Monetary Policy, Credit Markets, and Banks: A DSGE Perspective

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Abstract

The monetary policy transmission mechanism changed after the 2008 crisis. Evidence shows that credit markets and the banking system play now a predominant role in the pass-through of monetary policy to the real economy. This paper examines the monetary transmission mechanism in a Dynamic Stochastic General Equilibrium (DSGE) model that; on the one hand, includes a financial accelerator that operates through collateral constraints in credit markets, and, on the other hand, also presents regulatory constraints on the banking sector. Results show that the financial accelerator effects make monetary policy more effective, in line with the rest of the literature. However, the introduction of banks reduces part of this effectiveness due to regulatory requirements on bank capital, as observed during the crisis time. Furthermore, an optimal monetary policy analysis concludes that when adding all these ingredients into the model, monetary policy should respond more strongly to output and less to inflation than in a standard model new Keynesian model, due to the inclusion of extra distortions that create welfare trade-offs among agents.

Keywords: Monetary Policy, Pass-through, Credit, Banks, Collateral Constraints, Financial Accelerator

JEL Classification: E32, E44, E58

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1 Introduction

The 2008 crisis proved that the link between monetary policy and the economic activity through credit markets is crucial. In particular, monetary policy transmits itself to the real economy, not only through changes in banks' liabilities but also by inducing changes in banks' assets (i.e. total credit to the economy). In this new economic environment, credit markets have not only been a source of shocks to the economy but also a central channel in the transmission of shocks coming from other sectors in the economy.

There is evidence that the transmission of monetary policy has changed after the crisis. Wealth effects have strongly operated through credit markets but overall, the transmission of policy rates to bank lending rates has weakened. Melvin and Taylor (2009) consider the possibility that a break in the transmission of monetary policy occurred in July 2007 because of the financial turmoil. Blot and Labondance (2013) also show that the financial turmoil since August 2007 has affected drastically the interest rate pass-through in the eurozone. The extent to which policy actions pass through to consumer interest rates determines, in part, the effectiveness of monetary policy. Illes and Lombardi (2013) find that the difference between lending rates and policy rates is particularly high in peripheral euro area countries. Moreover, Darracq-Paries et al. (2014) find that on the one hand, financial shocks have also contributed to amplify business cycles in the euro area through the financial sector. On the other hand, they also show that financial factors have played a key role during the crisis, dampening euro area GDP growth at the peak of the crisis, namely around mid-2009. The reasons underlying such a break in the transmission channels are related to the financial position of borrowers, emphasizing the role of the credit channel when borrowing depends on borrower's wealth. Kato et al. (1999), for instance, have shown in a simple model of the bank loan market that monetary policy becomes less effective when the borrowers' net worth is decreasing.

However, with the subprime crisis, the financial situation of the lenders – the banking system – must also be taken into account. Banks play an important role in the transmission of monetary policy, especially in the euro area where borrowers rely more heavily on the banking systems to raise funds.[1] Although wealth effects may strengthen the effectiveness of monetary policy, regulatory requirements may weaken it (See Rubio and Carrasco-Gallego, 2014). When monetary policy tightens, the reduction in available bank reserves forces banks to create fewer reservable deposits. Banks must then either

[1] For a comparison, loans to the private sector granted by banks amounted to 145 % of GDP in 2007 in the euro area against 63 % of GDP in the United States.

replace the lost reservable deposits with nonreservable liabilities, or shrink their assets, such as loans and securities, in order to keep total assets in line with the reduced volume of liabilities. These two forces oppose each other and may end up in a reduction in the pass-through strength, as shown by the evidence.[2] Thus, the consequences of all these financial developments on the borrowing side and on the bank interest rate pass-through, should then be tested in a model with credit and a banking sector, so that the mechanisms are disentangled.

