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The role of financial shocks in business cycles with a liability side financial friction

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ABSTRACT

The paper investigates the role of investment specific technology shock within the particular type of financial friction of Gertler and Karadi (2011) and the impact of direct financial shock into this, such as a net worth shock, using US data. The paper explicitly shows how the bank balance sheet effect of counter cyclical movement of capital price attenuates such investment shocks and the extent depends on the type of financial shocks included in the model. Because of the construction of capital quality shock in such financial friction model, we need to incorporate a direct net worth shock while analysing the role of financial shock. This highlights finance sector as a fundamental source of shocks apart from amplifier of shocks originating in elsewhere of the economy.

1. Introduction

One of the most central questions of modern macroeconomics is, what are the prime sources of business cycles?, And economists have not reached any consensus yet on the answers. Neoclassical theories often consider neutral technology shock as the main driver of output movement (King and Rebelo, 1999). The seminal work of (Smets and Wouters, 2007) concludes that two 'supply shocks' – neutral technology, and wage markup shocks – are the primary sources of variation in output. From the aftermath of the financial crisis of 2007–2009, it became vividly apparent that any shocks originating in the financial sector can be disastrous to both financial and real sector variables through a balance sheet channel. The financial friction proposed by Gertler and Karadi (2011) is one among various attempts in the literature to design the real world financial frictions. Gertler and Karadi (2011) introduce an agency problem between bankers and depositors in a way that bankers may divert a fraction of the funds to the households bankers belong to. The introduction of such moral hazard problem is to bring an elegant technique that would put a limit on intermediaries' ability to expand assets infinitely. This creates an endogenous constraint on the intermediaries' leverage ratios which ties the overall credit supplies to the equity capital of the intermediaries. In order to analyse the financial crisis scenario, Gertler and Karadi (2011) incorporate a capital quality shock, which is a novel feature of their model.

In this paper, I incorporate the financial friction proposed by Gertler and Karadi (2011) into the otherwise standard New Keynesian DSGE model in order to empirically analyse US business cycles and the roles of financial and investment specific technology (Marginal Efficiency of Investment (MEI)) shocks. Hence the main research question is, what is the mechanism (hence, role) of investment specific technology (MEI) shock in presence of a banker-depositor type financial friction and financial shocks, such as the net worth and capital quality shocks, when the model contains both output and labour price rigidities? In addition, the paper seeks the relative importance of capital quality and bank net worth shocks, in terms of their ability to explain variations in output and interest spread. The latter part is closely related to the former because it shows which finance based shock is important to be included in the model to identify the true role of MEI and others shocks at business cycles. For this, identification strategy for disentangling the two financial shocks is crucial.

The research questions are interesting in two main dimensions. Since the paper investigates the balance sheet impacts of financial frictions and shocks on the transmission mechanism of MEI shock, the first dimension relates to the treatment of financial shocks within Gertler and Karadi (2011)'s framework. In their model, capital quality shock enters through the physical capital accumulation process which originates in the non-financial sector (e.g housing sector) and affects the asset side of bank balance sheets through the change in collateral

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value. The shock is categorised as financial because of the balance sheet identity between the assets and the liabilities. Here, banks play amplification roles for the shock that originates elsewhere in the economy. The amplification role of banks is well known in the literature and a number of literature suggests that the degree of amplification resulting from credit constraints is empirically limited outside the crisis period (Kocherlakota, 2000; Cordoba and Ripoll, 2004). The way the capital quality shock is constructed in Gertler and Karadi (2011)'s framework does not rule out the possibility of any physical destruction of capital machineries (including housing). Whether a 'qualitative' destruction or a 'physical' destruction of capital, the shock is directly related to the physical capital stock of the economy which can affect both bank dependent and less dependent agents strongly. Therefore, this shock is different from any exogenous changes in bank net worth arising directly within the financial sector. Examples of such events can be a sectoral tax on financial intermediation, an increase in the Capital Adequacy Ratio (CAR), an increase in the central bank's requirements for minimum equity capital, a change in the classification of Tier 1 and Tier 2 capital, or any other events not explicitly included in the model but affect the share price (equity) of the banks. So, I assess and quantify the impacts of bank net worth shock within Gertler and Karadi (2011)'s financial friction along with capital quality shock. Because bank's role as an independent source of fluctuations deserves separate treatment from the role as amplifier of shocks originating in elsewhere of the economy when estimating financial shocks. The net worth shock, in contrary to capital quality shock, will compress the profit in the finance sector relative to the broader economy, especially compared to the sector distant from financial intermediation and debt (see Fornari and Stracca, 2013 for example).

