Monetary policy under import price shocks: the case of Hungary

Zoltán M. Jakab[1] and Ferenc Karvalits[2]

Introduction

The general task of inflation targeting for central banks is to find an interest rate path that ensures the achievement of the inflation target by trading off the possible economic sacrifices. Commodities such as oil or food appear directly in the consumer basket, and also serve as input in the production process, especially in the case of oil. Central banks of small, open economies now and again face the problem of dealing with imported price pressures, i.e. terms-of-trade shocks. They often need to judge whether these pressures affect the production side of the economy or inflation expectations, or induce substitution in demand. Imported inflationary pressure can be counterbalanced by nominal exchange rate appreciation; this, however, does not constitute a free lunch, as it can temporarily contract activity in the tradable sector. In this respect, there is a question of whether monetary policies that work under a large terms-of-trade shift would target "*domestic*" inflation (as in Clarida et al (2001)) sometimes proxied by the "*core inflation*", which excludes food and energy prices from the consumer basket, or whether it is optimal to focus on total inflation.

Around nine months ago, a paper dealing with persistent shifts in terms of trade or the effects of potentially higher oil and food prices would have been the key issue for monetary policy makers of small, open economies. The world is changing, however, at a perhaps surprisingly fast pace. Currently, the question is flipped: what are the monetary policy consequences for a marked slowdown or recession in the world economy accompanied by large (downward) shifts in the price of commodities? Although the likelihood that terms of trade will persistently worsen has diminished, great volatility in the terms of trade may still pose an interesting policy question. In this paper we address the optimal response of monetary policy when terms-of-trade shocks – more precisely import price shocks – hit a small, open economy.

Figure 1 shows that in Hungary the volatility of import prices (measured in foreign currency) are no more volatile than consumer prices. This is mostly explained by the fact that consumer prices are also affected by other shocks and most notably by exchange rate fluctuations. Higher import prices do not directly translate into consumer prices, for two reasons. First, fluctuations in the nominal exchange rate serve as a natural way of accommodating these types of shocks. Second, large part of imports serve as intermediates in Hungarian production, and thus they have impact on firms' marginal costs. In addition, firms are able to accommodate to these shocks by adjusting wages, demand for labour and capital. Thus, the impact of import price shocks on final prices of goods might be smoother, and delayed.

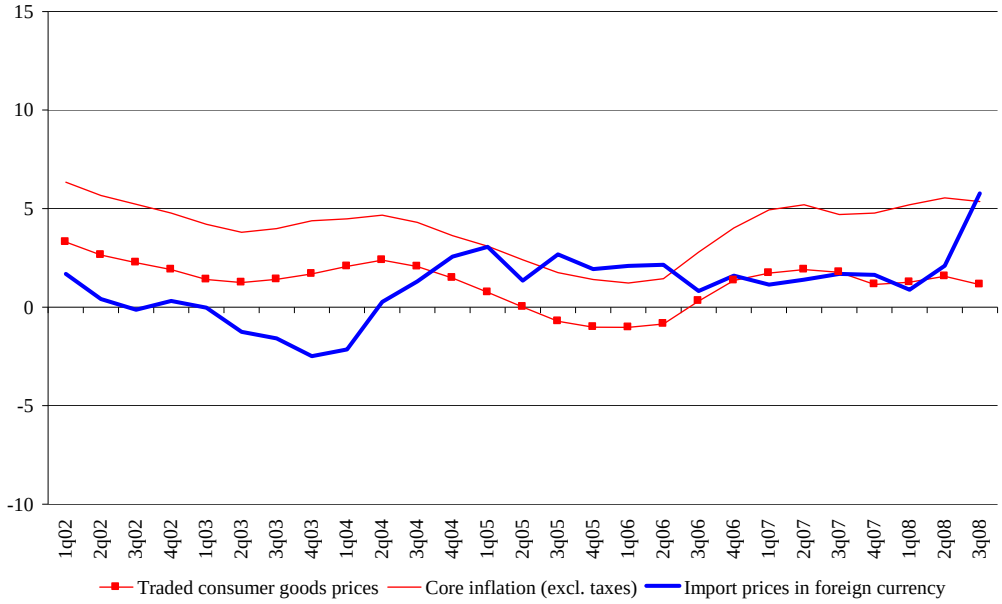
[1] Principal economist at the Magyar Nemzeti Bank (central bank of Hungary), e-mail: jakabz@mnb.hu

[2] Deputy Governor of the Magyar Nemzeti Bank (central bank of Hungary), e-mail: karvalitsf@mnb.hu

Figure 1

Import prices in foreign currency and consumer prices in Hungary

y-o-y changes in %



Source: Central Statistical Office of Hungary

This paper explores the properties of optimal monetary policy under import price shocks in a medium-scale dynamic stochastic general equilibrium (DSGE) model estimated for Hungary. Our framework is a two-sector, open economy model, with imports serving as intermediate inputs for production. We use the method for finding the optimal policy in "*medium-scaled*" closed economy DSGE (i.e. Smets-Wouters type) models of Altissimo et al (2005) and Adjemian et al (2007). This note builds on the results by Jakab, Szilágyi and Világi (2008) and Karvalits (2008).