The aim of this paper is to understand the monetary policy pass-through after the crisis and its consequences for policy making, emphasizing the role of credit in the transmission of shocks to the economy. In order to do that, I use a DSGE model with collateral constraints and a banking sector. Collateral constraints appear both in the demand and the supply-side of credit, since they affect both borrowers and banks. In this way, the financial accelerator that was missing in the standard new Keynesian model is present. Thus, I approximate the pre-crisis world by the standard new Keynesian model while approximating the post- crisis world by the model with collateral restrictions and capital regulation in the banking sector.[3]

This paper is related to different strands of the literature. For example, Pescatori and Mendicino (2005), Rubio (2014) and Clerc et al. (2015) incorporate collateral constraints and housing in their DSGE model and investigate the cyclical and welfare effects of different types of monetary policy. However, they do not explore how the presence of an explicit banking system affects the results. Iacoviello (2015) incorporates collateral constraints and a banking sector in the same spirit but does not analyze their effects on welfare and optimality of monetary policy. Benes and Kumhof (2011), Angeloni and Faia (2013), Quint and Rabanal (2014), Angelini et al. (2014) and Bailliu et al. (2015) perform a more complex welfare analysis in which they study the interaction between monetary policy and optimal pro- and countercyclical capital regulation in the banking sector. However, they do not disentangle the effects that collateral constraints and banks have on the transmission of monetary policy and on its effectiveness, which is the main contribution of the present paper.

I study the effectiveness of monetary policy through a Taylor curve analysis. Then, I analyze the optimal monetary policy when credit markets and banks are added to the model. Results show that, as opposed to the standard new Keynesian framework, in a model with banks and collateral constraints,

[2] Although, out of the scope of this paper, there have also been other developments (advanced economies hitting the zero lower bound, implementation of quantitative easing and other unconventional policies, etc.) that may have led to a change in the transmission and effectiveness of monetary policy.

[3] I am aware that such financial frictions are not specific to the period after 2008 but their importance and size has become evident and emphasized by the outbreak of the Global Financial Crisis.

monetary policy should respond more strongly to output than to inflation, because of the presence of borrowers and banks, and the collateral constraint distortion.

The rest of the paper is structured as follows. Section 2 describes the modeling framework. Section 3 presents results. Section 4 concludes.

2 Model Setup

The modelling framework is a DSGE model with a housing market, following Iacoviello (2015), which includes a banking sector. The economy features patient and impatient households, bankers and firms. Households work and consume both consumption goods and housing. Patient and impatient households are savers and borrowers, respectively. Financial intermediaries intermediate funds between consumers. Bankers are credit constrained in how much they can borrow from savers, and borrowers are credit constrained with respect to how much they can borrow from bankers. As in the standard new Keynesian model, the representative intermediate-good firm converts household labor into the intermediate good. Final good firms use intermediate goods to produce the final good. The central bank follows a Taylor rule for the setting of interest rates. I numerically evaluate welfare for the different agents of the model. Thus, I solve the model using a second-order approximation to the structural equations for given policy and evaluate the utility associated to each individual, aggregating across agents.

For comparison purposes, I show results for the standard new Keynesian model (NK).[4] Then, I add collateral constraints for borrowers, which imply a financial accelerator (NK+FA).[5] Finally the full model, also includes a banking sector and collateral constraints both for borrowers and banks (NK+FA+Banks):

Table 1: Model Comparison

Model	**NK**	**NK+FA**	**NK+FA+Banks**
Agents	Representative Consumer	Savers, Borrowers	Savers, Borrowers, Banks
Credit Markets	Perfect/Irrelevant	Imperfect (Collateral Constraints)	Imperfect (Collateral Constraints)
Policy Rate Pass-Through	Perfect	Perfect	Imperfect (Credit Spread)
Frictions	Sticky Prices	Sticky Prices, Credit Frictions	Sticky prices, Credit and Loan Frictions

[4] This is a plain new Keynesian model, in the spirit of a Calvo-Yun setting. This model does include a representative consumer and excludes durable assets, i.e. housing.

[5] This model follows closely Iacoviello (2005).

