



A model of unconventional monetary policy

Mark Gertler^{a,*}, Peter Karadi^{a,b,1}

^a New York University, United States

^b National Bank of Hungary, Hungary

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ABSTRACT

We develop a quantitative monetary DSGE model with financial intermediaries that face endogenously determined balance sheet constraints. We then use the model to evaluate the effects of the central bank using unconventional monetary policy to combat a simulated financial crisis. We interpret unconventional monetary policy as expanding central bank credit intermediation to offset a disruption of private financial intermediation. Within our framework the central bank is less efficient than private intermediaries at making loans but it has the advantage of being able to elastically obtain funds by issuing riskless government debt. Unlike private intermediaries, it is not balance sheet constrained. During a crisis, the balance sheet constraints on private intermediaries tighten, raising the net benefits from central bank intermediation. These benefits may be substantial even if the zero lower bound constraint on the nominal interest rate is not binding. In the event this constraint is binding, though, these net benefits may be significantly enhanced.

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1. Introduction

Over most of the post-war period the Federal Reserve conducted monetary policy by manipulating the Federal Funds rate in order to affect market interest rates. It largely avoided lending directly in private credit markets.

After the onset of the sub-prime crisis in August 2007, the situation changed dramatically. To address the deterioration in both financial and real activity, the Fed directly injected credit into private markets. It began in the fall of 2007 by expanding the ease at which financial institutions could obtain discount window credit and by exchanging government debt for high grade private debt. The most dramatic interventions came following the collapse of the shadow banking system that followed the Lehman Brothers failure. At this time the Fed began directly lending in high grade credit markets. It provided backstop funding to help revive the commercial paper market. It also intervened heavily in mortgage markets by directly purchasing agency debt and mortgage-backed securities. There is some evidence to suggest that these policies have been effective in reducing credit costs. Commercial paper rates relative to similar maturity Treasury Bills fell dramatically after the introduction of backstop facilities in this market. Credit spreads for agency debt and mortgage-backed securities also fell in conjunction with the introduction of the direct lending facilities.

The Fed's balance sheet provides the most concrete measure of its credit market intervention: since August 2007 the quantity of assets it has held has increased from about 800 billion to over two trillion, with most of the increase coming after the Lehman collapse. Most of the increase in assets the central absorbed were financial instruments previously held by the shadow banks. Further, it financed its balance sheet expansion largely with interest bearing reserves, which are in effect overnight government debt. Thus, over this period the Fed has attempted to offset the disruption of a considerable

* Corresponding author.

E-mail address: mark.gertler@nyu.edu (M. Gertler).

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fraction of private financial intermediation by expanding central bank intermediation. To do so, it has exploited its ability to raise funds quickly and cheaply by issuing (in effect) riskless government debt. Overall, the Fed's unconventional balance sheet operations appeared to provide a way for it to stimulate the economy even after the Federal Funds reached the zero lower bound.

At the same time, operational models of monetary policy have not kept pace with the dramatic changes in actual practice. There is of course a lengthy contemporary literature on quantitative modeling of conventional monetary policy, beginning with [Christiano et al. \(2005\)](#) and [Smets and Wouters \(2007\)](#). The baseline versions of these models, however, assume frictionless financial markets. They are thus unable to capture financial market disruptions that could motivate the kind of central bank interventions in loan markets that are currently in play. Similarly, models which do incorporate financial market frictions, such as [Bernanke et al. \(1999\)](#) have not yet explicitly considered direct central bank intermediation as a tool of monetary policy. Work that has tried to capture this phenomenon has been mainly qualitative as opposed to quantitative (e.g. [Kiyotaki and Moore, 2008](#); [Adrian and Shin, 2009](#)). Accordingly, the objective of this paper is to try to fill in this gap in the literature: the specific goal is to develop a quantitative macroeconomic model where it is possible to analyze the effects of unconventional monetary policy in the same general manner that existing frameworks are able to study conventional monetary policy.

