How the P* Model Rationalises Monetary Targeting - A Comment on Svensson[#]

by

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Abstract

In this comment, we answer the question posed in Svensson's (2000) paper "Does the P model provide any rationale for monetary targeting?" – in contrast to him – in the affirmative. We argue that a strategy of monetary targeting can be rationalised within the P* framework. Furthermore, we demonstrate that money growth targeting is a special form of inflation forecast targeting based on a 'limited' information set. In contrast to 'full information' inflation forecast targeting, monetary growth targeting is likely to be more robust under changing conditions of the real world.*

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1. Introduction

The P* model may fail to provide a rationale for monetary targeting, both on theoretical or empirical grounds. But Svensson's (2000) paper is neither theoretical nor empirical, it is purely "algebraical". He neither questions the theoretical foundation of the P* model nor its empirical relevance.[1] Rather, he argues along the line: Assume the P* model is valid; show that monetary targeting is different from inflation forecast targeting; conclude that the P* model provides no rationale for monetary targeting. We question this logic and explain how monetary targeting can be rationalised within the P* framework.

2. P* as a rationale for monetary growth targeting

The P* model has two building blocks: (1) a stable and controllable long-run money demand function, and (2) inflation dynamics driven by the price gap rather than the output gap alone.[2] The P* model may be summarised by Svensson's equations 2.3, 5.2 and 5.3 (all variables except the interest rate are in logs):

$$\pi_t = (1-\alpha_{\Delta p})\pi_{t-1} + \alpha_{\Delta p}\Delta p^*_{t-1} - \alpha_p(p_{t-1} - p^*_{t-1}) + \varepsilon_t \quad (2.3)$$

$$m_t - p_t = \kappa_y\, y_t - \kappa_i\, i_t + u_t \quad (5.2)$$

$$p^*_t = m_t - \kappa_y\, y^*_t + \kappa_i\, i^* \quad (5.3)$$

Equation (2.3) is a Phillips-type relationship for inflation dynamics in the error correction form, driven by the price gap which is decomposable into the output gap and the velocity gap.[3] The inflation rate is given by $\pi_t = p_t - p_{t-1}$ and p* is the long-run equilibrium level of prices. Equation (5.2) is a long-run money demand function depending on a transactions variable y_t and a short-term interest rate i_t.[4] Moreover, we have added a residual term u_t to capture all deviations of money demand from its

[1] In a further paper Rudebusch and Svensson (2000) try to show that a Eurosystem style of monetary targeting fails empirically. But the estimated model is not the P* model and, as the subtitle of the paper ("… *Lessons from US Data*") already demonstrates, this exercise has little explanatory power for the Euro area.

[2] Both relationships have been tested extensively; see Tödter and Reimers (1994), Issing and Tödter (1995), Groeneveld (1998), Scharnagl (1998), Wesche (1998) and Orphanides and Porter (2000). Using Euro-wide data, Gerlach and Svensson (1999) find that *„the price gap ... has substantial predictive power for future inflation, and more so than the output gap."*

[3] On p. 70f. Svensson rewrites (2.3) to incorporate the real money gap instead of the price gap (p-p*). The real money gap is (m-p) – (m-p*) = p*-p, i.e. it is the negative of the price gap. The usefulness of the creation of a 'real money gap' is not clear as 'm' could be replaced by any other variable without changing the economic content.

[4] It would be better to use an opportunity cost variable which takes into account interest bearing components of a broad monetary aggregate like M3. But then Svensson's analysis becomes even more complicated as the instrument of monetary policy and the opportunity cost variable differ from each other.

long-run (equilibrium) level. Equation (5.3) defines the equilibrium price level (p*) as a function of potential output (y*) and the equilibrium short-term interest rate (i*). This equation can be derived by inverting (5.2) and replacing output, the interest rate, and the residual by their equilibrium values ($y_t = y_t^*; i_t = i^*; u_t = 0$).The long-run or equilibrium rate of inflation implied by the model is

(1) $$\Delta p_t^* = \Delta m_t - \kappa_y \Delta y_t^*$$

Hence, the equilibrium rate of inflation is the difference between the rate of monetary growth and the rate of potential output growth. If the income elasticity of money demand (κ_y) differs from unity, equation (1) accounts for a trend in the velocity of circulation of money. Replacing in (1) the equilibrium rate of inflation by the inflation target ($\hat{\pi}$), the income elasticity and potential output growth by their current estimates and forecasts, respectively, we obtain an expression for the monetary target for period t+1:

(2) $$\Delta m_{t+1/t}^* = \hat{\pi} + \hat{\kappa}_y \Delta y_{t+1/t}^*$$

Subtracting (2) from (1) and ignoring errors in estimating κ_y and predicting potential output growth Δy_{t+1}^*, both of which are likely to be small, we get

(3) $$\Delta m_t - \Delta m_{t+1/t}^* = \Delta p_t^* - \hat{\pi}$$

Hence, monetary growth targeting is a special form of inflation forecast targeting where the equilibrium rate of inflation Δp^* serves as a predictor of inflation. Since this predictor does not incorporate any dynamics, it is not statistically efficient. However, it is likely to be more robust than the inflation forecast $\pi_{t+1/t}$ advocated by Svensson, which is conditional on all information available in period t and on the assumption of unchanged interest rates.

