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Did the TARP Expand or Contract Bank Lending? A Numerical Simulation Using a Financial Accelerator Model

Yuki Takahashi
State University of New York at Stony Brook

Abstract

This paper examines whether capital injections implemented under the Troubled Assets Relief Program (TARP) expanded or contracted bank lending within a general equilibrium framework. Using Gertler and Kiyotaki (2010)'s financial accelerator model, an economy that is hit by a financial crisis but injects government capital into its banks as a policy response is simulated. The simulation results imply that the TARP capital injections were likely to have contracted bank lending. However, the simulation results do not rule out the possibility that the TARP capital injections benefited the economy through channels other than lending expansion. These implications contribute to the literature on the effectiveness of the TARP capital injections on bank lending, which has been a subject of empirical studies.

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Contact: Yuki Takahashi - yuki.takahashi.1@stonybrook.edu.
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1. Introduction

Empirical debates have been spurred on whether capital injections implemented under the Troubled Assets Relief Program (TARP) during the global financial crisis 2008 expanded or contracted bank lending (Li, 2013; Montgomery and Takahashi, 2014). This paper examines this question from a general equilibrium perspective by simulating the TARP capital injections using Gertler and Kiyotaki (2010)'s financial accelerator model, which incorporates credit market frictions to real business cycle model.

The simulation results support the lending contraction story. In the model economy, the TARP capital injections contract bank lending, since banks keep the injected capital on their book rather than lend it to firms. However, the TARP capital injections increase output and employment, which pose a question whether the TARP capital injections can be considered as a failure.

The rest of the paper is organized as follows. The next section presents and discusses the model and the simulation method and section 3 the simulation results. General equilibrium nature of the analysis provides new insights to the existing empirical debates. Section 4 concludes.

2. Model and Simulation Method

The model economy consists of households, non-financial firms, banks and a government. In the first period, the model economy receives an unanticipated negative shock to asset price as a financial crisis as well as the Treasury's capital injection into its banks as a policy response. Since the model is based on Gertler and Kiyotaki (2010), only structure and size of the TARP capital injections are presented and discussed. Online appendix presents the full model as well as its steady state and parameter values.[1]

Structure of the TARP capital injections is simply modeled as an AR(1) process.

$$S_{get} = \rho_g S_{get-1} + u_{it} \tag{1}$$

Where S_{get} is the TARP funds at period t (a period corresponds to a quarter), ρ_g is persistence parameter that determines the length of the TARP funds staying on banks' book. u_{it} is white noise. The idea of this formulation is that the Treasury responds to a negative shock in asset price with a positive shock to asset quantity.[2]

The persistence parameter is determined as follows. According to the "TARP Transactions Report",[3] the Treasury implemented the TARP capital injections from 2008Q4 to

[1] Online appendix is available from the Economics Bulletin website.

[2] Gertler and Kiyotaki (2010) model the Federal Reserve's direct lending such that it supplies assets to the market as long as the loan-deposit interest rate spread is above the steady state level. However, Gertler and Kiyotaki (2010)'s formulation assumes that the Federal Reserve can supply unlimited amount of assets, which is unrealistic assumption for a fiscal authority's intervention to the market. In fact, the maximum amount of the TARP capital injections was capped to $250 billion.

[3] http://www.treasury.gov/initiatives/financial-stability/reports/Documents/10-29-10%20Transactions%20Report%20as%20of%2010-27-10.pdf.

2009Q4 and only 16.8% of the initial TARP funds stayed on banks' book by the end of 2010Q4 as most banks repaid capital by that time. Thus, persistence parameter, ρ_g, is set to 0.82 so that by the end of 9th period 16.8% of the TARP funds remain on banks' book.

Size of the TARP capital injection is determined by the following equation.

$$\frac{Q_g^{ss} S_{ge}^{\text{1st period}}}{N^{ss}} = \frac{\text{Total amount of the TARP funds injected}}{\text{Total banking sector equity by the end of 2008Q3}} \tag{2}$$

Where $S_{ge}^{\text{1st period}}$ is the TARP funds in the 1st period, Q_g^{ss} is steady state value of the Treasury's pricing of bank assets, which is 1.002, and N^{ss} is steady state value of bank equity capital, which is 1.762.

