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Money illusion and the long-run Phillips curve in staggered wage-setting models

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ABSTRACT

We consider the effect of money illusion – defined referring to Stevens' ratio estimation function – on the long-run Phillips curve in an otherwise standard New Keynesian model of sticky wages. We show that if households under-perceive real economic variables, negative money non-superneutralities will become more severe. On the contrary, if households over-perceive real variables, positive money non-superneutralities will arise. We also provide a welfare analysis of our results and we show that they are robust to the inclusion of varying capital into the model. Firms' (over-)under-perception of the real prices of production inputs (strengthens) weakens negative money non-superneutralities. In the Appendix, we investigate how money illusion affects the short-run effects of a monetary shock.

1. Introduction

Money illusion has recently attracted renewed attention by the economics profession—see for instance the literature quoted in Fehr and Tyran (2001, 2007), which developed an experimental approach to the issue, or Cannon and Cipriani (2006), which assessed its empirical relevance. The aim of this paper is to study how it affects the long-run connection between output and inflation within a DSGE model, where, similar to the relevant literature, we define the long-run as the steady state, namely a condition characterized by the absence of temporary shocks.[1]

The way we model money illusion here builds on Stevens (1946, 1951), which has been at the centre of an extensive literature surveyed for instance in Graham (1958), Anderson (1970), Schepard (1981), Luce and Krumhansl (1988) and Michell (1999).

We consider money illusion a biased subjective way economic agents have to evaluate real variables. Suppose an individual receives two pieces of information: his/her nominal wage, W, and the general level of prices, P. S/he will have to estimate her/his real wage as a ratio of the two above on the basis of her/his ratio estimation function $F=f(W,P)$. Stevens conjectured that subjective values are powers of real values, so that Stevens' ratio estimation function $f(W,P)$ can be written as

$$f(W,P)=\left(\frac{W}{P}\right)^{\xi}$$

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[1] The analysis of the transitional dynamics of the system is tackled in the Appendix.

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Such a distortion could arise for at least two reasons. Economic agents are often found to evaluate economic magnitudes combining real and nominal assessments, given that they have a nominal anchor and, at the same time, they are aware that nominal and real values differ (Shafir et al., 1997). Furthermore, following Pelham et al. (1994), there might be a numerosity effect, whereby people sometimes judge quantity on the basis of the number of units into which a stimulus is divided without fully considering other important variables—on this point see, for instance, Wertenbroch et al. (2007) and the literature quoted therein.[2]

We nest Stevens' original idea in an otherwise standard new Keynesian model of sticky wages with trend inflation. We do so and we assume that agents do not have other behavioral/informational imperfections because only by observing money illusion in isolation from other factors one can properly assess its implications. For this very reason, it seems advisable to consider households' and firms' money illusion separately.

The effect of trend inflation on output in new-Keynesian models has been the subject of a number of studies by now. Pioneering contributions on this issue were King and Wolman (1996) and Ascari (1998). The former study considers a model with a shopping time technology and it obtains a number of different results, among which there is that long-run inflation reduces firms' mark-up, boosting the level of output. Ascari (1998), instead, shows that in wage-staggering models money can have considerable negative non-superneutralities once not considering restrictively simple utility and production functions. Devereux and Yetman (2002) focused on a menu cost model. An analysis of dynamic general equilibrium models under different contract schemes in presence of trend inflation was offered in Ascari (2004). Graham and Snower (2004), instead, examined the microeconomic mechanisms underlying this class of models. In presence of Taylor wage staggering, in a monopolistically competitive labour market, they highlight three channels through which inflation affects output: employment cycling, labour supply smoothing and time discounting. The first one consists in firms continuously shifting labour demand from one cohort to the other according to their real wage. Given that different labour kinds are imperfect substitutes, this generates inefficiencies and tends to create a negative inflation-output nexus. The second one is that households demand a higher wage in presence of employment cycling given that they would prefer a smoother working time, decreasing labour supply and aggregate output. Finally under time discounting the contract wage depends more on the current (lower) level of prices than on the future (higher) level of prices and, therefore – over the contract period – the real wage will be lower the greater is the inflation rate, spurring labour demand and aggregate output. The time discounting effect dominates at lower inflation rates, while the other two effects at higher inflation rates, producing a hump-shaped long-run Phillips curve. The aim of this paper is to challenge the concept of the NAIRU and the possibility to identify demand and supply shocks assuming the former ones to be temporary and the latter ones to be permanent.

Graham and Snower (2004) was extended in a number of different directions. Graham and Snower (2008) showed that under hyperbolic time discounting positive money non-superneutralities are more sizeable than under exponential discounting. Vaona and Snower (2007, 2008) showed how the shape of the long-run Phillips curve depends on the shape of the production function. Finally, Vaona (2012) extended the model by Graham and Snower (2004) from the inflation-output domain to the inflation-real growth one.

The present contribution shows that the shape of the long-run Phillips curve changes under different degrees of money illusion. We do so by first assuming firms not to be subjected to money illusion as reminiscence of Friedman (1968). However, given that Shafir et al. (1997) found that even firms' decisions can be affected by money illusion, we deal with this case at a later stage.

The rest of this paper is structured as follows. Section 2 illustrates our baseline model. We then move to its calibration and solution. Section 4 sets out our results and their underlying intuition, also providing a welfare analysis of theirs. Section 5 extends the model by considering varying capital. Section 6 considers the case of firms' money illusion. The last section summarizes our findings and concludes. As mentioned above, in the Appendix we tackle the issue of how (either households' or firms') money illusion affects the impact of a temporary monetary shock on the model, given that, even if demand shocks cannot be identified on the basis of their transience, it will be interesting to study how transient demand shocks affect an economy.

2. The baseline model

2.1. Firms' cost minimization problem and the government

The model here presented is inspired to those by Ascari (1998) and Graham and Snower (2004). Firms populating the final perfectly competitive product market produce a homogeneous output and they minimize their total real cost subject to their production function

$$\min_{n_t(h)} \int_{h=0}^{1} \frac{W_t(h)}{P_t} n_t(h)\, dh$$

[2] Both these mechanisms tend to rule out the possibility for economic agents to *learn* the actual value of real variables.