2015

Monetary Expansion and Bank Credit: A Lack of Spark

Lucjan T. Orlowski
Sacred Heart University, orlowskil@sacredheart.edu

Recommended Citation

Orlowski, L.T. Monetary expansion and bank credit: A lack of spark. Journal of Policy Modeling (2015), http://dx.doi.org/10.1016/j.jpolmod.2015.03.013

+Model
JPO-6203; No. of Pages 10
ARTICLE IN PRESS

Available online at www.sciencedirect.com

ScienceDirect

Journal of Policy Modeling xxx (2015) xxx–xxx

Journal of Policy Modeling

www.elsevier.com/locate/jpm

Monetary expansion and bank credit: A lack of spark

Lucjan T. Orlowski *

Department of Economics, Sacred Heart University, 5151 Park Avenue, Fairfield, CT 06825, USA

Received 20 January 2015; received in revised form 28 February 2015; accepted 15 March 2015

Keywords: Quantitative easing; Monetary policy transmission; Credit channel; Portfolio balance channel; Excess reserves

1. Introduction

This paper aims to evaluate the effects of the Federal Reserve monetary expansion over the past 15 years on the credit channel of monetary policy transmission. To do so, we analyze the allocation of the Fed vast liquidity injections by the U.S. banks. The underlying hypothesis is that the considerable monetary expansion neutralized the bank credit expansion as banks channeled borrowed liquidity into other assets.

The monetary expansion was propelled by the financial crisis of 2007–2008. The crisis led to the rapid deterioration of asset performance and liquidity of the banking system. Among the key factors contributing to the crisis was the excessive accumulation of US household debt that reached 136% of households' disposable income by mid-2007 (Orlowski, 2008). Nevertheless, the crisis necessitated further monetary easing, even though the household debt reached an apparent ceiling. In order to provide liquidity to the banking system the Fed employed unconventional monetary policy tools[1].

As the policy interest rate was at its lower bound already prior to the financial crisis the Fed resorted to conducting monetary policy through its balance sheet management (Bernanke, 2012; Woodford, 2012; Thornton, 2014). This unconventional monetary policy follows the precepts of

* Tel.: +1 203 371 7858; fax: +1 203 371 7858.
E-mail address: OrlowskiL@sacredheart.edu

[1] In 2008 the Fed established several liquidity programs such as Term Auction Facility or Term Asset-Backed Securities Loan Facility. Those programs allowed banks to sell toxic assets to the Fed.

http://dx.doi.org/10.1016/j.jpolmod.2015.03.013

quantitative easing (QE), i.e. a further monetary expansion aimed at stimulating the economy when short-term interest rates are at or near zero level. The QE was carried through the portfolio balance channel[2]. By purchasing large amounts of treasury and agency securities in 2008–2012 the Fed intended to put downward pressure on long-term yields. The Fed believed that declining yields and rising prices would in turn induce investors to rebalance their portfolios and boost economic activities (Bernanke, 2012). The six year-long QE strategy was concluded in October 2014. Subsequently, the Fed has maintained the expansionary monetary policy by keeping the federal funds rate target at zero lower bound.

The monetary expansion has provided banks with massive liquidity injections[3]. We analyze the allocations of this borrowed liquidity by the U.S. banks by focusing on the empirical investigation of the credit channel of monetary policy transmission. Our underlying hypothesis is that the credit channel is ineffective in the presence of large monetary base increases particularly those propelled by QE. We develop a model of changes in the Federal Reserve monetary base as a function of changes in excess reserves, vault cash, bank credit, as well as domestic and foreign security investments. In essence, our model shows allocation of borrowed liquidity into major banks' assets. This functional relationship is empirically tested for the sample period beginning in the first quarter of 1999 and ending in the second quarter of 2014 (62 observations). We employ ordinary least squares (OLS) regression optimized for impact lags, and generalized linear model (GLM) with a logarithmic link function. Both tests indicate the association between the tested variables and do not imply their causal interaction. Robustness of the OLS and GLM test results is verified with a vector autoregressive (VAR) model, along with impulse response functions. Impulse responses allow for assessing causal reactions between changes in bank assets and changes in the monetary base.

Section 2 presents the underlying hypothesis and analytical assumptions. A model of allocation of borrowed liquidity into assets is developed and explained in Section 3. The empirical analysis is conducted in Section 4. The concluding Section 5 summarizes the main findings and provides policy recommendations.