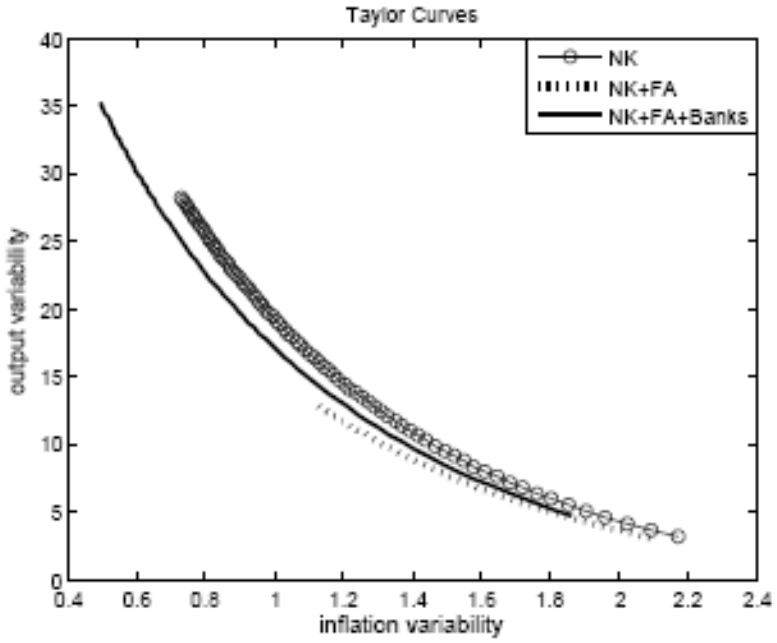

Figure 1: Taylor Curves. NK, NK+FA, NK+FA+Banks

3 Results

3.1 Taylor Curves

In order to correctly assess the effectiveness of monetary policy under the three models considered, I construct Taylor curves (See Figure 1). These curves, also known as policy frontiers, display the output and inflation stability trade-off that central banks face in the presence of supply shocks. These frontiers can be used to rank the effectiveness of policies, in the sense that a curve that is closer to the origin represents a more effective monetary policy.

When collateral constraints are added to the model, and there is therefore a financial accelerator, monetary policy is more effective than if it is not transmitted through credit markets. However, adding also a banking sector makes the Taylor curve shift upwards, placing itself in between the two other models. This is an interesting result because we see that banking regulation makes monetary policy less effective. Capital requirements interfere with monetary policy since lending is restricted and thus the effects of interest rate changes.[6]

[6] The effectiveness of monetary policy is directly related to the tightness of the collateral constraint. Shifts in the Taylor curve are always in the same direction regardless of this parameter but the higher the LTV, the closer the Taylor curve to the origin is. The stronger the wealth effects, the greater the shift. A very restrictive macroprudential policy (meaning cutting LTVs by a large amount) would make shift the Taylor curve less. On the other hand, introducing capital requirements makes monetary policy less effective but this is very robust to the specific values of the requirement. Taylor curve shifts

3.2 Optimal Monetary Policy

Table 2: Optimal Monetary Policy

	ϕ_π^*	ϕ_y^*
NK	5	0
NK+FA	4.3	3.2
NK+FA+Banks	0.2	5

Table 2 presents results for optimal monetary policy parameters corresponding to the three models analyzed, that is, the value of the Taylor rule coefficients that maximize welfare.[7] For the standard new Keynesian model, as it is shown in the literature, monetary policy should strongly respond to inflation and disregard output. However, when collateral constraints are added and financial accelerator effects arise, it is optimal to lower the response to inflation and increase the aggressiveness towards output. Finally, in the model with banks, results reverse with respect to the new Keynesian model. Now, it is optimal for optimal monetary policy to be more aggressive stabilizing output with a lower response with regards to inflation. Therefore, in the new world after the crisis, in which financial constraints are more relevant and banking regulation has become the norm, it is optimal for central banks to respond more strongly to output.

The reasons behind these results lie on the agents that take part in welfare for each model. In the standard new Keynesian model, there is one representative consumer and just one distortion coming from sticky prices. Consumers, are the owners of the firms and are directly affected by the nominal rigidity friction. In order to maximize their welfare, monetary policy should fight aggressively against inflation, to provide them an environment with low inflation volatility. Price stability minimizes the negative effects of the sticky price distortion. However, when we introduce the financial accelerator effect through collateral constraints we are adding a second friction to the model, a credit friction. Monetary policy responding to output moderates the effects of the financial accelerator.[8] In this model, there are two types of consumers: savers and borrowers, and welfare of both agents has to be taken into account when calculating the optimal monetary policy parameters. Savers are the owners of the firms and still concerned about price stability. However, borrowers are added into the picture and they care about the

are not so sensitive to the parameters that regulate credit supply.

