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Some evidence on policy makers' motives, macroeconomic performance and output–inflation trade-offs

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This paper presents the results of an empirical study of the relationship between macroeconomic performance and policy makers' preferences for real output growth and inflation based on quarterly data from 16 countries. The empirical results indicate that a lower priority to inflation and a higher real output growth target lead to higher inflation and a less favourable real output–inflation trade-off, without affecting real output growth.

I. INTRODUCTION

This paper presents the results of an empirical study of the relationship between macroeconomic performance and policy makers' preferences for real output growth and inflation. The analysis is based on annual data from 16 OECD countries for the period 1965–1992. We address ourselves three questions: (i) what are the motives behind aggregate demand policy? (ii) do these motives affect macroeconomic performance? and (iii) do these motives affect real output–inflation trade-offs?

To answer these questions, a simple model of stabilization policy is advanced. In this model, the policy maker chooses nominal output so as to minimize a quadratic loss function, describing his preferences for real output growth and price stability, subject to economic constraints which are based on a short-run Phillips curve. From this optimization problem a reaction function is derived which contains information about both the policy makers' preferences and the economic constraints. To disentangle this information, the Phillips curve is first estimated, and then the reaction function is estimated, making use of the estimates of the Phillips curve. Finally, the correlations between the estimated values of the parameters in the loss function and inflation, real output growth, the variability of output growth and the real output–inflation trade-off are investigated.

The present paper is closely related to two strands in the macroeconomic literature. The first concerns studies of monetary policy games that use rational expectations models to show that policy makers' attempts to increase real output growth above natural real output growth leads to inflation without affecting real output (for a survey of this literature, see Persson and Tabellini, 1990). A well-known policy recommendation from this literature is that institutional reforms should be directed at changing the preferences of monetary authorities, for example, by delegating monetary policy to an independent inflation-averse central banker (Rogoff, 1985). Recently, Alesina and Summers (1993) have reported correlations between measures of central bank independence and macroeconomic performance that suggest that central bank independence indeed promotes price stability without having effects on real variables. Although informative and consistent with the recent literature, Alesina and Summers' empirical analysis does not show why countries with independent central banks have lower inflation. Is it because independent central banks have relatively modest real output growth targets or because they are relatively inflation averse? By examining the effects of the motives behind monetary policy on macroeconomic performance, we hope to shed light on this question.

The second strand in macroeconomic literature this paper is related to originated with the seminal paper by Lucas (1973) on output–inflation trade-offs. In that paper, Lucas reports a negative relation between how much of a nominal demand shock shows up in real output and the variability of nominal demand. He concludes that the output–inflation trade-off is favourable as long as it remains unused. This implies that aggregate demand policy is an important determinant of the slope of the Phillips curve. In this paper, we examine whether differences in the trade-offs between real

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output and inflation across countries can be explained by differences in the motives behind aggregate demand policy across countries.

The main results of the empirical analysis are:

(a) Both the motives behind aggregate demand policy and the real output and inflation trade-off vary substantially across countries.
(b) A higher real output growth target and a higher priority weight to the real output target relative to the inflation target increase inflation without significant effects on real output.
(c) The real output–inflation trade-off is sensitive to changes in policy rules. The trade-off between real output and inflation becomes less favourable as the real output target or the priority given to the real output target increases.

Overall, the empirical results are consistent with rational expectations models of monetary policy. Moreover, the results suggest that as to aggregate demand policy, the Lucas critique is quantitatively highly significant.

This paper is organized as follows. The following section presents the model. Section III reports the empirical results of the real-output–inflation trade-offs. In Section IV the estimated values of the parameters in the loss function are discussed. In Section V the relationships between the estimated values of the parameters in the loss function and macroeconomic performance are examined. Section VI concludes this paper.