Now assume that monetary policy may be captured by a reaction function for the short-term interest rate. If monetary policy succeeds in bringing monetary growth in line with the monetary target ($\Delta m_t = \Delta m_{t+1/t}^*$), equation (3) shows that the equilibrium rate of inflation is equal to the inflation target ($\Delta p_t^* = \hat{\pi}$). Market forces operating behind the Phillips-curve then tend to eliminate any price gap inherited from the past. Hence, actual inflation converges to the target rate of inflation ($\pi_t = \hat{\pi}$). This strategy relies on a 'limited' information set which does not incorporate any knowledge concerning the dynamics of money demand, of the Phillips-curve,

and of the reaction function of the central bank. In contrast, inflation forecast targeting is based on a 'full' information set, which includes all currently available information evaluated under the assumption that the P* model – including its short run dynamics – correctly represents the economy.

The central bank faces a trade off between efficiency and robustness. Inflation forecast targeting as suggested by Svensson is an efficient strategy but requires a much wider information set than monetary growth targeting. If this information is incomplete (as it is in the real world), inflation forecast targeting ceases to be optimal. Specifically, given the notorious 'long and variable' lags of monetary policy, such a strategy is likely to be based on a mis-specified model. In contrast, a strategy that relies on the rate of money growth as an intermediate target requires information on long-run or equilibrium relationships only. Such information is more easily obtained from economic theory and empirical data and far more reliable. As long as a stable and controllable long-run money demand relationship holds, the liquidity gap serves as a useful indicator for inflationary pressures besides the output gap.[5] Market forces acting behind the Phillips curve then do the rest.

Thus, the P* model provides a sound rationale for monetary targeting. Such an intermediate target strategy is not optimal in the sense of optimal control theory. But control theory is optimal only in idiosyncratic circumstances. Squeezing all the information possible out of the economic model is a mixed blessing.[6] In contrast, monetary targeting is feasible on the basis of a significantly less demanding information set. The monetary targeting strategy of the Bundesbank surely was pragmatic.[7] It did not aim for optimality within the narrow framework of a specific model. Rather, it was directed at good performance under a wide variety of circumstances, coping with the changing conditions of the real world. But monetary developments always served as a firm anchor within this framework. And the Bundesbank treated the intermediate money growth target as what it should be: a means to finally achieve price stability.

3. What Svensson demonstrates

Svensson starts with the quantity equation from which he defines the equilibrium price level. The Phillips relationship for inflation dynamics (2.3) completes what he summarises as the P* model. However, this model is not yet operational as

[5] This conclusion also shows that the statement of Svensson (2000) on p. 72 that "*the money stock in the P* model is broad money*" is not generally valid. It depends on the characteristics of the monetary aggregate. The stability of Euro-M3 was shown, inter alia, by Brand and Cassola (2000).

[6] Tetlow and von zur Muehlen (2001) examine the friction between simplicity and optimality in the design of monetary policy rules when agents have to learn the preferences of policymakers.

[7] And so is the two pillar strategy of the Eurosystem with the reference value for M3 and a broadly based assessment of inflationary pressures in the euro area.

equilibrium velocity (v_t^*) needs to be pinned down. For this purpose Svensson formulates a standard dynamic money demand function of the error correction type whose long-run solution is given by equation (5.2).[8]

Svensson then proceeds under the assumption of 'strict' inflation targeting. The central bank's objective is to stabilise inflation around the inflation target. Given the assumed timing of the Phillips-curve relationship, the optimal policy is to set the interest rate such that the two-period-ahead inflation forecast equals the inflation target. He then obtains his formula (6.5) which he labelled a *"conditional nominal money-growth target that is consistent with strict inflation targeting"* (p. 74). This is contrasted with the Bundesbank money-growth target, or the Eurosystem reference value for money growth, which he calls an 'unconditional' money-growth target (see our equation 2). Svensson demonstrates in his equation (6.8) that both are not identical. Because the deviation between the inflation forecast and the inflation target ($\pi_{t+2/t} - \hat{\pi}$) is not solely a function of the money-growth indicator ($\Delta m_t - \Delta m^*_{t/t-1}$), he *rightly* concludes that the money-growth indicator *"disregards the other determinants of the inflation forecast in (6.8)"* (p. 76). In a similar way Svensson shows that the reaction function under strict money-growth targeting is not identical to that under strict inflation targeting.