The Treasury injected capital for amount of $204.9 billion. In addition, total banking sector equity in the third quarter of 2008, one quarter before the TARP capital injections, was $\$1,145.0$ billion.[4] Thus, a 0.315 shock is given to u_{it} in the 1st period so that banks are injected $204.9 billion of the TARP funds.

3. Simulation Results

3.1. No Intervention vs. Direct Lending

This paper first replicates Gertler and Kiyotaki (2010)'s simulation results to confirm that the model is correctly approximated, in which the Federal Reserve purchases private sector assets via direct lending.[5] Figure 1 plots simulation results without and with direct lending (solid and dashed lines, respectively). Each plot shows deviation from the steady state, so 0 is steady state for all panels.

In short, the Figure 1 is consistent with Gertler and Kiyotaki (2010)'s findings. According to Gertler and Kiyotaki (2010), the crisis was magnified through banking sector since a decline in asset price depreciated value of bank equity capital and tightened banks' borrowing constraint. This increased the gross return on assets intermediated by banks because there was now less supply of credit and increased loan-deposit spread. The increase in loan-deposit spread led to a decline in investment and output.

Keeping this mechanism in mind, Figure 1 shows that in the model economy, asset price drops without policy intervention. This leads to a decline in value of bank equity capital and an increase in loan-deposit spread. The high cost of borrowing leads to a decline in investment and output.

When the Federal Reserve intervenes via direct lending, however, asset price does not decline or even slightly increases. As a result, value of bank equity capital does not decline

[4] `http://www.federalreserve.gov/datadownload/Choose.aspx?rel=H.8`.

[5] The policy parameter showing the degree of the Federal Reserve's commitment to alleviate widening of loan-deposit spread via direct lending, ν_g, is set to 100, following Gertler and Kiyotaki (2010). In addition, the inefficiency terms associated with direct lending, τ, is simply set to 1.2 to minimize the effect of direct lending on outcome and other policy variables through conventional channel.

much and loan-deposit spread stays at almost its steady state level. As a result, investment and output slightly increase.

3.2. No Intervention vs. the TARP

Confirming that the model is properly approximated, this paper now examines the effect of the TARP capital injections.[6] The simulation results are plotted in Figure 2, with solid line being no policy intervention and dashed line being the TARP capital injections.

Figure 2 shows that in the model economy, the TARP capital injections decrease asset price *more than* the case without policy intervention, which declines value of bank equity capital and increases loan-deposit spread. The increase in loan-deposit spread decreases investment. Output increases, however, thanks to increase in government expenditure.

The simulation results are interpreted as follows: banks keep injected assets on their book rather than lending them to firms. Therefore, supply of deposits increases. This motivates households to consume less and work more for the future. The increase in labor supply increases marginal product of capital and the increase in marginal product of capital increases return on assets and loan-deposit spread. The increase in loan-deposit spread, however, decreases investment and physical capital. The decrease in investment decreases marginal cost of physical capital production and asset price.[7] The decline in asset price decreases value of bank equity capital and further reduces lending. Thus, the TARP capital injections contract bank lending in the model economy.

3.3. Discussion of the Results

Although the simulation results imply that the TARP capital injections were likely to have contracted bank lending, the simulation results also imply two benefits the TARP capital injections may have had. First, the TARP capital injections at least increase output in the model economy. This implies that the TARP capital injections were likely to have prevented worsening of the crisis, which must have been the most important policy objective (Montgomery and Takahashi, 2014).

Second, the TARP capital injections increase the model economy's employment, a key indicator for economic recovery.[8] Thus, these points imply that the TARP capital injections may have benefited the economy through channels other than increase in bank lending.

4. Conclusions

This paper examines the effect of capital injections implemented under the Troubled Assets Relief Program (TARP) on bank lending with a numerical simulation using Gertler

[6] As for direct lending, the inefficiency terms associated with the TARP capital injections, τ_e, is also set to 1.2 to minimize the effect of unconventional fiscal policy on outcome and other policy variables through conventional channel.

[7] From the identity in equation (A12) in the appendix.

[8] Berger and Roman (2014) find evidence in support of this point.

and Kiyotaki (2010)'s financial accelerator model. The simulation results imply that the TARP capital injections were likely to have contracted bank lending.

