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Bank behavior, incomplete interest rate pass-through, and the cost channel of monetary policy transmission

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ABSTRACT

This paper employs a New Keynesian DSGE model to explore the role of banks within the cost channel of monetary policy transmission for shaping the interest rate pass-through from money market rates to loan rates. Banks extend loans to firms in an environment of monopolistic competition by setting their loan rates in a staggered way, which means that the adjustment of the aggregate loan rate to a monetary policy shock is sticky. We estimate the model for the euro area by adopting a minimum distance approach. Our findings exhibit that (i) financial costs are an important factor for price changes, (ii) frictions in the loan market have an effect on the propagation of monetary policy shocks as the pass-through from a change in money market rates to loan rates is incomplete, and (iii) the strength of the cost channel is mitigated as banks shelter firms from monetary policy shocks by smoothing loan rates.

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1. Introduction

The cost channel assigns banks a pivotal role in the transmission of monetary policy, which stems from the notion that firms depend on credit to pre-finance production (Barth and Ramey, 2000; Ravenna and Walsh, 2006). Firms relate their price decisions to credit conditions as their marginal production costs are directly affected by interest rates. As a consequence, a monetary contraction induces upward pressure on prices by deteriorating credit conditions through higher interest rates.

Christiano, Eichenbaum, and Evans (2005) and Ravenna and Walsh (2006) present a New Keynesian DSGE model that incorporates the cost channel besides the interest rate channel - i.e. the traditional aggregate demand channel – which presumes that prices decline immediately after a monetary contraction due to a pro-cyclical drop in output and unit labor costs. As the cost channel is counteracting the interest rate channel, this implies that the reaction of prices to a monetary policy shock is mitigated, while the response of output is amplified. Although, banks are embedded in this context explicitly the scope of their behavior is limited as they only act as neutral conveyors of monetary policy.

This paper employs a New Keynesian DSGE model to explore the role of banks in the cost channel of monetary policy. Banks are assumed to

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extend loans to firms in an environment of monopolistic competition by setting their loan rates as in Calvo (1983) in a staggered way. In this setup, only a fraction of banks adjust their loan rates to a change in the policy rate, while the remaining fraction leaves their loan rates unchanged, which means that the reaction of the aggregate loan rate to a monetary policy shock is sticky. This is in contrast to Christiano, Eichenbaum, and Evans (2005) and Ravenna and Walsh (2006), who focus on banks operating costlessly under perfect competition with the consequence that the loan rate always equals the policy rate.

Our motivation stems from the evidence presented by Ehrmann et al. (2001), which shows for the Euro area that the degree of imperfections in the loan market is distinctive. Moreover, de Bondt (2005), de Bondt, Mojon, and Valla (2005), Hofmann and Mizen (2004), Mojon (2001) and Sander and Kleimeier (2002) document that loan rates immediately react sluggishly to a change in money market rates, which implies that the interest rate pass-through is limited.

So far, a number of studies have shown that the cost channel is empirically relevant. For the U.S., Barth and Ramey (2000) find that prices set by firms in several industries increase after a monetary contraction. Since the shift in prices occurs relative to wages this implies the existence of a cost-push shock. Likewise, Dedola and Lippi (2005) document that price changes by firms in different European countries are affected by the development of interest rates.³ For the euro area, Fabiani et al. (2006) reach similar results.

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³ This finding is also supported by Gaiotti and Secchi (2006), who show for a large number of Italian firms that financial costs are a driving force for price changes.

Christiano, Eichenbaum, and Evans (2005) conclude that the cost channel in the U.S. matters for the transmission of monetary policy because it contributes to explain inflation inertia, which emerges after a monetary policy shock.⁴ Ravenna and Walsh (2006) estimate a New Keynesian Phillips curve that explicitly incorporates the cost channel, and find that the dynamics of inflation is positively related to changes in interest rates. In a similar vein, Chowdhury, Hoffmann, and Schabert (2006) conclude that the cost channel is relevant in the U.S. and the U.K., but not in Germany and Japan, which suggests that the structure of the financial system – a market-based system versus a bank-based system – has an impact on the consequences of monetary policy actions. By contrast, Kaufmann and Scharler (2009) find in a cross region comparison between the US and the euro area that differences in the financial system are largely irrelevant to account for differences in the transmission of monetary shocks.

Following Christiano, Eichenbaum, and Evans (2005) and Rotemberg and Woodford (1998), we estimate the DSGE model for the euro area by using a minimum distance approach, which consists of two steps. In the first step, we specify a VAR model to generate empirical impulse responses to a monetary policy shock. In the second step, we estimate the model parameters by matching the theoretical impulse responses as closely as possible to the empirical impulse responses. Our results exhibit that (i) price decisions by firms are affected by loan rates, (ii) frictions on the loan market play an important role in the propagation of monetary policy shocks as the immediate pass-through from a change in money market rates to loan rates is incomplete, and (iii) the cost channel contributes to generate an inertial response of inflation to a monetary policy shock, but its effect is mitigated because of a disproportionate adjustment of loan rates to changing money market rates.