II. THE MODEL

In this section, a simple framework of aggregate demand policy is presented. As with most policy models, the model consists of two parts, one describing the policy maker's objectives and one describing the economic constraints the policy maker faces. The model deals with stabilization policy. The policy maker is assumed to care about economic growth and inflation. His preferences are described by the following quadratic loss function:

$$L = \beta \cdot (\Delta y_t - \Delta y^d)^2 + \pi_t^2 \tag{1}$$

where Δy_t is the change in the log of real output, π_t is the inflation rate, t is a time index and Δy^d is the desired growth rate of real output. The parameter β denotes the weight the policy maker attributes to the output target relative to the inflation target. Equation 1 is common in theoretical studies on stabilization policy. It reflects the widespread view that the ultimate goals of stabilization policy are high economic growth and zero inflation. The quadratic specification is mainly adopted for mathematical convenience. From a quadratic loss function and linear constraints, linear reaction functions can be derived which can be estimated with conventional econometric techniques. An obvious drawback of the quadratic loss function is its symmetry, which imposes that policy makers attach equal costs to positive and negative deviations of real output growth from the desired output growth rate. It should be emphasized that the parameters in the loss function, β and Δy^d, should not be interpreted in isolation. For example, in most theories on stabilization policy an overly ambitious real output growth target, Δy^d, eventually leads to inflation. Thus a modest real output growth target may reflect that the policy maker cares much about inflation, even if β is relatively high.[1]

Economic policy is assumed to affect real output and inflation through its effect on aggregate nominal demand. To circumvent the specification of a model describing the links between instruments and ultimate targets, we assume that the policy maker partially controls nominal output.[2] Each period the policy maker plans to achieve a particular growth rate of nominal output, Δx_t^d. Actual nominal output growth, Δx_t, may differ from planned nominal output growth because of imperfect control:

$$\Delta x_t = \Delta x_t^d + \varepsilon_{xt} \qquad \varepsilon_{xt} = N(0, \sigma_x^2) \tag{2}$$

In principle, Δx_t^d can be interpreted as the intermediate target. First, the policy maker determines Δx_t^d and next he sets instruments to meet the intermediate target. In this setting, σ_x^2 is a measure of the policy maker's ability to control nominal output.

There remains the specification of the links between nominal output and the ultimate targets, real output growth and inflation. The economic constraints the policy maker faces are based on a short-run Phillips curve as proposed by Lucas (1973) and recently used by Ball *et al.* (1988) and Hibbs (1994):

$$y_t = \alpha_1 + \alpha_2 \cdot \text{time} + \alpha_3 \cdot y_{t-1} + \alpha_4 \cdot \Delta x_t + \alpha_5 \cdot lpm_{t-1} + \varepsilon_{yt} \tag{3}$$

Equation 3 relates the log of real output to a time trend, its own lag, the growth rate of nominal output and the lagged log of import prices. Since by definition

$$\pi_t = \Delta x_t - \Delta y_t$$

holds, the inflation rate can be written as

$$\pi_t = (1 - \alpha_4) \cdot \Delta x_t - c_t \quad \text{where } c_t = \alpha_1 + \alpha_2 \cdot \text{time} + (\alpha_3 - 1) \cdot y_{t-1} + \alpha_5 \cdot lpm_{t-1} + \varepsilon_{yt} \tag{4}$$

[1] The estimates of β and Δy^d presented in Section IV show that this seems to be the case in the UK. Although the estimate of β for the UK is one of the highest of the countries in our sample, the estimate of Δy^d is one of the lowest. Accordingly, the UK rapidly implements restrictive nominal demand policy when the economy is overheated, thereby preventing inflation.

[2] Following Lucas (1973), the aggregate demand curve is assumed to be unit elastic (see Arak, 1977 for a comment on this assumption).

Equations 3 and 4 determine how much of a unit change in nominal output shows up in output, α_4, and how much shows up in inflation $(1-\alpha_4)$. If $\alpha_4 = 0$, expansionary policy only leads to inflation. In contrast, if $\alpha_4 = 1$, a change in nominal output only affects real output. The economic model employed in this paper may disappoint economists who strongly believe that only unanticipated changes in nominal output affect real output. However, in the following section we will argue that replacing Δx_t with unanticipated changes in nominal output does not affect the main empirical results.

