}{2}\left(\left(g_t - g_t^*\right)^2 + \left(\pi_t - \hat{\pi}\right)^2 \right), \tag{2}$$

where the growth rate of real output is $g_t = \ln(Y_t) - \ln(Y_{t-1})$, and $g_t^* = \ln(Y_t^*) - \ln(Y_{t-1}^*)$ is the natural rate of growth. We ignore all consideration of the trade balance until Section 7. Perhaps the inflation target $\hat{\pi}$ reflects a desire for seigniorage. Differing targets for inflation could account for ideological differences. Since Right governments traditionally prefer lower inflation than the Left, we thus expect a lower target under Right governments. Of course, not all Right governments have the same target, nor do all left ones; these differ over time and among countries.

The modeling of collective objectives is controversial. Textbooks define social welfare as some aggregation of individual preferences. Functions such as (2) have been called labeled "abbreviated social welfare functions" because they are written in terms economic indicators such as inflation or

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[1] See, for example, Nordhaus (1975) or Chappell (1982).

[2] The name of this equation derives from Phillips' (1958) study of the inverse relation between the unemployment rate and the wage inflation rate. Later Friedman (1968) reformulated the relation in terms on price inflation and added expected inflation.

unemployment, and rather than citizen preferences.[3] Within the family of quadratic forms a variety of alternatives are plausible; quadratic objectives are tractable because they always result in linear reaction curves.[4]

3. Endogenous stabilization equilibrium

The government has limited options for activist stabilization. It is assumed that the government can exploit information and implementation advantages to lean against the macroeconomic wind, although its goals ($g_t = g_t^*$ and $\pi_t = \hat{\pi}$) are often unattainable.[5] The government uses up-to-date information to guide policy, observing contemporaneous shocks and setting inflation accordingly. Thus, it has an advantage over economic agents, whose forecasts date from the previous period. A prominent feature of this model is that rational agents come to understand that a policy of $\hat{\pi} > 0$ implies inflation; this expectation is a self-fulfilling prophecy. This inflation bias result originated with Barro and Gordon (1983). The stylized fact of inflation is consistent with the hypothesis that governments prefer inflation.

The long-run equilibrium is disturbed by exogenous shocks, and perhaps by uncertainty about which party will rule in the next period.[6] To derive the government's policy in any particular year, we substitute the definition of the growth rate $g_t \equiv y_t - y_{t-1} + g_t^*$ into the Phillips curve (1),

$$\pi_t = \pi_t^e + \psi\left(g_t + y_{t-1} - g_t^*\right) + \varepsilon_t$$

and use this to substitute for g_t in the objective function (2),

$$U_t = -\frac{1}{2}\left(\left(\frac{\pi_t - \pi_t^e - \varepsilon_t}{\psi} - y_{t-1}\right)^2 + \left(\pi_t - \hat{\pi}\right)^2\right)$$

Maximizing with respect to π_t, the government's preferred policy is

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[3] See Lambert (1993).

[4] Sometimes circular indifference curves are made elliptical by adding a parameter to reflect the relative weight of growth versus inflation goals. Sometimes its growth target differs from the natural rate. Sometimes its indifference curves are parabolic. Another alternative asserts that goals are specified in terms of output levels, rather than growth rates. Equation (2) also assumes that only current conditions matter, but it might also include the discounted value of future outcomes. The government might plan for its current term of office only, or it might plan to be in office for several terms, discounting the future according to the probability of holding office. Alternatively, it might weigh pre-election years more heavily. See Kiefer (2000) for empirical evidence that only current conditions matter in political business cycle econometrics.

[5] Fischer (1977) is an early example in this literature.

[6] Election uncertainty is the hallmark of the rational political business cycle of Alesina (1987) and Alesina and Roubini (1992).

$$\pi_t = \frac{\pi_t^e + \varepsilon_t + \psi y_{t-1} + \psi^2 \hat{\pi}}{1+\psi^2} \tag{3}$$

$$g_t = g_t^* - y_{t-1} - \frac{y_{t-1} - \psi\left(\pi_t^e + \varepsilon_t - \hat{\pi}\right)}{1+\psi^2}$$

Among other things, this implies that inflation and growth may either rise or fall over a government's term, depending on expectations, on conditions inherited from the past, and on policy targets. We assume that the government can implement its preference policy, but we do not explicitly consider the instruments.

In the absence of shocks, the time-consistent equilibrium inflation rate should occur where inflation is just high enough so that the government is not tempted to spring a policy surprise. This equilibrium is the natural output, natural growth and an ideologically determined rate of inflation, $y = 0, g = g^*, \pi = \hat{\pi}$.

Ideally a rational agent uses available information to forecast inflation. We assume that the typical agent is sophisticated enough to know the government's inflation target. She also knows the slope of the Phillips curve, the long-run trend in growth and current economic conditions. However, we suppose that she cannot predict the next inflation shock ε_t. These are strong assumptions.

Formally, her information set is $I = \left\{\hat{\pi}, g_t^*, \psi, y_{t-1}\right\}$. To obtain the rational expectation of π given *I*, we take the conditional expectation of the inflation equation (3) and solve:

$$\pi_t^e = E\left(\pi_t\right) = \hat{\pi} + \frac{y_{t-1}}{\psi}, \tag{4}$$

so that expectations equal the government's inflation target with a correction for pre-existing economic conditions. Substituting (4) into (3) gives the rational solution

$$\pi_t = \hat{\pi} + \frac{\varepsilon_t}{1+\psi^2} + \frac{y_{t-1}}{\psi} \tag{5}$$

$$g_t = g_t^* - y_{t-1} - \frac{\psi\varepsilon_t}{1+\psi^2}$$

We label it "strongly rational" because it assumes that agents are well-informed sophisticated forecasters of government behavior.

A weaker alternative holds that inflation expectations are simply observed inflation in the previous year $\pi_t^e = \pi_{t-1}$. This is commonly known as the adaptive model; it assumes that agents are quick learners,

but forgetful. Although many economists view the adaptive model with suspicion because such forecasts can be irrational, adaptive behavior is often found. Usually, this simple forecasting rule has the desirable property that it too converges to the time-consistent equilibrium. For this reason we characterize adaptive expectations as "weakly rational."

Before elections the situation is less certain. Then, a rational agent should take into account her forecast of the election outcome. The rational expectation under these conditions should be a weighted average of partisan targets; the appropriate weights should be a prediction of which party will hold power during the next period. Furthermore, in many countries the government can call early elections at any time. In these countries every year is potentially an election year, and there is always a positive probability of government change. This paper ignores such issues because a simpler version of strongly rationality fits available observations so poorly.