To be clear, we do not attempt to explicitly model the sub-prime crisis. However, we do try to capture the key elements relevant to analyzing the Fed's credit market interventions. In particular, the current crisis has featured a sharp deterioration in the balance sheets of many key financial intermediaries. As many observers argue, the deterioration in the financial positions of these institutions has had the effect of disrupting the flow of funds between lenders and borrowers. Symptomatic of this disruption has been a sharp rise in various key credit spreads as well as a significant tightening of lending standards. This tightening of credit, in turn, has raised the cost of borrowing and thus enhanced the downturn. The story does not end here: the contraction of the real economy has reduced asset values throughout, further weakening intermediary balance sheets, and so on. It is in this kind of climate, that the central bank has embarked on its direct lending programs.

To capture this kind of scenario, accordingly we incorporate financial intermediaries within an otherwise standard macroeconomic framework. To motivate why the condition of intermediary balance sheets influences the overall flow of credit, we introduce a simple agency problem between intermediaries and their respective depositors. The agency problem introduces endogenous constraints on intermediary leverage ratios, which have the effect of tying overall credit flows to the equity capital in the intermediary sector. As in the current crisis, a deterioration of intermediary capital will disrupt lending and borrowing in a way that raises credit costs.

To capture unconventional monetary policy in this environment, we allow the central bank to act as intermediary by borrowing funds from savers and then lending them to investors. Unlike private intermediaries, the central bank does not face constraints on its leverage ratio. There is no agency problem between the central bank and its creditors because it can commit to always honoring its debt (which as we noted earlier is effectively government debt.) Thus, in a period of financial distress that has disrupted private intermediation, the central bank can intervene to support credit flows. On the other hand, we allow for the fact that, everything else equal, public intermediation is likely to be less efficient than the private intermediation. When we use the model to evaluate these credit interventions, we take into account this trade-off.

Section 2 presents the baseline model. The framework is closely related to the financial accelerator model developed by [Bernanke et al. \(BGG, 1999\)](#).² That approach emphasized how balance sheet constraints could limit the ability of non-financial firms to obtain investment funds. Firms effectively borrowed directly from households and financial intermediaries were simply a veil. Here, as we discussed, financial intermediaries may be subject to endogenously determined balance sheet constraints. In addition, we allow for the central bank to lend directly to private credit markets.

Another difference from BGG is that, we use as a baseline framework the conventional monetary business cycle framework developed by [Christiano et al. \(CEE, 2005a\)](#), [Smets and Wouters \(SW, 2007\)](#) and others. We adopt this approach because this framework has proven to have reasonable empirical properties. Here we use it to study not only conventional interest policy but also unconventional credit market interventions by the central bank.

Section 3 presents a quantitative analysis of the model. We illustrate how financial factors may amplify and propagate some conventional disturbances. We also consider a disturbance to the underlying quality of intermediary assets (a "valuation shock") and then show how this kind of disturbance could create a contraction in real activity that mirrors some of the basic features of the current crisis. As we show, either an actual decline in asset quality or the expectation (e.g. "news") of a future decline can trigger a crisis. We then illustrate the extent to which central bank credit interventions could moderate the downturn. Finally, we show the stabilization benefits from credit policy are magnified if the zero lower bound on nominal interest rates is binding.

In Section 4, we undertake a normative analysis of credit policy. We first solve for the optimal central bank credit intervention in crisis scenario considered in Section 3. We do so under different assumptions about the efficiency costs of central bank intermediation. We then compute for each case the net welfare gains from the optimal credit market

² The theory underlying the financial accelerator was developed in [Bernanke and Gertler \(1989\)](#). For quantitative frameworks, in addition to BGG, see [Carlstrom and Fuerst \(1997\)](#), [Iacovello \(2005\)](#), [Goodfriend and McCallum \(2007\)](#), [Gilchrist et al. \(2009\)](#), [Jermann and Quadrini \(2010\)](#), [Mendoza \(2010\)](#) and [Christiano et al. \(2010\)](#). As an example of recent theory, see [Brunnermeier and Sannikov \(2010\)](#).

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