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Monetary policy and stock-price dynamics in a DSGE framework

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ABSTRACT

This paper analyzes the role of stock prices in driving monetary policy for price stability in a non-Ricardian DSGE model. It shows that the dynamics of the interest rate consistent with price stability requires a response to stock-price changes that depends on the shock driving them: a supply shock (e.g. productivity) does not require an additional, dedicated response relative to the standard Representative-Agent framework, while a demand shock does. Moreover, we show that implementing the flexible-price allocation by means of an interest-rate rule that reacts to deviations of the stock-price level from the flexible-price equilibrium incurs risks of endogenous instability that are the higher the less profitable on average equity shares. On the other hand, reacting to the stock-price growth rate is risk-free from the perspective of equilibrium determinacy, and can be beneficial from an overall real stability perspective.

1. Introduction

Over the past three decades, with inflation successfully kept under control after the tumultuous 1970's, one of the major issues that Central Bankers had to learn to cope with was financial stability. The events of the last decade (the burst of the dotcom bubble in 2001 and the recent global financial meltdown), generated a revived interest, in the economic literature, in the links between monetary policy and stock-price dynamics, and gave new scope for a debate about the desirability that Central Banks be directly concerned with financial stability.[1] Among the others, one interesting issue being debated is the understanding of what should be the appropriate response of monetary policy makers in the face of real effects of large swings in stock prices, and whether an explicit concern about stock-price dynamics might improve macroeconomic performance.[2]

The issue was analyzed in a variety of setups, both theoretical and empirical, and the consequent debate is still very controversial, under many respects. The main stream of contributions analyzes the issue within a Dynamic New Keynesian (DNK) model with financial frictions,[3] where shocks to stock prices propagate to real activity by affecting the financial conditions of firms and thereby triggering a financial accelerator mechanism. Monetary policy in this context is analyzed by assessing the macroeconomic implications, for a calibrated economy, of augmenting a standard Taylor-type interest rule with an explicit response to deviations of the stock-price level from a given target.

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[1] Mishkin and White (2002) highlight the difference between financial instability and stock market crashes, maintaining that the real concern of monetary policy makers should be the former, rather than the latter. The strong point they make is related to firms' balance sheets conditions and seems weaker when it comes to the possible real effects through households' wealth. Truth is, anyhow, that the stock market fragility is more often than not a highly sensitive indicator of financial instability, especially in periods of financial sophistication like the ones we live in.

[2] See Nisticò (2006) for an extensive survey.

[3] The analytical framework exploited is the one developed in Bernanke et al. (1999), augmented to allow for stochastic bubbles.

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The implications of this body of literature are not at all univocal and the debate does not seem settled yet. On one side, Bernanke and Gertler (1999, 2001) conclude that since the macroeconomic relevance of stock-price dynamics relies on its links with inflation, a flexible inflation targeting approach is sufficient to achieve both price and financial stability, and that reacting to stock prices induces a perverse outcome in terms of output dynamics. Analogously, Gilchrist and Leahy (2002) find that both standard DNK models and economies featuring financial frictions, best replicate the dynamic properties of the benchmark RBC framework when no dedicated response is granted to stock-price dynamics. On the other hand, Cecchetti et al. (2000, 2002, 2003), though emphasizing the difference between *targeting* stock-price stability and *reacting* to stock-price misalignments, strongly recommend that a Central Bank that recognizes a bubble in the dynamics of the stock market react to it; the conclusion is motivated on the grounds of simulations of the same model as in Bernanke and Gertler (1999), showing that the perverse outcome reported by the latter can be ruled out by simply adding a reaction to the output gap in the Taylor rule, and that adding a reaction to stock prices reduces overall volatility in the economy. To assess the links between stock prices, inflation and monetary policy, Carlstrom and Fuerst (2001) derive analytically the welfare-maximizing monetary policy in a flexible-price general equilibrium model with financial frictions. They show that, notwithstanding the abscence of nominal rigidities – and hence the costs of inflation – a welfare-improving role for reacting to stock prices emerges, insofar as it can counteract the inefficient response of the economy to shocks to the equity market, which propagate through the binding collateral constraints. With a more recent contribution, Carlstrom and Fuerst (2007) re-enter the debate and analyze the issue of equilibrium determinacy in a standard, representative-agent, DNK model in which the Central Bank responds also to stock prices. In their framework, however, the latter are redundant for the equilibrium allocation, unless monetary policy explicitly responds to them. Accordingly, a monetary policy rule including a response to some measure of stock-market dynamics is never optimal (whatever the concept of " optimality" considered). Indeed, in such setup, the authors show that reacting to stock prices raises the risks of inducing real indeterminacy in the system. This result had already been pointed out by Bullard and Schaling (2002) in an even simpler setup, in which stock prices are driven (to first order) only by the short-term interest rate.[4]