4. Modeling the target

Whatever expectations model is most valid, politics and institutions should influence outcomes through the inflation target parameter. A famous result by Rogoff (1985) concludes that appointing central bank governors with more conservative inflation objectives than the government can mitigate the inherent inflation bias. This prescription can be modeled as governors with $\hat{\pi}^b < \hat{\pi}^g$, where superscripts denote the central bank and the government. Nevertheless, a conservative banker will be less effective when she is not also given full independence to pursue her goals. Following Eijffinger and Hoeberichts (1998) we model central bank independence with the objective function

$$U_t = \theta\left(-\frac{1}{2}\left(\left(g_t - g_t^*\right)^2 + \left(\pi_t - \hat{\pi}^b\right)^2\right)\right) + (1-\theta)\left(\frac{1}{2}\left(\left(g_t - g_t^*\right)^2 + \left(\pi_t - \hat{\pi}^g\right)^2\right)\right), \qquad (6)$$

where θ measures the degree of independence on the interval (0,1). With this extension we find that the policy rules are unchanged, except that $\hat{\pi} = \theta\hat{\pi}^b + (1-\theta)\hat{\pi}^g$. The result indicates that conservativeness without independence $(\theta = 0)$ has no impact, nor does independence without conservativeness $\left(\hat{\pi}^b = \hat{\pi}^g\right)$.

We further model the government's target by allowing that rightwing governments aim for a lower inflation target, $\hat{\pi}^g = \hat{\pi}^{g0} + \hat{\pi}^{g\rho}\rho_t^g$ where ρ_t^g is a left-right index of the government ideology. Another possibility is that the median voter ideology influences policy directly; this effect may be stronger during

election years.[7] Hypothesizing that the desire to cater to voter preferences dominates other factors in election years, we formalize specify $\hat{\pi}^g = \hat{\pi}^{g0} + \hat{\pi}^{g\rho} e_t \rho_t^g + \hat{\pi}^{gv}(1-e_t)\rho_t^v$, where e_t is a dummy variable, equal to 1 during election years, and ρ_t^v is a left-right index of the voter ideology.

Putting the effects of central bank independence and conservatism together with government ideology and election-year sensitivity gives the inflation target model,

$$\hat{\pi} = \theta\hat{\pi}^b + (1-\theta)\left(\hat{\pi}^{g0} + \hat{\pi}^{g\rho} e_t \rho_t^g + \hat{\pi}^{gv}(1-e_t)\rho_t^v\right). \tag{7}$$

Substituting (7) into (3), or (5), we derive a two-equation regression model.

5. Data definitions

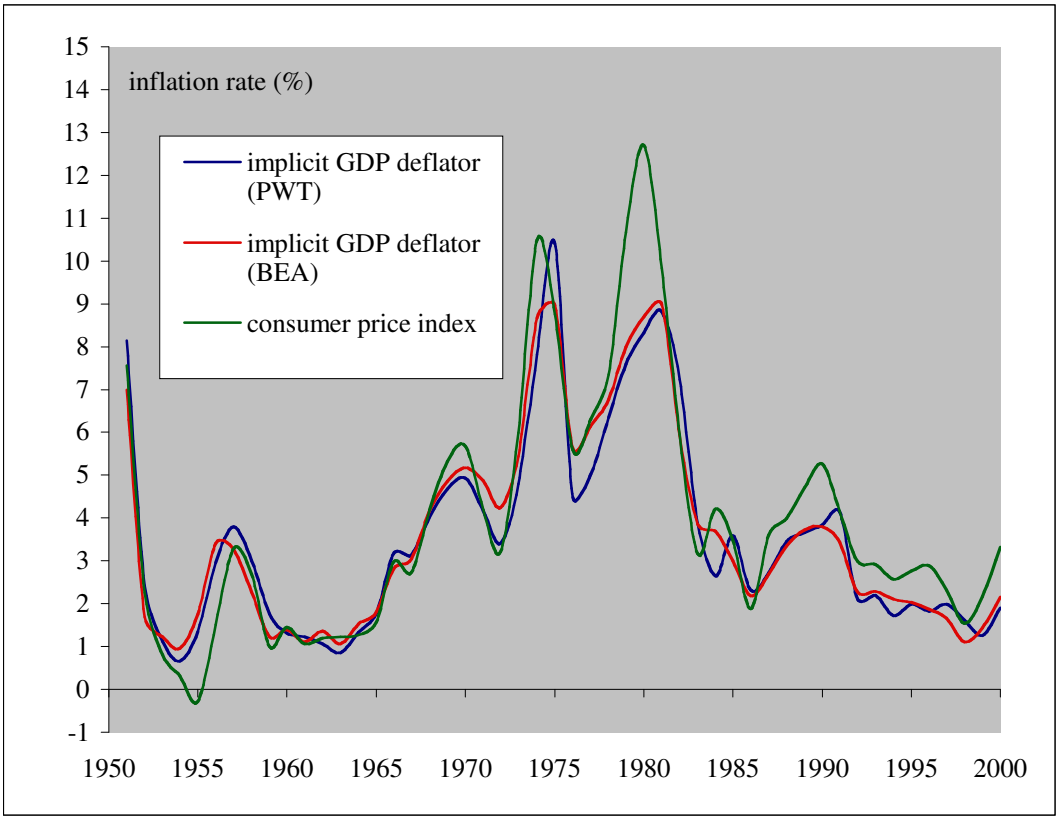
Our basic data derives from the Penn World Tables (PWT6.1), which includes internationally comparable time series on the national accounts for almost all the countries in the world for 1950-2000. Percentage growth is measured as the log difference in real GDP per capita; for the details on variable construction see Table 1. Although it is customary to study stabilization outcomes with aggregate statistics, such analysis is equally appropriate for the per capita data used here. The difference is that aggregate growth rates include population growth. Since population growth changes slowly, it has little effect on short-run stabilization.

[7] See Kiefer (2005) for a theoretical development of this idea and testing based on US popularity poll evidence.