The optimization problem the policy maker faces is to minimize the expected loss with respect to Δx_t^d, subject to Equations 2, 3 and 4, yielding:

$$\Delta x_t = \frac{\beta \cdot \alpha_4 \cdot \Delta y^d + (1 - \alpha_4 - \beta \cdot \alpha_4) \cdot c_t^e}{\beta \cdot \alpha_4^2 + (1 - \alpha_4)^2} + \varepsilon_{xt} \qquad (5)$$

where $c_t^e = \alpha_1 + \alpha_2 \cdot \text{time} + (\alpha_3 - 1) \cdot E(y_{t-1}) + \alpha_5 \cdot lpm_{t-1} + E(\varepsilon_y)$ and E is the expectation operator.

It is assumed that supply shocks are observed with a lag, so that current supply shocks do not enter into the reaction function.[3] Equation 5 expresses policy maker's reactions to the desired growth rate of real output and c_t^e which captures the past development of real output growth.

In this paper we want to obtain estimated values of the parameters in the loss function. To this end, we follow the two-step estimation procedure proposed by Friedlaender (1973) and further developed by Swank and Swank (1993). We start with estimating the economic constraint 3. Using these estimates, we calculate c_t^e. Next we estimate the reaction function of nominal demand:

$$\Delta x_t = \zeta_1 + \zeta_2 \cdot c_t^e + \varepsilon_{xt}$$

Equation 5 contains two unknown parameters, β and Δy^d (α_4 results from the estimation of Equation 3). Using the estimates of ζ_1 and ζ_2, β and Δy^d can be calculated.

The estimates of Equations 3 and 5 yield the data for the cross-country analysis which is performed to examine the relationship between policy targets on the one hand and macroeconomic performance and the output–inflation trade-off on the other hand. The question arises whether our rudimentary model provides a good enough characterization of aggregate demand policy to base empirical research on. Aggregate demand policy consists of various determinants of which some are weakly, if at all, related to stabilization policy. It is worth noting that the parameters in the loss function are intended to reflect some basic characteristics of aggregate demand policy in terms of stabilization goals, rather than the 'real' preferences of a single policy maker. The estimates of the parameters in the loss function are simply those values that yield the best approximation of aggregate demand. This implies also that policies that affect nominal demand but are not implemented for stabilization purposes affect our estimates. We do not regard this as a shortcoming of the approach. If a country is unable to achieve stable real output growth with low inflation due to other policies, this should affect its characterization of aggregate demand policy. It is evident that the approach does not provide information about what causes our estimates of the parameters in the loss function. Past economic outcomes, policy maker's and voters' preferences, and political and monetary institutions are all likely to affect the motives behind stabilization policy.

From an econometric point of view, ignoring determinants of nominal demand leads to a misspecification of the reaction function. Accordingly, the estimates of the reaction function probably do not satisfy conventional statistical tests. In fact, the approach to characterize nominal demand policy is mechanical. The estimates do not refer to a behavioural model, but refer to a stabilization rule that best characterizes past stabilization policy.

III. ESTIMATING THE SHORT-RUN PHILLIPS CURVE

In Equation 5, α_4 and c_t^e represent the economic constraints. Ball *et al.* (1988) have recently presented estimated values of the trade-off parameter, α_4, for 43 countries. Two of their results are of direct relevance to the present study. First, their results show that the output–inflation trade-off varies substantially across countries. Second, their analysis indicates that the higher is the mean level of inflation in a country or for a specific period, the lower is the trade-off parameter, α_4. In an earlier study, Lucas (1973) argues that the trade-off parameter is negatively related to the variability of nominal demand, rather than the mean inflation rate. In Section V evidence is presented that α_4 is related both to mean inflation and the variability of nominal demand. At this stage of the research, it is important to recognize that aggregate demand policy may affect the output–inflation trade-off. Naturally, this makes it more difficult to obtain unbiased estimated values of α_4, in particular when policy maker's responses to the state of the economy have changed over time.

Table 1 summarizes the estimation results of the Phillips curve. The third column of Table 1 presents the estimated values of the trade-off parameter for 16 countries. The fourth column reports the corresponding standard errors. All estimates were obtained by ordinary least squares using annual data. To correct for autocorrelation, autoregressive terms were added. Table 1 shows that all estimated values of α_4 lie between 0 and 1 and are significantly different from

[3] Due to this assumption, Δx_t does not instantaneously react to supply shocks. As a consequence, in estimating the real output–inflation trade-offs, nominal output can be taken as an exogenous variable.

