Discussion

of

"Measuring the Natural Output Level by DSGE Models: An Empirical Investigation for Switzerland" by Stefan Leist and Klaus Neusser

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The natural level of output[1] is a concept of paramount importance for monetary policymakers. Besides ensuring zero[2] inflation, it is the best allocation[3] that stabilization policy can achieve (Goodfriend and King, 2001; Woodford, 2003) and thus a natural benchmark for central banks.

Yet, the natural level of output cannot be observed. Identifying and estimating it is a difficult endeavor that requires a general equilibrium model of the economy.[4] This paper makes a first serious attempt at conducting such an exercise for Switzerland and should be praised for that.

However – and despite the use of state of the art econometrics – I argue that the failure of the model to explain variations in domestic inflation casts some doubts on its ability to really identify and estimate natural output in Switzerland.

A Closer Look at the Results

The authors' model-based estimation of the natural level of output results in a measure of the output gap that is at odds with traditional (HP) filtered measures. As shown in Figure 3(a) of the paper, the Swiss natural output gap does not seem to fluctuate at all, meaning that the level of output corresponds, by and large, to the natural level of output over the estimation period.

Although this result could be interpreted as a confirmation that monetary policy in Switzerland was conducted optimally during this period[5], some caution is warranted.

1 Defined as the level of output that prevails under imperfect competition in the absence of price and wage rigidities.

2 More precisely, it ensures constant inflation at the pre-specified steady-state value, which can be different from zero in certain applications.

3 At least within a New-Keynesian environment, which is the framework chosen by the authors.

4 With the obvious caveat that the estimates will depend strongly on the model specification.

 2010, Vol. 146 (1) 305–311

If the estimated natural output gap (LN) is to be considered a preferable measure of slack in the economy, it must be the case that it improves upon filtered alternatives (Hodrick-Prescott (HP), multivariate HP (MHP), linear detrending (LT), production function (PF)) when it comes to explaining domestic inflation. This must be true, at least, within the model environment. Solving forward[6] the NKPC (equation (3.3) in the paper) yields:

$$\pi_{H,t} = \frac{\kappa}{\tau + \lambda} E_t \sum_{j=0}^{\infty} (\gamma_f)^j x_{t+j}, \tag{1}$$

which shows that fundamental[7] domestic inflation is a function of current and future output gaps. Figure 1 compares fundamental domestic inflation rates – obtained using alternative measures of the output gap – to actual domestic inflation data. The contrast between the rate of inflation implied by the natural output gap and by more traditional filtered methods is striking.[8]

The bold red line is the historical quarterly domestic inflation rate, the bold green line represents the fundamental inflation rate based on the natural output gap (LN) and the thin lines represent the fundamental inflation rates based on the more traditional filtered methods. Although low during most of the period, domestic inflation still displays very clear cycles and even – on two occasions, in 2000 and 2008 – crosses the 2% (in annualized terms) threshold.[9] Surprisingly maybe, and despite the ad hoc nature of their detrending procedure, traditional measures of the output gap give rise to estimates of domestic inflation that are more or less in line with actual inflation, whereas the authors' computed natural output gap is clearly off the mark, predicting constant inflation of 1% over the whole period. How can we explain such a surprising result? In my view, there are two issues, mainly, related to the model specification and the estimation strategy, that I will address in turns in the next two paragraphs.