The second dimension relates to the role of nominal wage rigidities as the calibrated model of Gertler and Karadi (2011) does not incorporate any labour market imperfections. The work of Justiniano et al. (2010) shows the importance of MEI shock in the movements of output in a model without any financial sector. Sanjani (2014) estimated Gertler and Karadi (2011)'s model without labour market imperfections for the US data and found the largest role for capital quality shock while a negligible role for the MEI shock in output variations. Justiniano et al. (2010) argue that ignoring imperfections in the product and labour market is one reason that some early neoclassical studies do not find any significant role played by MEI shock in the business cycles. Due to nominal frictions in the goods and the labour markets, the efficiency condition becomes $\mu\left(\underset{-}{L}\right)MRS\left(\underset{+}{C},\underset{+}{L}\right)=MPL\left(\underset{-}{L}\right)$, where C is consumption and L is labour hours (Justiniano et al., 2010). The equation is different from the neoclassical benchmark because of the presence of an endogenous markup term, μ, which is a summation of the price and the wage markups. Thus, μ creates a wedge in the efficiency condition between the marginal rate of substitution (MRS) between C and L and the marginal product of L (MPL). When μ is ignored, as in earlier neoclassical models, C has to decrease if L increases, to maintain the efficiency condition. With μ, when a positive investment shock hits the economy, the equilibrium L can increase without any decrease in C, as both the price and wage markups drop, generating a positive shift in labour demand (see Justiniano et al., 2010 for more). Thus, labour market imperfections and nominal wage rigidities have important role in analysing the impact of MEI shock in a financial friction model.

What is new in my study is that I analyse the transmission mechanism of investment (MEI) shock within a financial friction (Gertler and Karadi, 2011) model in presence of various shocks including financial, and show explicitly what role nominal wage rigidities play in it during the post war period in the US. Most importantly, I show the type of financial shock included in the model has important implications in identifying the role of investment specific shock. Second, I present a comparative analysis whether finance sector is merely an amplification device for collapse of assets value that originate in non-finance sector or, other (fundamental) shock in finance sector, is independently important. Finally, the paper identifies shock that is the main driver of fluctuations in a bank's net worth and spread. Thus, the paper contributes to the literature by revisiting the factors contributing to the US business cycles.

Although a number of literature (Meh and Moran, 2010; Gerali et al., 2010; Chen, 2001, for example) has analysed the role of bank net worth shock, this paper highlights the need to disentangle net worth shock from capital quality shock as a finance based shock within the Gertler and Karadi (2011)'s framework and quantify their relative impacts.Meh and Moran (2010) identify the financial shock as a direct exogenous change in bank net worth (such as tax on bank capital). Fornari and Stracca (2013) suggest that bank capital is a key tool of financial intermediaries' debt production capacity, therefore, the shock may have wider consequences for financing conditions and the real economy. Other studies, apart from Sanjani (2014), have estimated the financial friction model of Gertler and Karadi (2011), however, not all of them estimate the net worth shock and if they do, they find no substantial impact of the net worth shock. For example, Villa and Yang (2011) analyse the empirical properties of the model without labour market heterogeneity with UK data, and find no substantial role for the net worth shock. Another study, Villa (2013), compares the performances of three models (Smets and Wouters, 2007; Bernanke et al., 1999; Gertler and Karadi, 2011) while replicating the Euro area business cycles and finds that the Gertler and Karadi (2011)'s model outperforms the other two models in fitting the Euro area data. In order to make the three models comparable, Villa (2013) modifies the Gertler and Karadi (2011) version and includes only the MEI shock, not the capital quality shock. However, Villa (2014) estimates both MEI and capital quality shocks for the Euro area and the US but not financial net worth shock. Another study containing similar financial frictions is by Görtz and Tsoukalas (2012), who construct a two sectors real economy following Huffman and Wynne (1999), which analyses the impacts of financial news shocks in sectoral and aggregate fluctuations. These gaps in the literature and better fit of Gertler and Karadi (2011)'s model to actual data found in previous estimation examples, along with the interesting facts discussed above, motivate further work with this financial friction.

The main results are that investment specific technology shock is weakened in the long run when the model includes financial friction and the type of finance base shock we include has implications in quantifying this impact. There appears to have benefits in disentangling the net worth and capital quality shock in terms of model's ability to replicate moments and other business cycle properties, in which net worth shock provides better fit.

The rest of the paper is organised as follows: The model description is in Section 2. The properties of the data, estimation and identification issues are available in Section 3. Next, Section 4 discusses the estimated parameters, and Section 5 analyses fit of the estimated model. Section 6 contains the application of the estimated model and Section 7 shows the robustness of the baseline estimates. Finally, Section 8 concludes the discussion.

2. Model

This section contains only brief features of the model and some explanatory notes on transmission mechanisms where needed. A detailed model description and mathematical derivation are skipped where they are well known and same as in the cited literature. All model equations and their log-linearized version are listed in the Appendix B.