Table 1. *Estimates of the output–inflation trade-off for various countries*

Country	Sample period	Trade-off parameter	Standard error	Q(4)	ARCH(4)	Chow(78)
Australia	1965–1992	0.576	0.105	1.68	0.352	0.443
Austria	1965–1992	0.776	0.108	0.47	0.354	0.579
Canada	1965–1992	0.605	0.069	5.52	0.793	1.322
Finland	1965–1992	0.418	0.142	3.64	0.474	0.226
France	1965–1992	0.701	0.062	2.42	0.899	2.587
Germany	1965–1992	0.729	0.065	0.51	0.413	0.211
Italy	1965–1992	0.273	0.040	1.45	0.268	2.046
Japan	1965–1992	0.411	0.094	2.47	0.309	0.578
Netherlands	1965–1992	0.485	0.134	0.36	0.361	2.528
Norway	1965–1992	0.227	0.105	0.72	1.530	4.148
Portugal	1965–1992	0.449	0.105	1.56	16.350	2.389
Spain	1965–1992	0.384	0.146	0.43	0.139	0.400
Sweden	1965–1992	0.491	0.072	1.77	0.205	0.609
Switzerland	1965–1992	0.582	0.071	1.26	2.209	1.035
UK	1965–1992	0.290	0.092	3.26	3.698	1.828
US	1965–1992	0.646	0.070	0.74	0.091	0.281

All data used in the estimations are from IMF, International Financial Statistics. Depending on the country real output is real GDP or real GNP. Q(4) refers to Box–Pierce Q-statistic with four lags, ARCH(4) refers to the Arch test for heteroscedasticity with four lags and Chow(78) refers to the Chow-test for a break point in 1978. For most countries the statistics are satisfactory. Exceptions are Canada (autocorrelation), Norway (instability) and Portugal (strong heteroscedasticity).

Table 2. *Estimates of the parameters in the loss function (1965–1992)*

Country	Δy^d	Standard error	$1/\beta$	Standard error
Australia	0.083	0.008	0.842	0.237
Austria	0.078	0.009	3.438	0.799
Canada	0.065	0.011	0.819	0.261
Finland	0.071	0.015	0.303	0.124
France	0.053	0.008	0.717	0.240
Germany	0.066	0.013	2.541	0.880
Italy	0.141	0.029	0.372	0.015
Japan	0.096	0.009	0.819	0.052
Netherlands	0.071	0.008	1.293	0.139
Norway	0.067	0.019	0.151	0.085
Portugal	0.138	0.017	0.561	0.085
Spain	0.116	0.012	0.467	0.069
Sweden	0.095	0.006	0.934	0.088
Switzerland	0.063	0.007	1.844	0.286
UK	0.038	0.007	0.206	0.055
US	0.062	0.011	1.226	0.373

both 0 and 1. In line with the results reported by Ball *et al.* (1988) and Lucas (1973), α_4 appears to vary substantially across countries. In Austria, for example, almost 80% of a shock in nominal output shows up in real output. In contrast, in Italy and Norway a rise in nominal output shows up mainly in inflation.

Let me conclude this section by making some remarks about the specification of the short-run Phillips curve. In the recent literature on monetary policy games, the economic constraint the policy maker faces is usually specified in terms of policy surprises (Barro and Gordon, 1983). For example:

$$y_t = \alpha_1 + \alpha_2 \cdot \text{time} + \alpha_3 \cdot y_{t-1} + \alpha_4 \cdot [\Delta x_t - \Delta x_t^e] + \varepsilon_{yt} \quad (6)$$

where Δx_t^e denotes expected nominal output. If expectations are rational, Δx_t^e will be based on the reaction function adopted by the policy maker. Since in the present framework Δx_t is a linear function of c_t^e, Δx_t^e will also be a linear function of c. This implies that even if Equation 6 is the correct representation of the economy, estimation of Equation 3 will lead to an unbiased estimate for α_4. As a consequence, the estimated values of α_4 presented in Table 1 can be used in the following section, regardless of whether Equation 3 or Equation 6 is the correct specification of the Phillips curve.