2. Underlying hypothesis and analytical assumptions

Consistently with our key objectives, this study focuses exclusively on the credit channel of monetary policy transmission. We question whether or not the central bank's liquidity injections translate into credit expansion, which normally stimulates economic growth. We look at end-points of the credit channel of policy transmission and analyze the allocation of borrowed liquidity into banks' assets. We identify three types of allocated liquidity:

(a) *Inactive* (*idle*) *liquidity* that is stored by banks as vault cash or reserves.
(b) *Active liquidity*, i.e. allocated to bank loans to consumers and businesses.
(c) *Invested liquidity*, i.e. allocated to investments securities, both domestic and foreign.

[2] The portfolio balance channel stems from the monetary theory and assumes that different classes of financial assets are not perfect substitutes in investors' portfolios for reasons such as regulatory restrictions, transaction costs or risk tolerance. As prices and yields of assets change, investors tend to rebalance their portfolios (Cúrdia & Woodford, 2011; Thornton, 2014).

[3] The monetary base increased from \$552 to \$827 billion during 1999–2007 and expanded to \$3927 billion by the end of 2014. This translates into the increase in the monetary base as a share of nominal GDP from a stable level of 5.7% in 1999 through 2007 to 22.5% in 2014.

Please cite this article in press as: Orlowski, L.T. Monetary expansion and bank credit: A lack of spark. *Journal of Policy Modeling* (2015), http://dx.doi.org/10.1016/j.jpolmod.2015.03.013

A relative combination of these three types of liquidity allocations affects real economic growth, inflation, as well as asset prices in security markets. *Inactive liquidity* has minimal or no impact on credit, economic growth or inflation. It neither increases aggregate demand nor drives up (demand-pull) inflation, therefore, it does not permeate into the economic system. *Active liquidity* that is transformed into the economic system via bank loans contributes to credit growth and aggregate demand expansion as well as to demand-pull inflation. Therefore it may affect economic growth with a relatively short impact lag. *Invested liquidity* affects asset prices and yields through the portfolio balance channel that is believed to stimulate economic growth (Bernanke, 2010, 2012). It has a long impact lag on consumption and business investment (Thornton, 2012; Fawley & Neely, 2013). It may entail large increases in asset prices, and, by extension, in the prices of asset-backed securities, potentially leading to formation of asset-price bubbles.

In agreement with Fawley and Neely (2013) we argue that invested liquidity may restrain banks' credit expansion that has been otherwise historically known to contribute directly to economic growth and job creation. After all, these real economy effects are consistent with monetary policy goals and objectives. Moreover, invested liquidity, particularly when channeled into more risky securities, may lead to formation and unpredictable implosion of asset-price bubbles (Orlowski, 2008). Therefore, while relying on the portfolio balance channel the policy-makers need to monitor the effects of liquidity allocation by banks on the financial markets.

In hindsight, the relative allocation of borrowed liquidity affects inflation risk, market risk, and, potentially in countries with flexible exchange rates and large portfolio capital inflows, the exchange rate risk. Additionally, invested liquidity may exacerbate tail risks in financial markets by contributing to higher asset-price volatility. One shall notice that neither inactive liquidity nor invested liquidity has a predictable impact on consumer inflation.

3. The model of allocation of borrowed liquidity

To analyze the credit channel of policy transmission in the course of monetary expansion we examine the allocation of borrowed liquidity by the banking system. New liquidity can be borrowed directly from a central bank or, more likely, indirectly from the banking system. A central bank supplies liquidity to the banking system either via discount window lending or via open market operations. Banks allocate the new liquidity into various types of assets. They may deposit it on central bank reserves or use it to increase vault cash (inactive liquidity); or to expand lending (active liquidity). They may also invest borrowed liquidity in domestic and foreign securities (invested liquidity). From the standpoint of policy-makers that aim at stimulating the economy through the portfolio balance channel, invested liquidity would be a preferable form of liquidity allocation. As mentioned above, the Fed perceived the portfolio balance channel as an effective policy mechanism for stimulating the economy in the aftermath of the financial crisis.

Prior to the financial crisis the Fed relied on the credit channel of monetary policy transmission, along with other conventional tools and mechanisms. In such scenario, increases in the central bank's monetary base translate into larger money supply and bank credit as explained by the fractional reserve banking theory of credit creation. The theory claims that banks hold reserves only as a stable share of potential deposit withdrawals. Under such assumption, money supply can grow only to a fixed multiple of the base money originally created by a central bank. The fixed money multiplier is a pillar of endogenous money theories, including the Post-Keynesian 'money circuit theory'. As banks' preferences to hold reserves and households' preferences to hold currency are assumed to be stable, a given increase in the monetary base should result in a proportionally larger increase in money supply, which will ultimately foster economic (real