Clarida et al (2001) show that the optimal policy problem for a small open economy is isomorphic to the closed economy case. In particular, small open economy dynamics can be reduced to a dynamic system that is identical to that associated with the workhorse sticky price model of a closed economy. Thus, the optimal policy should seek to stabilise domestic (as opposed to total CPI) inflation, and the form of the interest rate rule is not affected by the openness of the economy. Gali-Monacelli (2005) also emphasise this isomorphy where strict domestic inflation targeting turns out to be the optimal monetary policy for open economies. This means that according to the above models, optimal monetary focuses on domestic inflation. In other words, import price shocks' effects on the optimal policy can be characterised through their impact on output and domestic inflation: monetary policy takes care of the second-round effects of these type of shocks.

On the other hand, Campolmi (2008) argues that the inclusion of sticky wages in an otherwise standard small open economy model rationalises CPI inflation targeting. To our knowledge, there are no publications on the welfare-maximising policy properties of an empirically motivated, fully fledged small open economy model.

We argue that in a small open economy like Hungary, and when imports are production inputs, optimal monetary policy is also concerned with import price shocks. We also find that the way imports are modelled is crucial for the normative implications of import price (terms-of-trade) shocks. That is, while it can be optimal for the monetary policy to overlook international relative price changes if imports are used in final consumption, it no longer holds once they enter into production.

The model

We use the model of Jakab-Szilágyi-Világi (2008), which is an amended version of the estimated dynamic stochastic general equilibrium (DSGE) model of Jakab and Világi (2008).[3] The model has the usual nominal and real frictions of applied DSGE models. It also has a two-sector, open economy setup, with imports serving as intermediate input to production.

First, we examine the flexible price version of the model. Here we explore how the economy would behave without nominal rigidities. This (flexible price) allocation serves as a natural benchmark as, by assuming away nominal rigidities, it represents a socially optimal solution.[4] Then, we investigate reactions of the economy under the estimated rule, discovering the role of nominal rigidities, which constrain the solution of the optimal policy problem. We compare the optimal policy allocation to both the flexible price model and the one with the estimated rule.

The model of Jakab-Szilágyi-Világi (2008) features a large number of real and nominal frictions usually assumed in the literature (staggered price and wage setting, indexation mechanisms, adjustment costs on investment, habit formation in consumption, fixed costs in production). This model is a simplified version of that of Jakab-Világi (2008). The production process is represented by a two-stage CES (constant elasticity of substitution) production function. In the first stage, imports and labour are combined to a composite production input, and in the second, final output is produced out of the composite input and capital. Adjusting all the three factors of production is costly. There are two sectors: domestic and export. Monetary policy is characterised by a simple Taylor rule with interest rate smoothing estimated for the IT regime (from 2001). The estimated coefficient of inflation is barely 1.4 and less than the standard baseline of 1.5. Rule-of-thumb (non-Ricardian) consumers are assumed away from the original Jakab-Világi (2008) model. A special feature of the full Jakab-Világi (2008) model is that agents' "*perception on underlying inflation*" is made endogenous by a real-time adaptive-learning algorithm. For simplicity, we abstract from potential problems of imperfect commitment caused by this learning process. Apart, from the differences highlighted above, we imported the parameters estimated by Jakab-Világi (2008) for the inflation targeting regime. Throughout the simulations, the posterior means of the parameters were chosen.

Optimal policy

Figures 2–4 show the reactions to a 1% increase in import prices. In the *flexible* price model (abbreviated NR), increased import prices act as a negative shock to technology by making production more costly and reducing output in both sectors. Obviously, the rise in import prices leads to strong substitutions in production, mostly of imports for labour. The rising cost of domestic production also makes the domestic firms less competitive in export markets, and induces a sectoral reallocation of inputs from the export to the domestic sector.

With *nominal rigidities* and *under the estimated rule* (Rule), monetary policy reacts with a moderate tightening. *Optimal monetary policy*, too, behaves as if facing a negative technology shock; consequently, the optimal response is a tightening.