IV. ESTIMATING THE REACTION FUNCTION

Now that we have estimated values of the trade-off parameter for the countries under consideration, we can proceed with estimating the parameters in the loss functions. To this end, we have substituted the estimated values of α_4 and the predicted values of c_t^e into Equation 5, so that the parameters β and Δy^d can be identified. Table 2 presents the estimation results. The reaction functions were estimated with non-linear least squares using quarterly data. With the exception of the estimate of β for Norway, all estimated

coefficients appear to be significant at conventional levels (1%).[4]

Overall, the estimates indicate that the motives behind aggregate demand policy vary substantially across countries. The highest desired growth rates of real output are found for Italy, Portugal and Spain. These countries aim at a real growth rate that is higher than 10%. The United States, France, Germany, Switzerland and the United Kingdom aim at a relatively moderate growth rate of real output. However, in all countries the desired growth rate of real output is higher than the mean real output growth rate (see the second column of Table 3). Furthermore, the estimation results indicate that Austria, Germany, the Netherlands, Switzerland and the United States attribute high priority to the inflation target (low β). In contrast, the South European countries, Finland and the United Kingdom give high priority to the output target. Basically, the estimated values of β and Δy^d are consistent with popular views on the reputation of central banks. The relatively small estimated values of Δy^d and β for Canada, Germany, the Netherlands and the United States confirm the conventional view that these countries have conservative banks. In contrast, for the southern European countries which are often said to have less conservative central banks relatively high values for Δy^d and β have been found.

Let us now elaborate upon the interpretation of the estimated values of the parameters in the loss function by addressing the question whether the estimated values of Δy^d and β provide information about the 'real' preferences of political authorities. There are at least three reasons why we are highly reluctant to answer this question in the affirmative.

The first reason is methodological. To determine policy maker's 'real' preferences from past behaviour, the economic constraints in the optimization model should reflect the policy maker's perception of the working of the economy, rather than the actual working of the economy. Thus if a policy maker has based policy on the wrong model, that model should still be used to estimate Δy^d and β. Hence, even if the estimated values of α_4 are 'correct' they might be improper devices to determine policy maker's real preferences.

Secondly, the literature on monetary policy games shows that monetary policy may be subject to a time consistency problem, in the sense that policy maker's incentives to create policy surprises may lead to an inflationary bias. Political authorities may reduce the time consistency problem by delegating monetary policy to an inflation-averse central banker (cf. Rogoff, 1985). Alternatively, the policy maker may purchase the reputation of an inflation averse country by pegging the exchange rate to the currency of that country (cf. Giavazzi and Pagano, 1988). The basic idea behind both strategies is that the incentives to create policy surprises are reduced by changing the motives behind monetary policy. It is evident that if one of both strategies is followed, monetary policy does not contain information about the real preferences of the political authorities.

Thirdly, as discussed in Section II policy makers may affect nominal demand for other purposes than stabilization policy.

The points discussed above highlight some problems as to the determination of 'real' or 'social' preferences. There are a number of reasons why *revealed* preferences may deviate from *real* preferences. This implies that the estimated loss functions are probably improper means to welfare analysis. At most, the estimated values of the parameters in the loss function can be interpreted as 'operational' preferences in the context of a specific optimization problem. A policy maker's choice of an economic model to base policy on or his decision to peg the exchange rate to a foreign currency affects stabilization policy. In the above analysis, all these decisions are reflected by the parameters in the loss function. Thus, the estimated values of the parameters in the loss function can best be interpreted as a mix of policy maker's real preferences and his decisions about the monetary policy regime.

V. POLICY MAKERS' PREFERENCES AND ECONOMIC PERFORMANCE

As discussed in the introduction, several authors have stressed the importance of the motives behind monetary policy for economic performance. In this section, we examine whether across countries a correlation can be found between the estimated values of the parameters in the loss function and inflation, real output growth and the variance of real output growth. Furthermore, we examine the relationship between the estimated values of the output–inflation trade-off and the estimated values of the parameters in the loss function. All correlations are based on the estimates presented in Tables 1 and 2 and realized economic outcomes presented in Table 3.