Table 1. Variable definitions

	symbol	definitions using PWT 6.1 variable names
real GDP per capita	Y_{it}	$RGDPCH_{it}$
natural real GDP per capita	Y_{it}^{*}	estimated by cubic smoothing
rest of world output gap	$\tilde{y}_{it}$	$\ln\left(\sum_{j\neq i} Y_{jt}POP_{jt}\right) - \ln\left(\sum_{j\neq i} Y_{jt}^{*}POP_{jt}\right)$
growth rate	g_{it}	$\ln(RGDPCH_{it}) - \ln(RGDPCH_{it-1})$
implicit deflator	p_{it}	$\frac{PPP_{it}(CGDP_{it})}{PPP_{i96}(RGDPCH_{it})}$
inflation rate	π_{it}	$\ln(p_{it}) - \ln(p_{it-1})$
net exports	x_{it}	$(100 - CC_{it} - CI_{it} - CG_{it})\frac{Y_{it}}{Y_{it}^{*}}$
log of real exchange rate	z_{it}	$\ln\left(\frac{PPP_{it}}{XRAT_{it}}\right)$

Figure 1. Comparing US inflation rate statistics

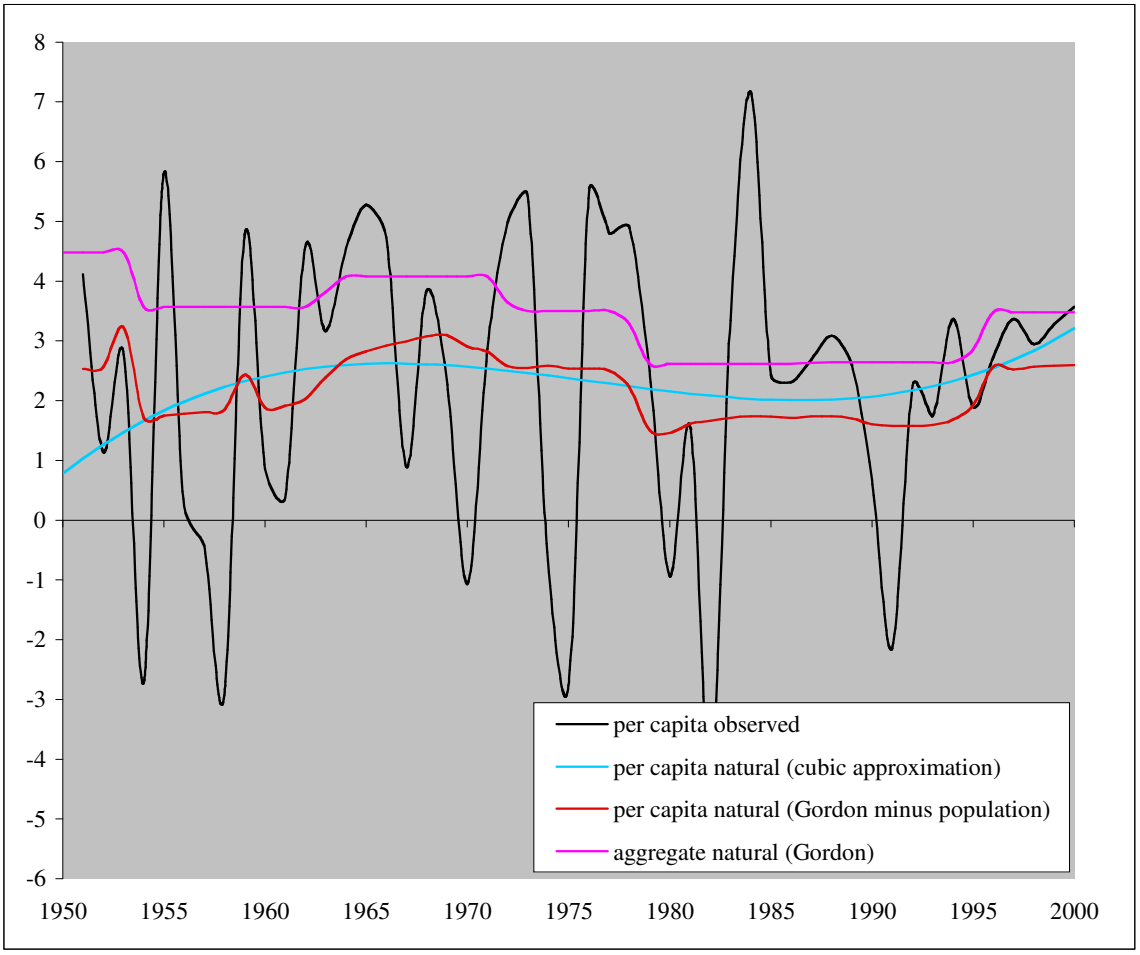


The inflation rate is defined using the purchasing power parity and GDP estimates from the PWT.

In Table 1 the numerator of the implicit deflator is GDP per capita measured in current local currency, and

the denominator is the same quantity measured in real terms (1996 local currency units). As an example Figure 1 compares this measure of inflation to official Bureau of Economic Analysis statistics. It is clear that they are quite close and that the PWT measure can be interpreted as an implicit deflator rate, and thus is an appropriate indicator of macrostabilization.

Figure 2. Estimated natural growth and observations: US



Our model calls for a measure of the output gap, also for the underlying trend of natural output. The published series include only real output per capita, not its natural level. In the absence of a superior method that can be applied worldwide, we estimate a smoothly evolving trend in potential output by fitting a cubic trend to the observed growth rates according to

$$\ln\left(\frac{Y_t}{Y_{t-1}}\right) = \beta_0 + \beta_1 t + \beta_2 t^2 + \beta_3 t^3,$$

one cubic regression for each country. The predicted values from these regressions are used to estimate Y^* according to

$$\ln\left(Y_t^*\right) = \ln\left(Y_0\right)\left(\prod_{s=0}^{t} \hat{\beta}_0 + \hat{\beta}_1 s + \hat{\beta}_2 s^2 + \hat{\beta}_3 s^3\right).$$

We use the results to construct the required series, the output gap y and the trend growth rate g^*. This method makes the convenient assumption that macroequilibrium was achieved in the first year of observation, usually 1950.

There are other methods of estimating the output gap. Gordon (2006) picks a list of benchmark dates when he judges that the US economy approximated macroequilibrium, and then estimates the natural growth rate between these dates as constant. His benchmark dates are: 1949Q1, 1954Q1, 1957Q3, 1963Q3, 1970Q2, 1974Q2, 1979Q3 1987Q3, 1990Q4, 1995Q1.[8] Figure 2 compares our estimated natural growth with Gordon's. To make the series comparable, we convert Gordon's aggregate statistics to a per capita basis by subtracting US population growth (according to PWT). By definition the natural level changes over time as technology advances and as capital is accumulated. Assuming that these influences evolve slowly, natural output should also. Thus, it seems inconsistent that Gordon's natural growth is discontinuous at benchmark dates. However, we do not find much difference between these two estimates for the US. Either method illustrates the fact that the underlying growth rate of the US economy has changed over time. Clearly, our methodology yields smoother changes in the natural growth, showing a slight slowing of growth from the 1960s through the 1980s, with an acceleration in the 1990s.[9] Both methods give quite similar estimates of natural trend and the output gap for the US.