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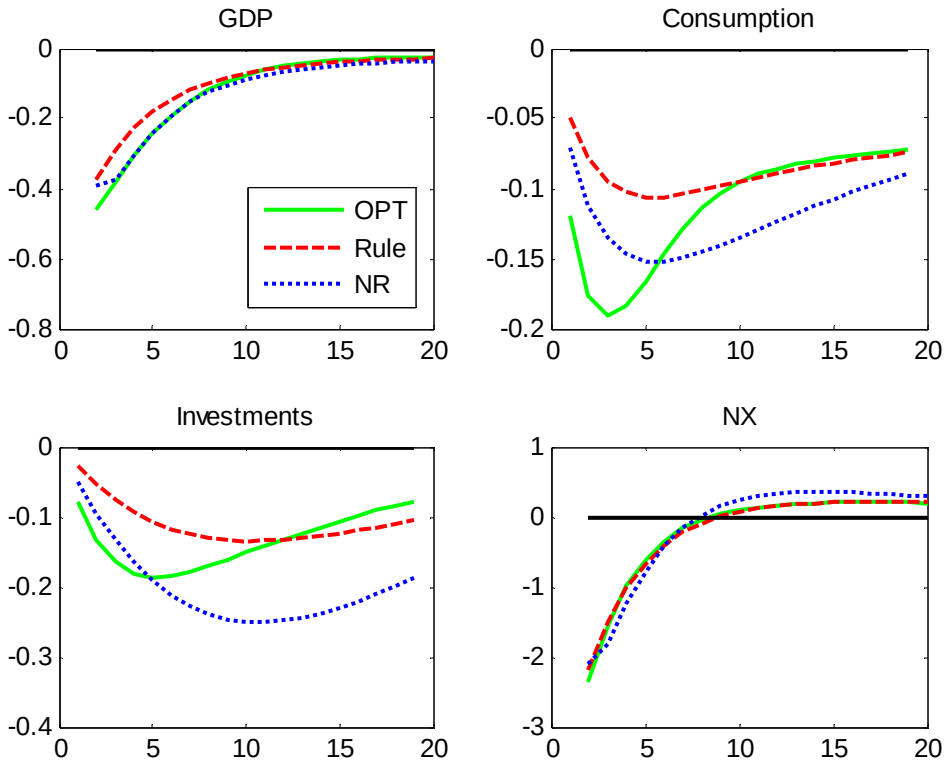
[3] The linear-quadratic (LQ) approximation is used to solve the optimal policy problem, as suggested by Benigno-Woodford (2005); and the standardised algorithm proposed by Altissimo et al (2005) is used.

[4] More precisely, this is the case if the government subsidises producers with a monopoly to supply the amount of output that they would in a perfectly competitive environment (case of the optimal steady state) – an assumption that we maintain throughout.

The reason is that *optimal monetary policy* (OPT) seeks to replicate the flexible price allocation by increasing the policy rate and thus contracting aggregate demand (as is usual in the closed economy setup). In addition, there is another motivation of the central bank of a small open economy: it also seeks to induce "optimal" relative price movements (as it was the case in the flexible price model). Given nominal rigidities, this is achieved by nominal appreciation, which adds a further motive to the monetary tightening. Optimal policy lowers the variability of domestic and wage inflation, and induces real exchange rate movements similar to what would prevail in a flexible price situation.

Figure 2

Impulse response of policy rate after an increase in import prices



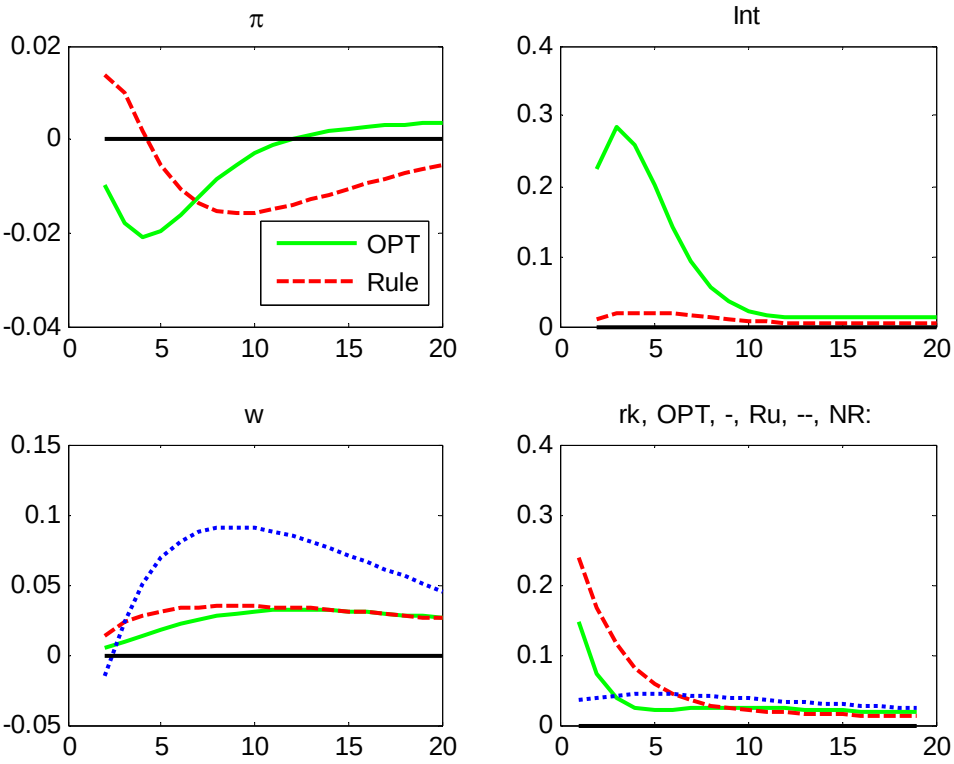
x-axis in quarters and y-axis in percent.