As discussed in Section II, the estimated values of the parameters in the loss function contain little information separately, but together they may provide a characterization of stabilization policy. As an indicator of countries' attitude towards inflation we use as an indicator:

$$pref = 1/\beta(\Delta y^d - \Delta y^m)$$

where Δy^m is the mean real output growth rate (first column of Table 3). For all countries the values of *pref* are reported in the last column of Table 3.

[4] As discussed in Section II, test-statistics do not provide much information about the characteristics of stabilization policy. From this point of view, the fact that the estimates are significant is of minor importance.

Table 3. *Inflation and real output growth in various countries (1965–1992)*

Country	Mean real output growth rate	Standard deviation real output growth rate	Mean inflation rate	Standard deviation inflation rate	*pref*
Australia	0.035	0.021	0.072	0.037	0.057
Austria	0.031	0.019	0.047	0.018	0.014
Canada	0.036	0.025	0.056	0.030	0.035
Finland	0.036	0.024	0.084	0.038	0.115
France	0.033	0.018	0.066	0.033	0.028
Germany	0.028	0.022	0.040	0.016	0.015
Italy	0.034	0.024	0.099	0.054	0.029
Japan	0.053	0.030	0.045	0.038	0.052
Netherlands	0.032	0.025	0.047	0.034	0.030
Norway	0.035	0.019	0.062	0.036	0.212
Portugal	0.037	0.034	0.145	0.056	0.180
Spain	0.037	0.025	0.102	0.043	0.169
Sweden	0.022	0.019	0.073	0.027	0.078
Switzerland	0.021	0.025	0.043	0.022	0.023
UK	0.021	0.023	0.082	0.049	0.082
US	0.027	0.023	0.053	0.021	0.029

Except for *pref*, all calculations are based on annual data from IMF, International Financial Statistics. $pref = (1/\beta)$ (Δy^d-value in first column of Table 3) and is used in the cross-country analysis.

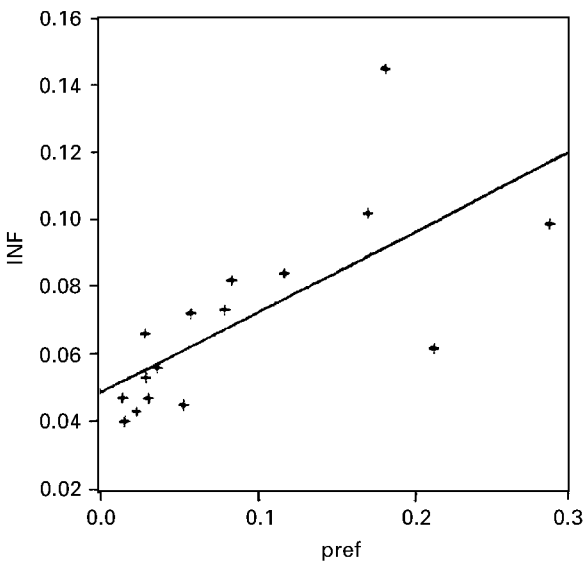

Fig. 1. *Inflation and pref.*

$$\pi^m = \underset{(0.049)}{0.239}\,pref + \underset{(0.008)}{0.049} \qquad R^2 = 0.499$$