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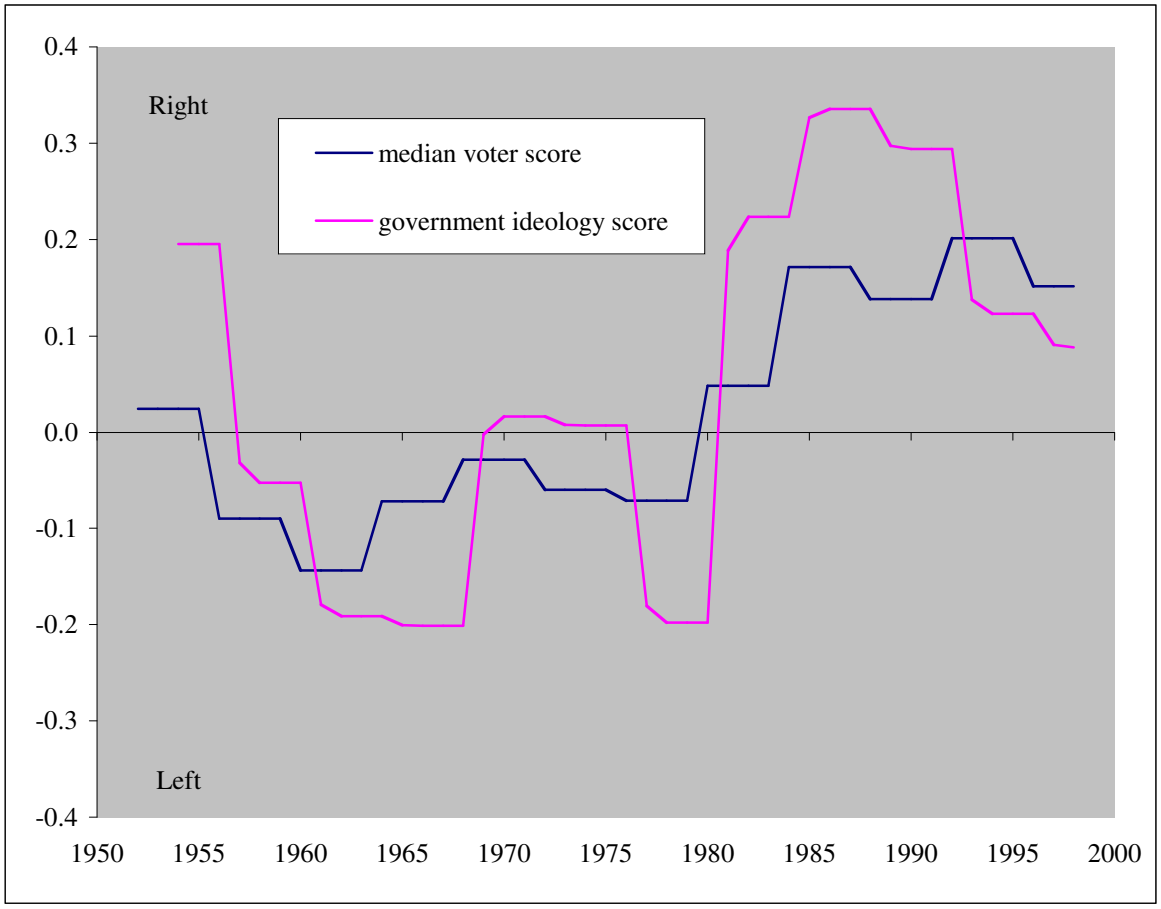
[8] Others have used more complicated estimation methods. Wachter uses a method based on demographic changes to estimate u^*, reported in Fleisher and Kniesner (1984). His estimates are lower than Gordon's in the 1960s, nearly identical during the 1970s, but turn down in the early 1980s coincident with maturing of the baby-boom generation when Gordon's series is still rising.

[9] The bumpy appearance of Gordon's estimate is in part explained by subtraction of population growth. Although population growth should be quite smooth itself, the PWT reports anomalous population jumps in 1953 and 1958.

Figure 3. Budge's ideology scores for the US government and the US median voter



Our model of the inflation target allows ideological differences among governments. Budge et al. (2001) publish Left-Right scores for political parties derived from a content analysis of pre-election platforms and manifestos for a panel of democracies covering a long series of postwar elections; their scores range from +1 at the extreme Right to –1 at the extreme Left.[10] A government ideology score is defined as the score of the party in power. To define annual statistics for the years in which the government changes, the score is the average weighted according to months in office. Thus for example, since the US president takes office in January, the out-going president's ideology is given a weight of 1/12th for that year. By this measure Figure 3 shows that the second Reagan Administration was the farthest to the right,

[10] We rescore Budge's –100 to +100 scale for convenience. These data are published online by Michael McDonald at www.binghamton.edu/polsci/research/mcdonalddata through 1995. We augment these data through 1998 and add Japan using Woldendorp et al. (2000) to code government dates and coalition membership.

while the Johnson and Carter Administrations were nearly tied for the farthest left. In countries ruled by a coalition the governing ideology is estimated by the average of the parties in the coalition, weighted by seats in the lower house of Parliament. Starting with the same database we use the distribution of party ideologies, weighted by election percentages, to estimate the ideology score of the median voter. For the US this estimate of the 50^{th} percentile ideology displays less variation than the government's, a phenomenon also observed in other democracies.

We also require an index of central bank independence. Cukierman et al. (1992) develop formal index of legal independence, defined on the (0,1).[11] According to this measure the German and Italian central banks achieve the greatest independence in our sample (.92 after 1998), and the Belgian central bank is the most dependent (.17 before 1992). Since the Cukierman index is unavailable before 1980, we fill in the missing values with 1980 numbers.[12] We interpret this index as a measure of independence θ, even though it's coding includes elements of conservativeness (whether price stability is the only objective).

Measuring the conceptual shock variable accurately is problematic. There are so many potentially important types of shocks to consider, and different countries may feel the impact of inflation shocks differently. We account only for exogenous energy price shocks, defined as the difference between the US inflation rates of the CPI and of the CPI less energy, hoping that the US experience reflects that of all countries.

6. Regression results

Because our models are reduced forms, they are consistently estimated by ordinary least squares. These are two-equation models of inflation and growth. These endogenous variables are explained by a list of predetermined variables (natural growth, expected inflation, lagged output gap, energy inflation shock, central bank independence, two ideology scores and an election-year dummy). These regressions are linear in variables but nonlinear in their coefficients. Our sample is defined by availability, the US CPI less energy series is available only after 1956 and the ideology series extends only through 1998.