Overall, our results imply that the strength of the cost channel is mitigated since banks refrain from transmitting monetary policy shocks neutrally. Although, firms base their price decisions on credit conditions, the impact on inflation dynamics arising through a change in loan rates is partly suspended by an incomplete interest rate passthrough.

The paper is structured as follows. In Section 2, the DSGE model is set out. Section 3 presents the empirical results that are obtained from the minimum distance estimation. In Section 4, the implications for the cost channel of monetary policy arising through an incomplete loan rate pass-through is discussed. Section 5 summarizes the main findings and concludes.

2. The model

We employ a New Keynesian DSGE model that consists of firms, households and banks. Firms are partitioned into final good producers and a continuum of intermediate good producers, which each produce a differentiated type of good by using capital and labor services. Intermediate good producers have some monopoly power over prices that are set in a staggered way as in Calvo (1983). Households obtain utility from consumption and leisure, they supply a differentiated type of labor, own the capital stock and make investment decisions. They decide on their wages, which are also set in a staggered way. Finally, banks extent loans to firms in an environment of monopolistic competition. They face frictions when changing their loan rates, which implies that the aggregate loan rate reacts stickily to a monetary policy shock.

The model builds on the framework of Christiano, Eichenbaum, and Evans (2005), Smets and Wouters (2003), Galí, Gertler, and

López-Salido (2001) and Erceg, Henderson, and Levin (2000) by sharing the same kind of nominal and real rigidities. Following Rabanal (2007) we account for a cost channel by assuming that a fraction of firms require loans from banks as they are obliged to pay their wage bill in advance of selling their product. An addition is the inclusion of a limited interest rate pass-through.⁵

2.1. Final good producers

Final good producers operate under perfect competition. The technology to produce the aggregate final good is given by:

$$Y_t = \left[\int_0^1 Y_t^{\frac{\epsilon-1}{\epsilon}}(i)di\right]^{\frac{\epsilon}{\epsilon-1}},\tag{1}$$

where Y_t is the final good, $Y_t(i)$ are the intermediate goods indexed by $i \in [0, 1]$, and $\epsilon > 1$ is the elasticity of substitution between the different types of goods.

Profit maximization by the final good producers leads to the following demand equation for each intermediate good:

$$Y_t(i) = \left(\frac{P_t(i)}{P_t}\right)^{-\epsilon} Y_t, \text{ for all } i \in [0, 1],$$
(2)

where $P_t = \left[\int_0^1 P_t^{1-\epsilon}(i)di\right]^{\frac{1}{1-\epsilon}}$ is the price of the final good and $P_t(i)$ is the price of the intermediate goods.

2.2. Intermediate good producers

Firms indexed by $i \in [0, 1]$ operate in an environment of monopolistic competition. Each firm *i* has access to the technology:

$$Y_t(i) = \tilde{K}_t^{\alpha}(i) N_t^{1-\alpha}(i), \tag{3}$$

where $\tilde{K}_t(i)$ denotes capital services, which is the effective utilization of the capital stock given by: $\tilde{K}_t(i) = u_t K_{t-1}(i)$, with u_t describing the capital utilization rate, $N_t(i)$ denotes labor services and α is the capital share of output.

Nominal profits by firm *i* are given by:

$$\Pi_t^{\text{firm}}(i) = P_t(i)Y_t(i) - Q_t^{\text{firm}}(i), \tag{4}$$

where $Q_t^{\text{frm}}(i)$ denote nominal production costs. The firm rents effective capital input in a perfectly competitive market and chooses a composite labor input. For the mass of firms $i \in [0, \nu]$, which are required to take up loans $L_t(i)$ from banks to pay their wage bill $W_t N_t(i)$, nominal production costs are determined by: $Q_t^{\text{firm}}(i) = R_t^L W_t N_t(i) + R_t^K \tilde{K}_t(i)$, where the wage index W_t , the gross loan rate R_t^L and the rental rate of capital R_t^K are taken as given. For the remaining mass of firms nominal production costs are given by: $Q_t^{\text{firm}}(i) = W_t N_t(i) + R_t^K \tilde{K}_t(i)$. Loan repayment by firms occurs at the end of each period.

Firm $i \in [0, \nu]$ holds a loan portfolio, which is diversified over all types of loans *k* offered by banks that are aggregated the following way:

$$L_t(i) = \left[\int_0^1 L_t^{\frac{\zeta-1}{\zeta}}(i,k)dk\right]^{\frac{\zeta}{\zeta-1}},\tag{5}$$

where $L_t(i)$ denotes the demand for loans by firm *i*, which is equal to the wage bill $W_t N_t(i)$, and $\zeta > 1$ is the elasticity of substitution between the different types of loans *k*. Each firm obtains the optimal mix of

⁴ Moreover, Christiano, Eichenbaum, and Evans (2005) find that the cost channel contributes to assessing the average duration of price contracts. In a model with the cost channel they obtain an average price duration of 2.5 quarters, while the exclusion of the cost channel leads to an average duration of price contracts equal to 2.5 years, which appears implausible in the light of available microeconomic evidence (see e.g. Bils and Klenow, 2004).

⁵ As the theoretical framework surrounding the cost channel usually neglects problems arising from informational frictions (see e.g. Christiano et al., 2005), we refrain from considering any problems arising from possible loan default.

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