NX = net exports.

Source: Jakab-Szilágyi-Világi (2008).

Figure 3

Impulse response of policy rate after an increase in import prices (cont'd)



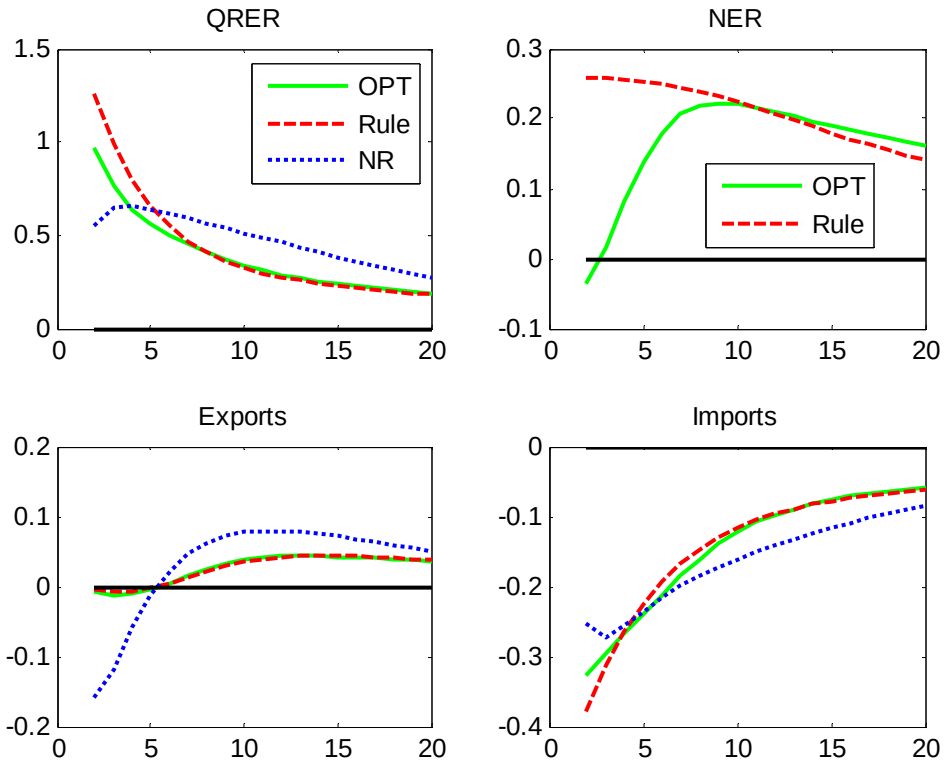
x-axis in quarters and y-axis in percent.

Int = interest rate; w = real wage; rk = real user cost of capital; OPT = optimal; Ru = Rule, NR = Natural rate.

Source: Jakab-Szilágyi-Világi (2008).

Figure 4

Impulse response of policy rate after an increase in import prices (cont'd)



x-axis in quarters and y-axis in percent.

QRER = real exchange rate; NER = nominal exchange rate.

Source: Jakab-Szilágyi-Világi (2008).

Conclusions and some policy implications

This paper has analysed the optimal monetary policy reaction to import price shocks in an estimated, small open economy DSGE model of the Hungarian economy. The modelling framework (two-sector setup, with imports modelled as input to production) has clear normative consequences.

According to the simulations, import price changes – imports as an input to production – act like shocks to the technology, and consequently, trigger a monetary action (loosening if prices fall). Imports as an input to production, as opposed to a final consumption good, dramatically changes the normative implications of a terms-of-trade shock. We argue that while it is optimal for the monetary policy to overlook international relative price changes in the latter setup, this no longer applies once imported goods enter into production.

Optimal monetary policy described by the small, open economy model for Hungary is one that actively responds to commodity price movements. This result is in sharp contrast to the theoretical result usually derived in the literature, i.e. terms-of-trade shocks should be overlooked. Our results highlight the striking difference in normative implications of the way imports are modelled (final consumption good vs. intermediary production input).

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