However, the simulation results also imply that the TARP capital injections may have increased output and employment, the important indicators for the economy. These implications call policymakers and economists for reassessments of the effect of the TARP capital injections from a broader perspective.

Thus, this paper provides new insights to the literature on the effectiveness of the TARP capital injections on bank lending in a general equilibrium setup.

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Figure 1: No Intervention vs. Direct Lending

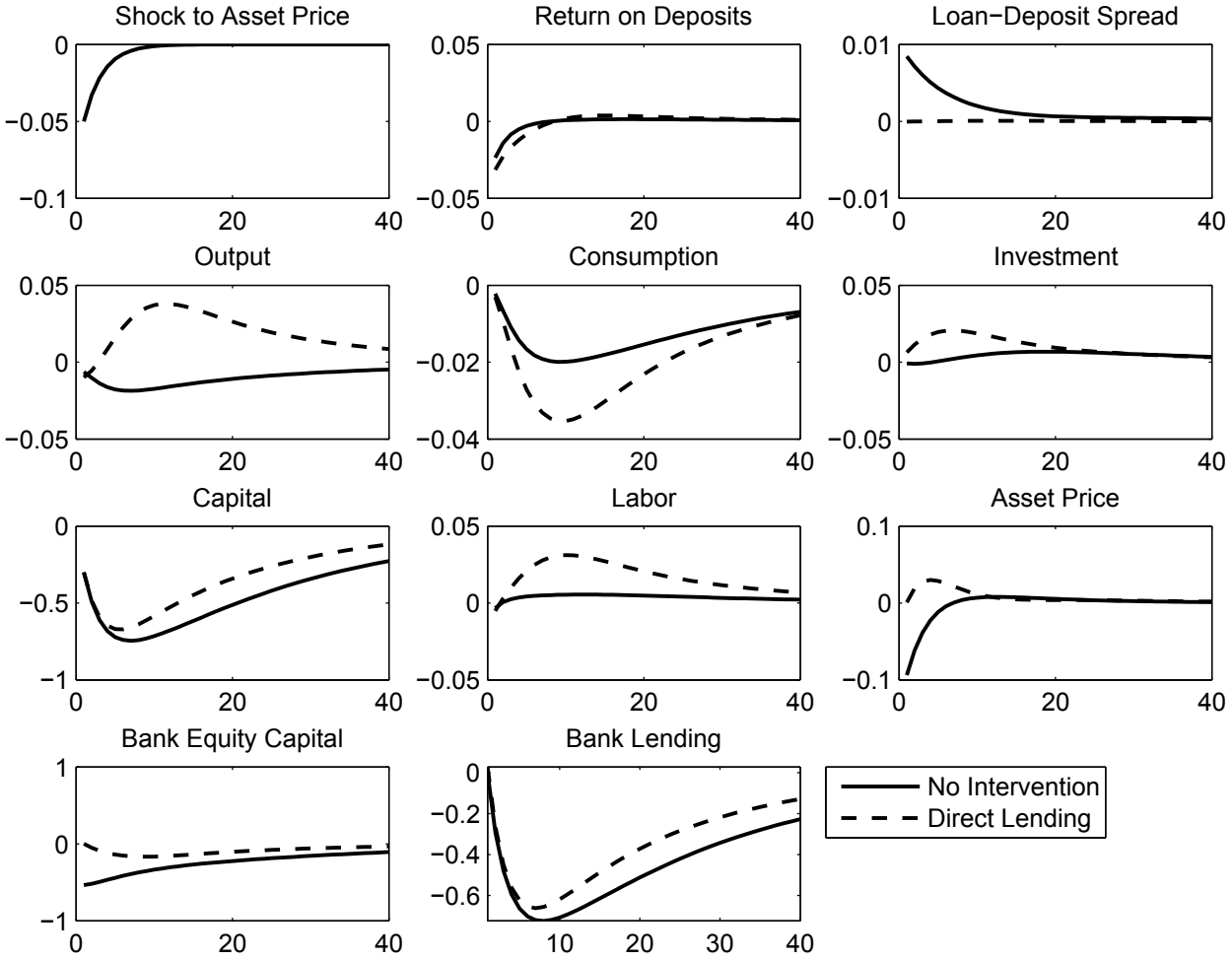

Figure 2: No Intervention vs. the TARP