5 Of course, an alternative interpretation is that the shocks have been particularly small since 1996.

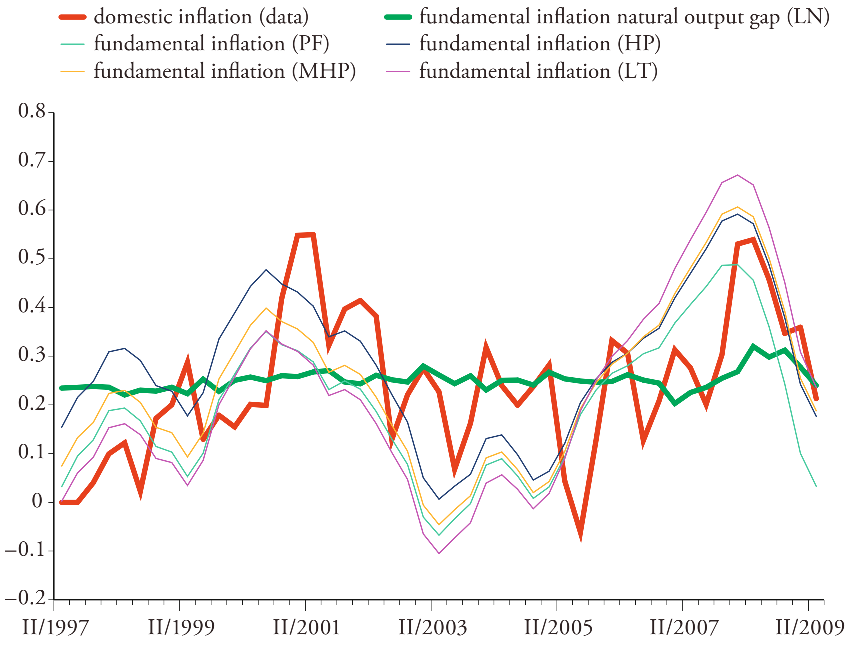
6 By assuming no indexation, like the authors do.

7 The term "fundamental inflation" was coined by J. Galí and relates to the isomorphic formula used to compute the fundamental value of an asset based on its future discounted returns.

8 Note that the fundamental domestic inflation rate is computed by using, in each case, equation (1), the authors' estimates of κ, τ, λ and γ_f and by assuming the same AR(1) process for all output gaps, natural and filtered alike.

9 It is worth mentioning here that the SNB defines price stability in terms of yearly CPI inflation below 2%, and not in terms of quarterly domestic inflation, as depicted here to comply with the model definition of inflation.

Figure 1: Quarterly Domestic Inflation Rates, as Implied by Natural or Filtered Output Gaps



Issue #1: Model Specification

My first concern is that the model may be too simple to be considered a realistic model of an open economy. Especially if it is to be taken to the Swiss data. The authors assume complete markets, perfect risk-sharing, the law of one price between foreign and domestic goods and a unique, worldwide productivity trend, which allows them to derive a very simple and elegant expression for the natural level of output, deemed proportional and negatively correlated to world output (as implied by equation (3.5)).[10]

10 Previous experiments with DSGE-CH, a dsge model of the Swiss economy developed at the SNB, have shown that i) local currency pricing in export and import markets, ii) real wage rigidity and iii) the incorporation of oil as an input to production and consumption are crucial features of a model able to replicate the dynamics of output and inflation in Switzerland.

But perfect risk sharing also implies that current accounts must be zero at all times, which stands in stark contrast with Switzerland's experience over the last fifteen years, when current account surpluses have kept increasing to reach exceptional levels by international standards. Moreover, trend productivity is lower in Switzerland than in the rest of the world, a characteristic that is partly reflected in lower real interest rates. Finally, ample empirical evidence as shown that the law of one price does not hold in the short run.

In order to get reasonable parameter estimates despite the simplicity of the model, something has to give. The authors chose to treat foreign variables as unobserved states, estimated with a Kalman filter. I argue below that this approach has important drawbacks in the present context as important information to the identification and estimation of natural output is ignored.

An obvious alternative is to relax the simplifying assumptions. Clearly, this would complicate the analysis. Natural output would still be a function of foreign output, but also of domestic productivity, the real exchange rate and Switzerland's net foreign asset position. In addition, a closed form solution for the natural level of output would no longer be available. But this extra complexity would allow to loosen the straightjacket that the present version of the model imposes on the data and to use a larger information set to help identifying and estimating natural output.

Issue #2: Estimation Strategy

The authors rely on five quarterly time series (CPI inflation, 3M Libor, changes in the terms of trade, Swiss real GDP growth (ΔGDP), change in nominal exchange rate) over the period 1997:2–2009:2 to estimate the model parameters and to filter out Switzerland's natural output gap, foreign output (y^*) and inflation, as well as the common worldwide technological stochastic trend (z) using the Kalman filter.