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[11] See Cukierman et al (1992) and the update by Polillo and Guillén (2005).
[12] According to Cukierman (2005: 4), it is a "fact that during the forty years ending in 1989 there hardly had been [any]reforms in [central bank] legislation."

First we assume adaptive expectations in model (a) of Table 2 according to (3). The second model (b) invokes the strongly rational expectations according to (5). Judging by the log likelihood statistics, the adaptive model fits the data much better than the rational version; it also fits better than a benchmark VAR(1) model that achieves a log likelihood of -164. This result suggests that economic agents are not nearly as sophisticated as the strongly rational model assumes. In all of these models the estimated slope of the Phillips curve is positive as expected, and statistically significant, although its magnitude varies markedly in the rational specification. The Phillips slope estimated in the adaptive versions is more consistent with the literature; see Gordon (1990). In all cases the estimated target variable implies positive equilibrium inflation rates of around 4%. Judging by the R^2 statistics, the adaptive version predicts inflation more accurately than growth. This no doubt comes from the inclusion of the lagged inflation in the adaptive models.

Model (c) in Table 2 adds Budge's ideology score for as a linear determinant of the inflation-target parameter. The results are consistent with the hypothesis that rightwing governments aim for a lower inflation target; model (c) implies that when the score in Figure 3 shifts rightward by 0.1 points, the governments inflation rate target falls about 2/3 of a percent. Model (d) substitutes the median voter score for that of the government, and model (e) includes both scores under the restriction that voter preferences dominate during election years and government ones at other times. The results suggest that US voters have less impact on macroeconomic policy than the ruling party.[13]

[13] We do not account for central bank independence in the US because that version is not identified, as there is no variation in Federal Reserve independence over the sample period.

Table 2. Regression results, US 1957-1998
(*t*-ratios in parentheses)

	(a)	(b)	(c)	(d)	(e)
target restrictions	$\theta = 0,$ $\hat{\pi}^{g\rho} = 0,$ $\hat{\pi}^{v\rho} = 0$	$\theta = 0,$ $\hat{\pi}^{g\rho} = 0,$ $\hat{\pi}^{v\rho} = 0$	$\theta = 0,$ $e = 0$	$\theta = 0,$ $e = 1$	$\theta = 0$
expectations model	adaptive	Rational	adaptive	adaptive	adaptive
Phillips curve slope	0.503	1.766	0.533	0.570	0.518
	(4.715)	(4.686)	(5.540)	(5.307)	(5.487)
target	3.932	3.878	4.221	4.134	4.206
	(7.088)	(14.243)	(8.527)	(8.758)	(8.406)
government ideology			-6.96		-8.75
			(-2.290)		(-2.492)
median ideology				-8.12	-0.48
				(-1.950)	(-0.063)
energy shock	0.507	0.161	0.347	0.399	0.338
	(1.557)	(0.108)	(1.103)	(1.214)	(1.089)
R^2 (inflation)	0.825	0.369	0.844	0.840	0.839
R^2 (growth)	0.185	0.210	0.186	0.176	0.210
observations	42	42	42	42	42
log likelihood	-155	-189	-152	-154	-152

Table 3 reports the same models on 17 OECD democracies. These are the same countries in the Alesina and Roubini (1992) study of political business cycles.[14] Base models (f) and (g) repeat the adaptive versus rational test. Again the results are unfavorable to the strongly rational expectations hypothesis, suggesting that unsophisticated economic forecasting is not limited to the US.[15] While the base models assume that all countries share a single inflation target (about 5%), models (h) and (i) relax this by adding political variables. All ideology parameters have the predicted sign, but only the median voter preference in model (i) is significant by conventional standards. And, contrary to our US findings, these results suggest that voter preferences have more influence on stabilization than government ideology.

[14] They are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany (only after reunification), Ireland, Italy, Japan (only after 1961), Netherlands, New Zealand, Norway, Sweden, Switzerland and United Kingdom.

[15] By comparison the VAR(1) benchmark model achieves a log likelihood of –3166.

Table 3. Regression results, 17 OECD countries, 1957-1998 (excluding the US)
(*t*-ratios in parentheses)

	(f)	(g)	(h)	(i)	(j)	(k)	(l)
target restrictions	$\theta = 0$, $\hat{\pi}^{g\rho} = 0$, $\hat{\pi}^{v\rho} = 0$	$\theta = 0$, $\hat{\pi}^{g\rho} = 0$, $\hat{\pi}^{v\rho} = 0$	$\theta = 0$, $e = 0$	$\theta = 0$	$\hat{\pi}^{g\rho} = 0$, $\hat{\pi}^{v\rho} = 0$	$e = 0$	
expectations model	adaptive	rational	adaptive	adaptive	adaptive	adaptive	adaptive
Phillips curve slope	0.23	1.98	0.23	0.23	0.24	0.24	0.24
	(10.20)	(7.98)	(10.38)	(10.36)	(10.43)	(9.88)	(9.78)
government target	5.15	5.25	5.02	4.90	7.06	6.77	6.47
	(12.97)	(35.13)	(12.65)	(12.12)	(7.39)	(6.77)	(6.39)
central banker target					1.90	2.16	2.37
					(1.24)	(1.38)	(1.55)
government ideology			-3.51	-3.25		-3.02	-2.84
			(-1.61)	(-1.27)		(-0.94)	(-0.76)
median ideology				-10.22			-11.65
				(-2.02)			(-1.69)
energy shock	0.29	-1.20	0.28	0.28	0.28	0.28	0.27
	(1.71)	(-2.04)	(1.67)	(1.65)	(1.70)	(1.68)	(1.66)
R^2 (inflation)	0.64	0.03	0.64	0.64	0.64	0.64	0.64
R^2 (growth)	0.24	0.18	0.24	0.25	0.24	0.24	0.25
observations	676	676	676	676	676	676	676
log likelihood	-3154	-3725	-3152	-3151	-3151	-3151	-3150

Models (j) through (l) investigate the notion that anti-inflation conservatism can be institutionalized into the central bank's legal terms of reference. Using the Cukierman index to measure θ, and the assumption that the central bank's inflation target is an unknown constant, our estimate of this target about 2%. This result validates the hypothesis that central bankers are conservative.[16] Model (j) suggests that if the Belgian central bank before 1992 had had the independence of the German bank after 1998, then Belgium's long-run inflation rate should have been 3.9% lower. Model (l), our most general version, estimates the effects of central bank independence, government ideology and election-year voter preferences on inflation targets (the government effect is insignificant). Even though our extension in models (h) through (l) only increases the goodness-of-fit to a minor degree, we conclude that contributions of ideology and institutions to policy are plausibly revealed in these macroeconomic outcomes.