[7] For monetary policy, I consider a Taylor rule, which responds to inflation and output growth.

[8] In fact, for simulations, Iacoviello (2005) sets the output parameter in the Taylor rule equal to zero, so that the financial accelerator effects are emphasized.

second distortion, since they are directly affected by the collateral constraint. This generates a trade-off between savers and borrowers' welfare. Thus, the optimal monetary policy will reflect this trade-off. In the model with the financial accelerator, monetary policy is less aggressive against inflation than in the standard new Keynesian model in favor of increasing the responsiveness to output. In this way, the optimal monetary policy is taking care of both distortions by also responding to output.[9] Finally, in the full model, we are adding a third agent, namely banks. We still keep the first and second distortion but we are adding a third one, loan frictions. Loan frictions and credit frictions are closely related, since they both come from collateral constraints, from the banks and borrowers' side, respectively. Now, there are three agents in the model, two of them care about minimizing the effects of frictions coming from collateral constraints and just one is concerned about the sticky price distortion. This is why, for the full model, monetary policy becomes more aggressive towards its output component at the expense of responding less to inflation.[10]

4 Concluding Remarks

In this paper, I develop a DSGE model with a financial accelerator and banks that it is able to account for the observed change in monetary policy that took place during the crisis. Credit markets became more important in the transmission of monetary policy in two senses: on the one hand, the presence of collateral constraints made borrowers more vulnerable to monetary policy effects, amplifying the effects of these shocks. On the other hand, capital requirements on banks and an imperfect pass-through between the policy rate and the lending rate made monetary policy less effective.

A Taylor curve analysis shows that monetary policy is more effective when there is a financial accelerator, coming from the borrowers' side, but part of this effectiveness is lost when banks and banking regulation are included. This is in line with the empirical evidence that shows that during and after the crisis credit markets play an important role in the monetary policy transmission mechanism.

An optimal monetary policy analysis also shows that all these developments in credit markets and in the banking sector have important consequences on how monetary policy should be conducted. Before

[9] See Rubio and Carrasco-Gallego (2015) in which they find that when monetary policy responds to output, it is achieving a macroprudential goal. However, an independent macroprudential regulator would achieve this goal in a more effective way, letting monetary policy take care just of price stability.

[10] Macroprudential policies make monetary policy less effective, and thus we can say they are substitutes to monetary policy. When macroprudential policies come from the borrower's side (i.e. cutting the LTV), they weaken the wealth effects. When they come from the credit supply side (i.e. introducing capital requirements), the effects of changes in the interest rates are mitigated by the restrictions imposed on the availability of credit.

the crisis, when the standard new Keynesian framework was the one prevailing for policy analysis, there was consensus that monetary policy should strongly respond to inflation, almost neglecting the output component of the Taylor rule. Within this framework, there was only one distortion coming from sticky prices, and just one representative consumer, that being the owner of the firm solely cared about minimizing the pervasive effects of this distortion. Under this framework, monetary policy aimed at minimizing the negative effects of this friction and therefore was mainly concerned about price stability. However, the crisis has proven that new elements have to be added to the framework if we want to realistically reflect those events. In particular, if we include in the model collateral constraints and banks, unless additional policies are considered, monetary policy is in charge of minimizing both distortions, maximizing welfare of savers, borrowers and banks. In this case, it should respond more strongly to output and less to inflation than in the standard model.

Appendix

Table A1: Parameter Values		
β_s	.99	Discount Factor for Savers
β_b	.98	Discount Factor for Borrowers
β_f	.965	Discount Factor for Banks
j	.1	Weight of Housing in Utility Function
η	2	Parameter associated with labor elasticity
k	.80	Loan-to-value ratio
α	.64	Labor income share for Savers
ρ_A	.9	Technology persistence
BIII CRR	.105	CRR for Basel III

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