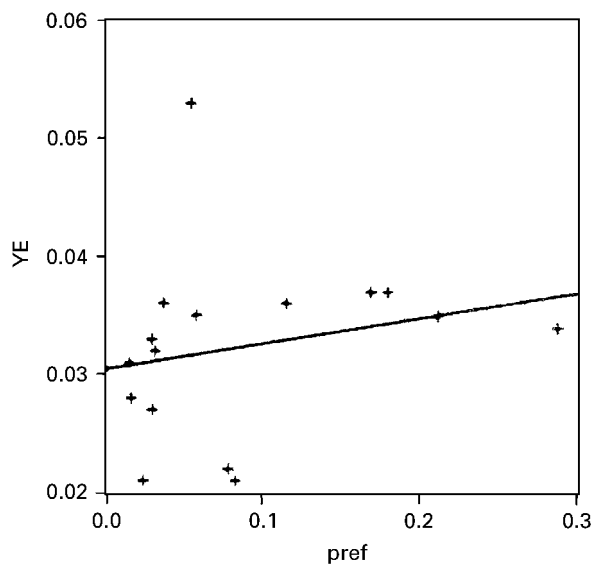

Fig. 2. *Real output growth and pref.*

$$\Delta y^m = \underset{(0.025)}{0.021}\,pref + \underset{(0.003)}{0.030} \qquad R^2 = 0.050$$

Figure 1 presents the scatterplot of the mean level of inflation, π^m, against *pref*. Figure 1 displays a clear relationship between *pref* and mean inflation. The slope of the regression line indicates that a rise in *pref* of one percentage point results in a rise in mean inflation of about 0.24. Exclusion of the two main outlayers from the sample, Spain and Portugal, does not affect the qualitative nature of this result.

Figure 2 shows the correlation between mean real output growth, Δy^m, and the indicator *pref*. The scatterplot does not reveal a clear relationship between the two variables. The regression below Fig. 2 confirms this. This finding is in line with the widespread notion that aggregate demand policy cannot permanently increase real output growth. Figure 3 repeats the analysis for the variability of real output growth and *pref*. Again no relationship is found.

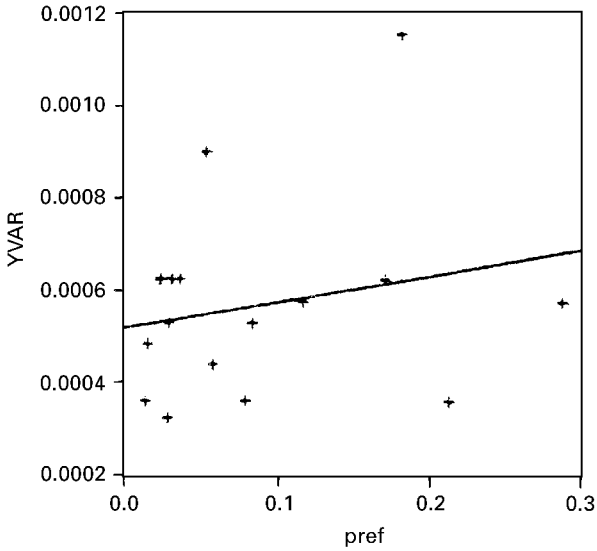

Fig. 3. *Output variability and pref.*

$$y^{\text{var}} = \underset{(0.067)}{0.057}\,pref + \underset{(0.008)}{0.052}$$

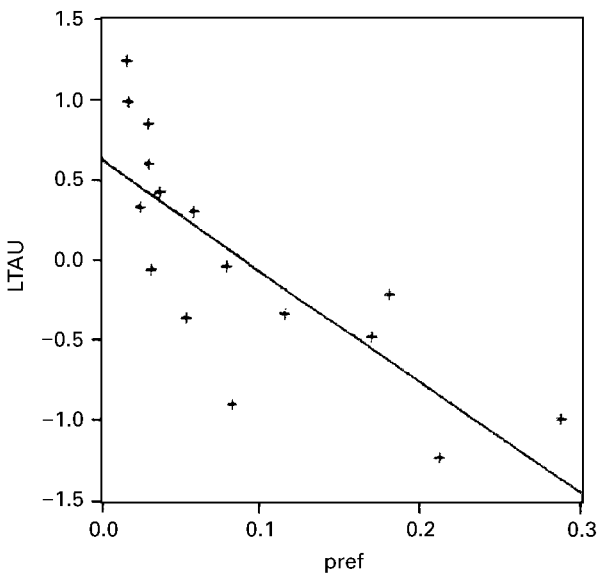

Fig. 4. *Output–inflation trade-off and pref.*

$$L\alpha_4 = \underset{(1.448)}{-\,6.853}\,pref + \underset{(0.172)}{0.615}$$

Finally, Fig. 4 displays the relationship between the trade-off parameter and *pref*. Since the trade-off parameter must lie between zero and one, the effect of *pref* on the trade-off parameter will be marginal if the trade-off parameter is near its boundaries. For this reason, we have used $L\alpha_4 = \log(\alpha_4/(1-\alpha_4))$ to examine the relationship between *pref* and the trade-off parameter. Figure 4 shows a strong relationship between the trade-off parameter and *pref*. The relationship between $L\alpha_4$ and the estimates of the parameters in the loss function becomes even clearer when $L\alpha_4$ is regressed on $(1/\beta)$ and Δy^d.