To our knowledge, therefore, all contributions analyzing the topic for micro-founded New-Keynesian setups, focus on the supply-side effects of stock-price dynamics, when considering any real effect at all.

A second stream of literature, to which this paper is also related, focuses on the analysis of a highly stylized and parsimonious Dynamic Stochastic New Keynesian model, describing the economy with two simple equations: an IS curve for the demand-side, and a New Keynesian Phillips Curve for the supply side. The major advantage of such model, and the reason of its widespread popularity for policy analysis, consists in its extreme tractability, which allows for analytical derivation of both endogenous dynamics and optimal monetary policy.[5] This model, which we will refer to as the *Standard Dynamic New Keynesian model* (SDNK), however, does not explicitly consider the dynamics of stock prices and their interplay with the business cycle and the conduct of monetary policy.

This paper aims at filling this gap, and presents a framework (which nests the *SDNK model* as a special case) which achieves both preservation of high tractability and explicit consideration of stock prices as a non-redundant variable for the business cycle. More specifically, we analyze the links between monetary policy, price stability, and stock-price dynamics within a tractable DSGE New-Keynesian model in which agents are non-Ricardian and stock prices thereby affect real activity through wealth effects on consumption. In this way we establish an active role for stock prices in affecting the business cycle and a theoretical motive for the Central Bank to react to their dynamics. We analyze the implications of this extension for price stability and the role of the interplay between monetary policy and stock-price dynamics.[6]

We depart from the *SDNK model* mainly along two dimensions. First, while in the SDNK model profits from the monopolistic sector are uniformly distributed among households, here we assume there exists a market for shares on those profits: the stock market. The households then can choose to allocate their savings by either buying state-contingent assets or a portfolio of private stocks. This assumption implies endogenous stock-price dynamics.

Second, we model the demand-side of the economy along the lines traced by Yaari (1965) and Blanchard (1985): every period, a constant fraction of agents in financial markets is randomly replaced by newcomers holding zero-wealth. While the SDNK model features a representative agent, here we introduce heterogeneity in households, related to the accumulated stock of financial wealth. The demand-side hence takes the form of a stochastic "perpetual youth" model, for which a closed-form solution for aggregate consumption within a closed economy is derived by Chadha and Nolan (2003) and Piergallini (2006).[7] The interplay between "newcomers" entering the markets with no wealth and "old traders" with accumulated wealth drives a wedge between the stochastic discount factor pricing all securities and the average marginal rate of intertemporal substitution in consumption, which in the case of infinitely-lived consumers coincide. In equilibrium, this wedge affects the growth rate of aggregate consumption, and makes stock prices a non-redundant asset even with complete markets. Recently, Castelnuovo and Nisticò (2010) have estimated an empirical version of the model presented here, using Bayesian

[4] Other contributions using different approaches (and drawing different conclusions) from each other can be found in Chadha et al. (2004), Cogley (1999), Filardo (2000), Faia and Monacelli (2005), Goodhart and Hofmann (2002), Gruen et al. (2005), Ludvigson and Steindel (1999), Miller et al. (2001), Mishkin (2001), and Schwartz (2002).

[5] For a thorough analysis using this baseline model, a detailed discussion and complete references, see Woodford (2003), Ch. 4, and Galí (2003).

[6] In the same spirit, Curdia and Woodford (2009, 2010, 2011) extend the SDNK model by introducing heterogeneity in households' patience and financial intermediaries to study analytically the role of unconventional monetary policy.

[7] Cardia (1991) derives an analogous solution within a small open economy framework.