[16] Although this estimate is not statistically different from zero, it is significantly different from the government's target (t=5.16).

The estimated Phillips curve slope for these countries contrasts with that of Table 2. Although all estimates are statistically significant, the estimated slope for these 17 economies is less than half as steep as that for the US. Perhaps this is due to their smaller size or more open pattern of trade in our OECD sample.

7. An open economy extension

Perhaps the differences between our US and non-US results reflect government objectives in addition to inflation and domestic growth. Policymakers may also pay attention to the foreign trade balance in more open economies.[17] We extend the endogenous stabilization model to the open economy by adding the foreign balance to the government's list of policy targets. Specifically, we now suppose that the government's goals are given by

$$U_t = -\frac{1}{2}\left(\left(g_t - g_t^*\right)^2 + \left(\pi_t - \hat{\pi}\right)^2 + x_t^{\,2} \right), \tag{8}$$

where x is net exports as a fraction of natural GDP. This functional form specifies that the trade target is balance, and that deviations from all three targets weigh equally in policy-making. Of course, many other specifications are possible. This is a "what if" investigation of whether observed outcomes are consistent with this particular assumption about governmental preferences. Our assumption is tested below, to a limited extent.

Again, the government exploits information and implementation advantages to lean against the macroeconomic wind, although its goals ($g_t = g_t^*, \pi_t - \hat{\pi}, x_t = 0$) may be unattainable.[18] The government uses up-to-date information on both domestic and global shocks to pick the inflation rate. The government's options are still limited by the Phillips curve (1), but now they are also limited by the net export function

$$x_t = \alpha_1 y_t + \alpha_2 \tilde{y}_t + \alpha_3 z_{t-1}, \tag{9}$$

where $\tilde{y}$ is the GDP gap in rest of the world and z is the natural logarithm of real exchange rate. The first two terms parameterize the conventional understanding that imports are related to by domestic output (α_1>0), while exports are determined by foreign output (α_2<0). The Law of One Price motivates the third term: the real exchange rate tends to converge to purchasing power parity (z=0). Thus, a positive z will

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[17] The openness ratio (exports plus imports as a percent of GDP) for the US averaged 15% during the sample period, and 60% for the 17 countries.

[18] Fischer (1977) is an early example in this literature.

adjust downward, and this adjustment will increase the trade balance ($\alpha_3<0$). The one-year delay is a simple version of *J*-curve dynamics. The econometric advantage of the lagged specification is that it makes z predetermined. On the other hand, most theorists would think that the real exchange rate should be endogenous, since by definition z depends on domestic inflation and the nominal exchange rate. Our assumption that z is exogenous may be valid if the inherent delays are such that a change in the real exchange rate does not affect the current trade balance (or growth, or inflation), and if governments do not plan beyond one year. To the extent that this simplification is invalid (the extent that z is jointly determined with π, g and x), our estimates may suffer from simultaneity bias.

The long-run equilibrium is disturbed by exogenous shocks, ε_t and $\tilde{y}_t$. To derive the government's policy, we use the Phillips curve and the net export function to substitute for g_t and x_t in the (8),

$$U_t = -\frac{1}{2}\left(\left(\frac{\pi_t - \pi_t^e - \varepsilon_t}{\psi} - y_{t-1}\right)^2 + (\pi_t - \hat{\pi})^2 + \left(\alpha_1 z_{t-1} + \alpha_2 \frac{\pi_t - \pi_t^e - \varepsilon_t}{\psi} + \alpha_3 \tilde{y}_t\right)^2\right)$$

Maximizing with respect to π_t, the government's preferred economic outcome is

$$\pi_t = \frac{\left(1+\alpha_1^{\,2}\right)\left(\pi_t^e + \varepsilon_t\right) + \psi y_{t-1} + \psi^2 \hat{\pi} - \psi\alpha_1\left(\alpha_2 \tilde{y}_t + \alpha_3 z_{t-1}\right)}{1 + \psi^2 + \alpha_1^{\,2}} \tag{10}$$

$$g_t = g_t^* - y_{t-1} + \frac{y_{t-1} + \psi\left(\hat{\pi} - \pi_t^e - \varepsilon_t\right) - \alpha_1\left(\alpha_2 \tilde{y}_t + \alpha_3 z_{t-1}\right)}{1 + \psi^2 + \alpha_1^{\,2}}$$

$$x_t = \frac{\alpha_1\left(y_{t-1} + \psi\left(\hat{\pi} - \pi_t^e - \varepsilon_t\right)\right) + \left(1+\psi^2\right)\left(\alpha_2 \tilde{y}_t + \alpha_3 z_{t-1}\right)}{1 + \psi^2 + \alpha_1^{\,2}}$$

Assuming that the government can implement this policy, (10) defines a reduced form regression model.

In long-run equilibrium purchasing power parity (z=0) holds, as does macroeconomic equilibrium in the rest of the world ($\tilde{y} = 0$). And, in the absence of shocks, the equilibrium inflation rate should occur where inflation is just high enough so that the government is not tempted to spring a policy surprise. Thus the long-run equilibrium is $x = 0, y = 0, g = g^*, \pi = \hat{\pi}$: foreign trade balance, macroeconomic equilibrium, the natural growth rate and a politically determined rate of inflation.

Ideally a rational agent uses all available information to forecast inflation. Above we preferred the alternative adaptive expectations model ($\pi_t^e = \pi_{t-1}$) for empirical reasons. Nevertheless, the sophisticated

typical agent should be able to predict the government's inflation target. She should also know the slope of the Phillips curve, the parameters of the net export function, the long-run trend in growth and the economic conditions of the previous year. However, we suppose that she cannot predict the current inflation shock, nor can she predict current rest of the world GDP gap. Thus her information set is $I_t = \{\hat{\pi}, g_t^*, \psi, \alpha_1, \alpha_2, \alpha_3, y_{t-1}, z_{t-1}\}$. Given these strong assumptions, the rational expectation of π is

$$\pi_t^e = E(\pi_t \mid I_t) = \hat{\pi} + \frac{y_{t-1} - \alpha_1 \alpha_3 z_{t-1}}{\psi}, \tag{11}$$

the target inflation with adjustments for the business cycle and the real exchange rate. Substituting (11) into (10) gives the rational expectations solution

$$\pi_t = \hat{\pi} + \frac{\left(1+\alpha_1^{\,2}\right)\varepsilon_t - \psi\alpha_1\alpha_2\tilde{y}_t}{1+\psi^2+\alpha_1^{\,2}} + \frac{y_{t-1} - \alpha_1\alpha_3 z_{t-1}}{\psi} \tag{12}$$

$$g_t = g_t^* - y_{t-1} - \frac{\psi\varepsilon_t + \alpha_1\alpha_2\tilde{y}_t}{1+\psi^2+\alpha_1^{\,2}}$$

$$x_t = \frac{-\alpha_1\psi\varepsilon_t + \alpha_2\left(1+\psi^2\right)\tilde{y}_t}{1+\psi^2+\alpha_1^{\,2}} + \alpha_3 z_{t-1}.$$

8. Foreign trade data definitions

Figure 4 compares the official national accounts definition of US net exports with that derived from PWT; the two series track well. The PWT includes measures of all the variables in our open economy extension; see Table 1 for the details. For modeling consistency we redefine the trade balance as a percent of natural GDP, rather than actual. We measure the rest of the world GDP gap by aggregating all observations of real GDP (except the particular country being studied) to obtain the rest of world total, which is compared to the similar aggregation for natural GDP to define the rest of the world gap.