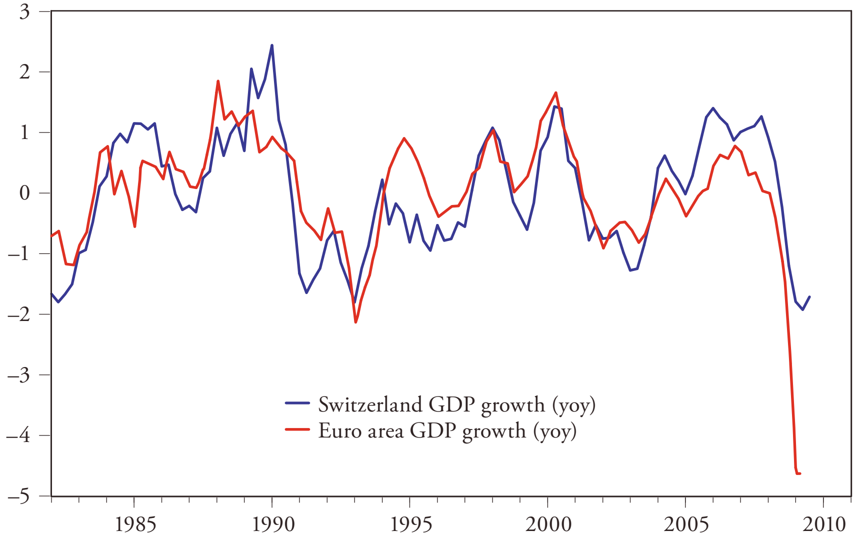
This is a lot of information to be extracted from only five observable time series! In particular, the state-space representation of the model shows that ΔGDP is related to two AR(1) processes for y^* and z, both of which are treated as unobservable. The difficulty is that in the absence of more structural differentiation, the Kalman filter is not able to separately estimate the variance and persistence of these two processes, thus leaving them unidentified.[11] This in turn affects the

11 See HAMILTON (1994), chapter 13, for a description of the identification problem with the Kalman filter.

estimation of the natural output gap since the natural level of output is a negative, linear function of y^* in the model.

Some reverse engineering can illustrate the extent of the problem. If the output gap was closed during the whole period, as estimated by the authors, this would imply that Swiss real GDP was also negatively correlated with foreign output (as imposed by equation (3.5)), a pattern clearly at odds with actual data[12], as Figure 2 shows.

Figure 2 : Swiss and Foreign GDP Growth



Artificially increasing the number of unobserved state variables, as is done in this paper, relaxes the (too restrictive) constraints imposed by the model on the data but at the risk of compromising its ability to identify the *truly unobservable* natural output gap. I would therefore encourage the authors to at least use available information on y^* when estimating the model. More generally, they should make

12 Most of Switzerland's trade is conducted with the Euro area. Using OECD GDP instead would not alter the message.

use of all available information on foreign and domestic variables[13], or show that the model – if it is to be trusted as a reliable model of the Swiss economy – is able to capture reasonably well the dynamic behavior of these series.

Is Closing the Natural Output Gap Always Optimal ?

The natural level of output is an important benchmark for monetary policy. However, as some recent papers have shown, closing the natural output gap by aiming at zero inflation in all periods may not be the optimal stabilization policy if, for instance, the cyclical fluctuations are due to markup or distortionary tax shocks (WOODFORD, 2003), if oil price shocks interact with real rigidities (BLANCHARD and GALÍ, 2007), or if they lead to time-varying cost shares (NATAL, 2009).

In these cases a monetary policy trade-off arises so that perfectly stabilizing inflation (however defined) may turn out to be quite costly. How costly will depend on the type and the size of the shocks hitting the economy, on the differences between the responses of natural and efficient[14] output and on the welfare cost of inflation.

Whether or not a closed natural output gap is the best allocation possible in Switzerland is thus an empirical question that can only be answered by estimating a micro-founded model of the Swiss economy. It is a challenging endeavor and this paper is a welcome first step in that direction.

Literature

BLANCHARD, OLIVIER J., and JORDI GALÍ (2007), "Real Wage Rigidities and the New Keynesian Model", *Journal of Money, Credit and Banking, Blackwell Publishing*, 39 (1), pp. 35–65.

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13 The authors mention their reluctance to add measurement errors to the model. I would argue that allowing for different productivity trends and markup shocks in foreign and domestic economy would go a long way towards solving the problem. An alternative would be to rely on limited information estimation methods like GMM or SMM (RUGE-MURCIA, 2002).

14 The level of output that would prevail under perfect competition and flexible prices and wages.

Hamilton, James D. (1994), *Time Series Analysis*, Princeton University Press.
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