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Determinacy and learnability of equilibrium in a small-open economy with sticky wages and prices

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ABSTRACT

In a small-open economy model with nominal wage and price rigidities, it has been argued that, in terms of welfare losses, the monetary policy rule that responds to consumer price index (CPI) inflation performs better than rules that react to competing inflation measures. From the viewpoint of determinacy and learnability of rational expectations equilibrium (REE), this paper suggests that the rule that responds to CPI inflation does not increase the Central Bank's ability to promote the convergence of an economy to a determinate and learnable REE nor improves the speed of this convergence when compared with rules that react to contending inflation measures.

1. Introduction

Despite the behavior of many inflation-targeting central banks, most research on small-open economies with sticky prices, such as Gal and Monacelli (2005), suggests that the monetary authority should respond to domestic inflation rather than to consumer price index (CPI) inflation. In a small open economy with sticky wages and prices, Rhee and Turdaliev (2013) and Campolmi (2014) compared monetary policy rules that reacted to different inflation measures according to their welfare losses. In this context, they found that CPI inflation performed better than some contending measures, including domestic inflation.

Sticky nominal wages alter the dynamics of the Gal and Monacelli (2005) model. In the presence of nominal wage rigidity, fluctuations in CPI inflation induce movements in real wages, which affect wage markups. Hence, changes in wage markups lead to fluctuations in wage inflation and in firms' marginal costs. Therefore, in contrast to Gal and Monacelli (2005), there is a direct effect of CPI inflation on domestic price inflation.

In addition, since CPI inflation depends on movements in the real exchange rate or in the terms of trade, foreign shocks, by changing these variables, immediately influence domestic inflation dynamics. This mechanism is the direct exchange rate channel to domestic price inflation. This channel emerges through staggered wage contracting in small open economies and it is absent in standard new Keynesian open-economy models without sticky nominal wages.

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As pointed out by Campolmi (2014), in response to domestic and foreign shocks, movements in CPI inflation translate into more volatile wage and domestic inflation rates. In this context, the central bank improves welfare by reacting to CPI inflation since this reaction reduces the volatility of wage inflation and the volatility of domestic inflation. By decreasing these volatilities, the central bank promotes reductions in wage and price dispersions, which enhance welfare.

In addition to its repercussion on welfare, the change in model dynamics engendered by the introduction of sticky nominal wages has potential implications for determinacy and E-stability of REE in small open economies. The investigation of these implications is therefore the goal of this paper.

Since researchers have also assessed the desirability of an interest rate rule by examining the determinacy and learnability properties that this rule induces in equilibrium, the main contribution of this paper is to revisit, from the perspective of determinacy and learnability of rational expectations equilibrium (REE), the following question: which inflation index should monetary policy rules react to?

In contrast to Rhee and Turdaliev (2013) and Campolmi (2014), I emphasize determinacy and learnability properties as performance criteria to address the question of which inflation measure should a central bank respond to. Indeed, I present numerical results on determinacy and E-stability of equilibria for a small open economy model with sticky nominal wages and prices in which interest rate rules respond to alternative inflation measures.

This paper also addresses the effects of introducing nominal wage rigidity and trade openness on determinacy and learnability conditions associated with competing interest rate rules. Moreover, following Ferrero (2007) and Christev and Slobodyan (2014), I investigate how the specification of interest rate rules matters for the speed of convergence of an economy to a determinate and E-stable REE through an adaptive learning process. In fact, the speed of learning is an additional yardstick through which I evaluate monetary policy rules.

The main finding of this paper suggests that, when compared with rules that react to competing inflation measures, the rule that responds to CPI inflation does not provide any noticeable improvement in the central bank's ability to promote convergence of an economy to a determinate and learnable REE. Moreover, for this rule, the learning algorithm converges slowly or with the same speed implied by alternative rules. Hence, in contrast to the evaluation based on welfare losses, the rule that responds to CPI inflation does not exhibit superior performance from the viewpoint of determinacy and E-stability.

This study is closely related to Llosa and Tuesta (2008) and Best (2015). Llosa and Tuesta (2008) studied the small open economy model developed by Gal and Monacelli (2005) and showed that the degree of openness interacted with particular interest rate rules, which may respond to exchange rates, to change the relevance of the Taylor principle as a condition ensuring determinacy and E-stability of REE. In a previous paper, Linnemann and Schabert (2006) found similar results by studying a more restricted class of interest rate rules. Best (2015)[1] studied a closed economy model with nominal wage and price rigidities as described in Erceg, Henderson, and Levine (2000).

The paper proceeds as follows. Section 2 sets out the model. Section 3 presents the numerical findings on determinacy and E-stability of REE. Section 4 discusses the speed of convergence of determinate and E-stable equilibria. Finally, the last section concludes.

2. The model

In this section, I present the log-linear approximation of the model investigated in Rhee and Turdaliev (2013) and Campolmi (2014)[2]. This model is the small-open economy studied in Gal and Monacelli (2005) with the labor market characteristics found in Erceg et al. (2000), i.e., there is monopolistic competition in the labor market and households set nominal wages following the scheme proposed by Calvo (1983)[3]. I also discuss alternative interest rate rules representing how the central bank conducts monetary policy and I then report how I calibrate the parameters.

2.1. The private sector equilibrium conditions

After the log-linearization around the steady state of the equilibrium conditions exposed in Appendix A, the following equations represent the small open economy:

$$\tilde{y}_t = E_t(\tilde{y}_{t+1}) - \frac{1}{\sigma_\alpha}\left[r_t - E_t\left(\pi_{H,t+1}\right)\right] + \frac{1}{\sigma_\alpha} rr_t^n \tag{1}$$

$$\pi_{H,t} = \beta E_t\left(\pi_{H,t+1}\right) + \kappa_{ph}\tilde{y}_t + \lambda_{ph}\tilde{w}_t \tag{2}$$

[1] Flaschel, Franke, and Proaño (2008) studied a similar model in continuous time.

[2] Llosa and Tuesta (2008) and Best (2015) are special cases of this model. In fact, the model in Llosa and Tuesta (2008) corresponds to setting the degree of wage rigidity to zero whereas the specification in Best (2015) is equivalent to the situation of zero degree of openness.

[3] Regarding the introduction of nominal wage rigidity, Adolfson, Lassén, Lindé, and Villani (2008); Jääskelä and Nimark (2011), and Dong (2013) pointed out that this type of nominal rigidity improved the ability of open-economy medium-scale models to fit the data.