Figure 4. Comparing trade balance statistics: US

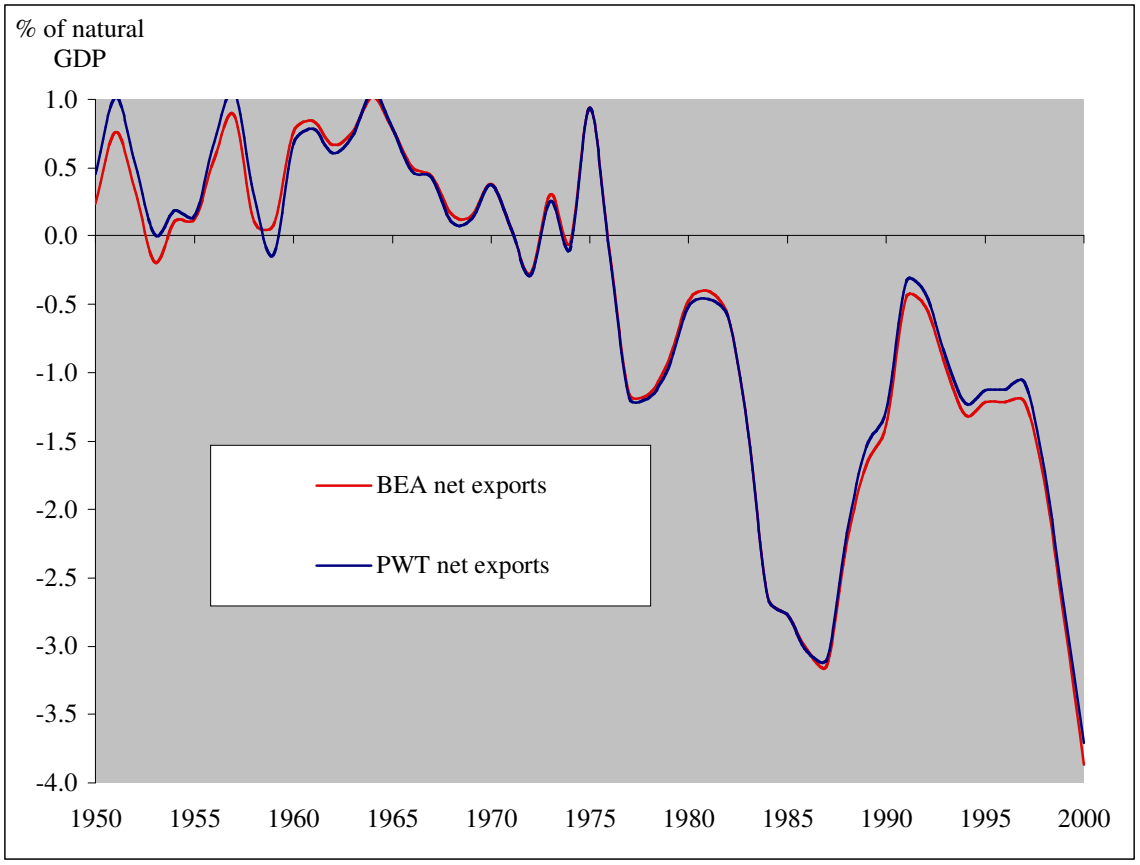
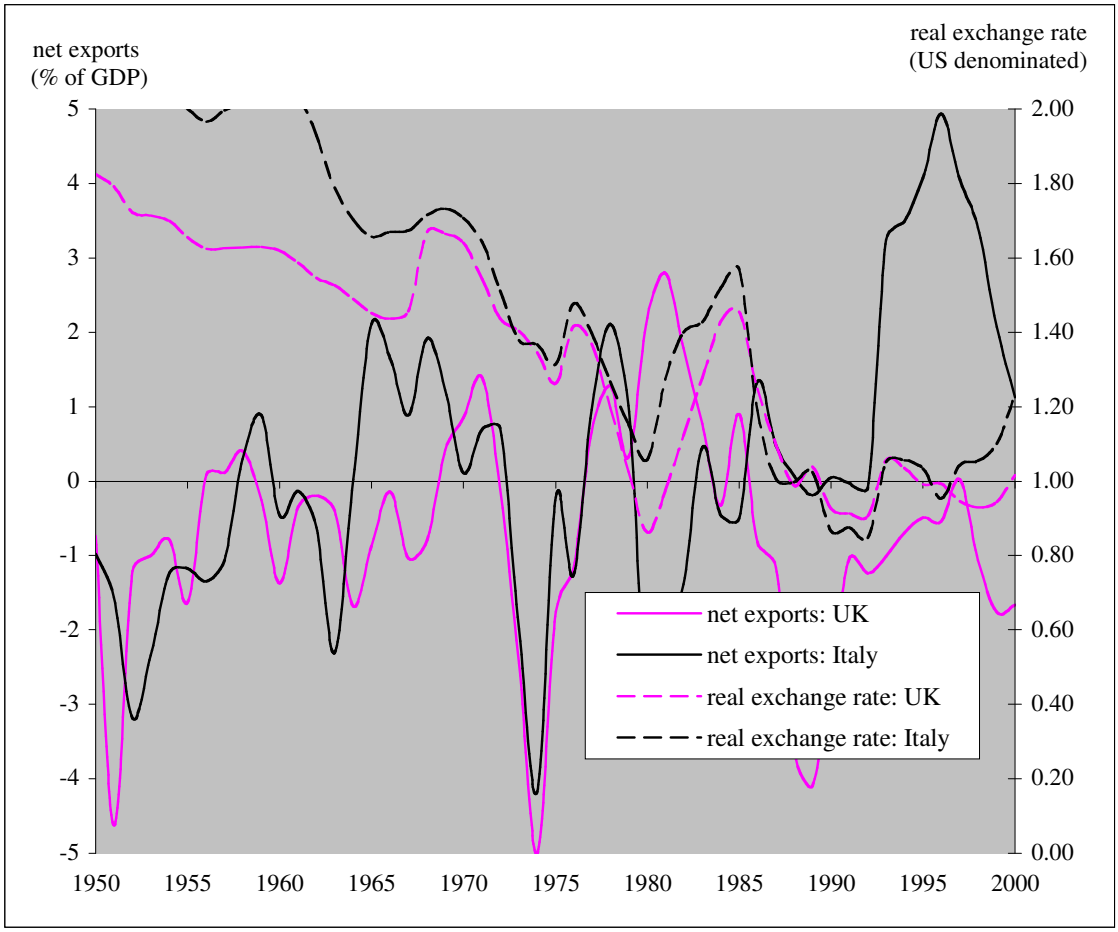