Hence, given the P* model, Svensson demonstrates that monetary growth targeting is a special case of - but in general different from - inflation forecast targeting. However, these differences do not justify the conclusion that *"the P* model does not provide any rationale for targeting a Bundesbank-style nominal money-growth target"* nor *"... give any rationale for the Eurosystem-style money-growth indicator either."* (p. 77). According to this logic, the P* model would only qualify as a rationale for monetary-growth targeting if it yielded identical results to inflation forecast targeting.

Moreover, inflation forecast targeting under constant interest rates (CIR-targeting) itself has some less attractive features, as was recently pointed out by Leitemo (2000). First, there is a time-inconsistency problem because a non-valid assumption of a constant interest rate in the forecast horizon is used. *"This may seriously distort the information content of the forecast as well as the credibility of the inflation targeting central bank that publishes them, leading agents to base their inflation expectations on other sources of information."* (Leitemo, 2000, p. 32). Moreover, in an open-economy context the exchange rate channel may distort the appeal of CIR-targeting even further. CIR-targeting may *"contribute to explaining the high degree of*

[8] The interest rate (i*) is expressed as the sum of two constants: the long-run equilibrium real interest rate and an expected inflation term which is the inflation target. Hence, Svensson assumes full credibility of the announced targets.

persistent real exchange rate movement that the UK has experienced in the second part of the 1990s. The high variability in Swedish CPI inflation and, somewhat less pronunciated, in the Swedish real exchange rate, may also partly be a result of the CIR-targeting policy." (p. 33).

4. Conclusions

The P* model has two essential building blocks: a stable and controllable long-run money-demand function and inflation dynamics driven by the price gap. Empirically, both relationships have withstood many empirical tests. We have shown that the P* model provides a sound rationale for monetary growth targeting as a strategy for controlling inflation over the medium term. Given the P* model, Svensson (2000) has demonstrated that inflation forecast targeting is different from monetary targeting, requires a significantly wider information set, and quickly becomes analytically intractable, even within a simple model. Commitment to complex rules is difficult and agents are not able to distinguish between rule-driven reactions and pure discretion. Relying on a Bundesbank-style monetary growth indicator as part of its monetary policy strategy, the Eurosystem is likely to serve its final goal of price stability. A distinction should be made between this final goal and intermediate targets such as money growth targets. The latter are only means to achieve the first.

References

Brand, C. and N. Cassola (2000), 'A Money Demand System for Euro Area M3', *ECB Working paper* No. 39, November 2000.

Gerlach, S. and L.E.O. Svensson (1999), 'Inflation and Money in the Euro Area: A Case for Monetary Indicators?', Working Paper.

Groeneveld, J.M. (1998), *Inflation Patterns and Monetary Policy – Lessons for the European Central Bank*, Edward Elgar, Cheltenham and Northampton.

Issing, O. and K.-H. Tödter (1995), 'Geldmenge und Preise im vereinigten Deutschland', in: D. Duwendag (ed.), *Neuere Entwicklungen in der Geldtheorie und Währungspolitik*, Duncker & Humblot, Berlin.

Leitemo, K. (2000), 'Open-Economy Inflation Forecast Targeting', *Norges Bank, Arbeidsnotat* 2000/2.

Orphanides, A. and R.D. Porter (2000), 'P* Revisited: Money-Based Inflation Forecasts with a Changing Equilibrium Velocity', *Journal of Economics and Business* 52, 87-100.

Rudebusch, G. and L.E.O. Svensson (2000), 'Eurosystem Monetary Targeting: Lessons from US Data', *CEPR Disussion paper* No. 2522, May 2000.

Scharnagl, M. (1998), 'The Stability of German Money Demand: No Just a Myth', *Empirical Economics* 23,355-370.

Svensson, L.E.O. (2000), 'Does the P* Model Provide Any Rationale for Monetary Targeting?', *German Economic Review* 1, 69-81.

Tetlow, R.J. and P. von zur Muehlen (2001): 'Simplicity versus Optimality: The Choice of Monetary Policy Rules when Agents must Learn', *Journal of Economic Dynamics & Control* 25, 245-279.

Tödter, K.-H. and H.-E. Reimers (1994), 'P-Star as a Link between Money and Prices in Germany', *Weltwirtschaftliches Archiv* 130, 273-289.

Wesche, K. (1998), *Die Geldnachfrage in Europa*, Physica-Verlag, Heidelberg.