$$L\alpha_4 = \underset{(0.052)}{-\,0.346(1/\beta)} - \underset{(3.141)}{9.807}\Delta y^d + \underset{(0.297)}{1.466} \qquad R^2 = 0.792$$

The above estimation results suggest that policy makers who attribute high priority to the output target relative to the inflation target tend to face a relatively steep Phillips curve. This result confirms the implication of the Lucas model that the trade-off parameter between real output and inflation is favourable as long as it remains unused. In addition, $L\alpha_4$ and Δy^d are negatively related. The higher is the real output growth target, the less a shock in nominal demand shows up in real output. Since high values of Δy^d and β lead to high inflation (Fig. 1) the relation displayed the above regression confirms Ball *et al.*'s result that mean inflation is an important determinant of the output–inflation trade-off. These results show that as to aggregate demand policy the Lucas critique is highly relevant in the sense that the real output–inflation trade-off is not invariant to the policy rule adopted by the policy maker.

Overall, the conclusions emerging from Figs 1–4 are in accordance with rational expectation models of monetary policy that predict that policy makers' attempts to raise real output above its natural level lead to excessive inflation without affecting real output. In particular, countries with high desired growth rates of real output and attributing low priority to fighting inflation experience high inflation rates.

VI. CONCLUDING REMARKS

The results presented in this paper suggest that policy makers' preferences for real output growth and inflation affect macroeconomic performance as predicted by rational expectations models of monetary policy. Furthermore, as to aggregate demand policy the Lucas critique appears to be important in the sense that the trade-off between real output and inflation is related to the policy rule followed by the policy maker. Overall, the results indicate that institutional reforms directed at changing policy makers' incentives might be welfare improving, in particular when those reforms lead to less ambitious real output growth targets. In developing monetary institutions, attention should be paid to the effects of monetary policy regimes on the slope of the Phillips curve.

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REFERENCES

Alesina, A. and Summers, L. H. (1993) Central bank independence and macroeconomic performance: some comparative evidence, *Journal of Money, Credit and Banking*, **25**, 151–62.

Arak, M. (1977) Some international evidence on output-inflation tradeoffs: comment, *American Economic Review*, **67**, 728–30.

Ball, L. N., Mankiw, G. and Romer, D. (1988) The new Keynesian economics and the output-inflation trade-off, *Brookings Papers on Economic Activity*, **1**, 1–65.

Barro, R. J. and Gordon, D. B. (1983) Rules, discretion, and reputation in a model of monetary policy, *Journal of Monetary Economics*, **17**, 3–20.

Friedlaender, A. F. (1973) Macro policy goals in the postwar period: a study in revealed preferences, *Quarterly Journal of Economics*, **87**, 25–43.

Giavazzi, F. and Pagano, M. (1988) The advantage of tying one's hands, *European Economic Review*, **32**, 1055–82.

Hibbs, D. A. (1994) The Partisan model of macroeconomic cycles: more theory and evidence for the United States, *Economics and Politics*, **6**, 1–23.

Lucas, R. E. (1973) Some international evidence on output–inflation tradeoffs, *American Economic Review*, **63**, 326–34.

Persson, T. and Tabellini, G. (1990) *Macroeconomic Policy, Credibility and Politics* (Hardwood Academic Publishers, Chur.).

Rogoff, K. (1985) The optimal degree of commitment to an intermediate monetary target, *Quarterly Journal of Economics*, **100**, 1169–90.

Swank, O. H. and Swank, J. (1993) In search of the motives behind US fiscal policy, *Applied Economics*, **25**, 1013–22.