Figure 5 shows the Italy and UK real trade balances, as examples. These series were volatile even before the end of the Bretton Woods system in 1973. It is hard to see much bivariate support for the inverse link between real exchange rates and net exports in these two countries, especially during Bretton Woods. We note that the PWT definition of real exchange rates is less than ideal because it takes US prices as its base. The PWT rate may be especially inaccurate for countries that trade little with the US. Although it would be better to recognize actual trading patterns with a trade-weighted average of the real exchange rate for each country, this is infeasible without additional data.

Figure 5. Trade balances and real exchange rate: Italy and the UK



9. Extension estimates

Table 4 reports estimation results for these extended models, (10) and (12), for the same countries and years as in Table 3.[19] Further evidence against the strongly rational model of expectation is the failure of the model (n) estimation to converge. Although the adaptive expectations results seem plausible, and the net export function parameter estimates are theoretically expected and statistically significant, nevertheless a VAR(1) benchmark of the same three variables fits the data better (log likelihood=-4434). No doubt this result is connected to our poor fit for the trade balance equation. We nevertheless judge the open economy extension as successful because it improves R^2 of the growth equation, probably because of the linkage between net exports and output. Model (m) suggests that a one percent increase in the GDP gap produces

[19] A US model is not estimated because the US is basis of comparison for all real exchange rates, so that by definition z=0 in all US observations.

about a one-third-percent decrease in net exports. Likewise, a one percent increase in the rest of the world gap produces about the same increase in domestic net exports. In an unreported regression we relax our assumption that governments prefer a foreign balance, introducing a nonzero net export target $\hat{x}$ into the objective function. We find that we cannot reject the hypothesis that $\hat{x}$ is zero (t=0.61).[20]

Comparing the results in Tables 3 and 4, it appears that the extension does result in a slightly steeper Phillips curve estimate, and a very slightly greater inflation target. From this point of view, the two-goal, two-equation methodology may often be adequate for the study of political economy issues. On the other hand, the open economy extension strengthens our conclusion that ideology and institutions affect stabilization policy. Models (p) and (s) again suggest that governments adjust their policy to accommodate median preferences in election years. And, models (q) through (s) support our earlier conclusions about the importance central bank conservatism and independence.

[20] In another estimation we attempt to relax the assumption that deviations from the growth, inflation and net export targets weigh equally by adding a weighting parameter to the net export term in (8), this estimate does not converge.

Table 4. Open economy results, 1957-1998, 17 OECD countries
(*t*-ratios in parentheses)

	(m)	(n)	(o)	(p)	(q)	(r)	(s)
target restrictions	$\theta = 0$, $\hat{\pi}^{g\rho} = 0$, $\hat{\pi}^{v\rho} = 0$	$\theta = 0$, $\hat{\pi}^{g\rho} = 0$, $\hat{\pi}^{v\rho} = 0$	$\theta = 0$, $e = 0$	$\theta = 0$	$\hat{\pi}^{g\rho} = 0$, $\hat{\pi}^{v\rho} = 0$	$e = 0$	
expectations model	adaptive	rational	adaptive	adaptive	adaptive	adaptive	adaptive
Phillips curve slope	0.26	*divergent*	0.26	0.26	0.27	0.27	0.27
	(10.29)		(10.55)	(10.60)	(10.54)	(10.52)	(10.51)
government target	5.42		5.25	5.14	7.37	6.94	6.63
	(14.23)		(14.01)	(13.61)	(8.29)	(7.47)	(6.93)
central banker target					2.10	2.48	2.71
					(1.47)	(1.73)	(1.88)
government ideology			-4.42	-4.42		-4.40	-4.53
			(-2.17)	(-1.84)		(-1.46)	(-1.30)
median ideology				-10.85			-12.61
				(-2.30)			(-1.95)
domestic gap	-0.28		-0.29	-0.29	-0.28	-0.29	-0.29
	(-6.45)		(-6.61)	(-6.66)	(-6.45)	(-6.60)	(-6.43)
rest of world gap	0.31		0.32	0.32	0.31	0.32	0.32
	(3.96)		(4.06)	(4.08)	(4.00)	(3.97)	(3.81)
real exchange rate	-1.28		-1.23	-1.24	-1.30	-1.26	-1.26
	(-3.16)		(-3.04)	(-2.91)	(-3.20)	(-3.04)	(-3.06)
energy shock	0.20		0.19	0.18	0.19	0.18	0.18
	(1.15)		(1.08)	(1.05)	(1.10)	(1.07)	(1.04)
R^2 (inflation)	0.63		0.64	0.63	0.64	0.64	0.64
R^2 (growth)	0.28		0.28	0.29	0.28	0.29	0.29
R^2 (net exports)	0.02		0.02	0.02	0.02	0.02	0.02
observations	676		676	676	676	676	676
log likelihood	-4878		-4876	-4874	-4876	-4875	-4873

10. Conclusion

This paper extends a theory of political and macroeconomic interaction to the open economy, and tests its relevance to the macroeconomic history of the 18 OECD countries. The results are promising; this extension adds a tradeoff between growth and trade balances and two additional exogenous variables, the state of the world economy and the country's real exchange rate. Although our three-equation regression model explains only a small fraction of the variation in net exports, the open economy extension is interesting because it improves the fit of our growth equation.

All versions of the partisan business cycle model fits the data well, as long as we invoke an adaptive, rather than a rational, theory of expectations. Even with careful modeling, the strongly rational model of expectations does not improve on a VAR(1) benchmark; one rational specification does not even converge to a least square estimate.

Substantive conclusions are varied. For observations on the US, the government's ideology markedly affects outcomes, however, for other democracies the ideology of the median voter shows greater statistical association to outcomes than does that of the ruling coalition. There is also evidence that central bank independence with conservative governors have reduced the inherent inflationary bias.

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