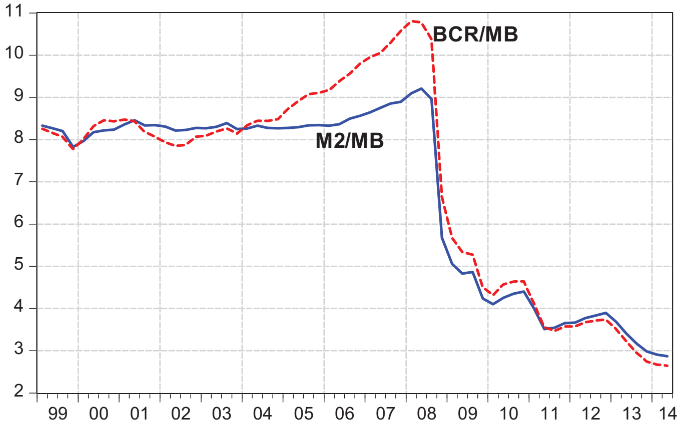

Fig. 1. Ratios of M2 Money and total bank credit to the U.S. monetary base, (M2/MB and BCR/MB, respectively).
Notes: 1999Q1–2014Q2 quarterly data.
Data source: Federal Reserve Bank of St. Louis FRED.

GDP) growth. Taking into consideration the willingness of households to hold currency and the willingness of banks to hold total (required and excess) reserves, the money multiplier mm is specified as

$$\mathrm{mm} = \left(\frac{1 + \mathrm{cd}}{\mathrm{rr} + \mathrm{cd}}\right) \tag{1}$$

where cd is the currency-to-deposit ratio, reflecting households' preferences to hold currency, and rr is the banks' preferred reserve-to-deposit ratio. Neo-classical economists, namely Kydland and Prescott (1990) questioned the business cycle leading function of the money multiplier already in the early 1990s. They provided evidence that the monetary base actually lags the cycle and M1 money is pro-cyclical.

The assumption of a stable money creation multiplier has been rigorous in monetary policy modeling. Historical evidence, particularly from the recent fifteen-year period, shows that the broad money multiplier has not been stable (Fig. 1). It is because individual banks may use their reserves, particularly excess reserves, not necessarily to increase credit, but to buy securities. They may also lend their reserves to other banks. Therefore, preferences of individual banks to hold reserves are not fixed. These preferences are more stable for the entire banking system because of the balancing effect of transfers of reserves between individual banks. But even for the banks in aggregate, the broad money multiplier has recently declined rather abruptly, as shown in Fig. 1. Evidently, the financial crisis undermined stability of the money multiplier approximated either by the M2-to-monetary base, or even more importantly by the total credit-to-monetary base ratios. This stems from a considerably higher banks' preference to hold reserves rr as safe, liquid assets that are in high demand during periods of economic crisis and uncertainty (Fawley & Neely, 2013). The sharp increase in rr not only contributed to the collapse of the multiplier, but it did not translate the base money expansion into growth of credit and money supply.

The instability of the money creation process discussed above deserves a deeper investigation in the context of our underlying hypothesis questioning the effects of central bank liquidity injection on bank credit. We take into consideration the major categories of bank assets: reserves re, vault cash vc, loans lo and security investments si. Changes in these assets are matched by changes in

Please cite this article in press as: Orlowski, L.T. Monetary expansion and bank credit: A lack of spark. *Journal of Policy Modeling* (2015), http://dx.doi.org/10.1016/j.jpolmod.2015.03.013

liabilities, i.e. private sector deposits pd, government deposits gd, borrowings from a central bank or from other banks bo and by changes in equity capital ec. Changes in our variables are reflected by the following equation:

$$\text{re+vc+lo+si} = \text{pd+gd+bo+ec} \tag{2}$$

It can be observed on practical grounds that an increase in deposits leads to higher lending, thus lo = pd+gd [4]. Such creation of loans is relatively weak when the economy is in recession, its growth outlook is uncertain and pd growth is insufficient, and also when the government pursues fiscal tightening that decreases gd. A central bank may step in with monetary expansion, hoping that an increase in bo will translate into a proportional increase in lo. However, such presumably smooth matching is likely to face serious obstacles. There is a growing consensus in the recent literature, particularly from the post-financial crisis period, that there are limits to what monetary policy can accomplish. Monetary policy cannot be perceived as a panacea for macroeconomic imbalances, and, certainly for a sluggish economic growth. Among others, White (2012) points out that monetary stimulus operating through a traditional aggregate demand channel has been less effective in the post-crisis economic environment, than before the crisis. Moreover, credit expansion does not always lead to economic growth. Rousseau and Wachtel (2011) show the weakening impact of credit on economic growth that has been recently associated with the increasing reliance of businesses on equity- and debt-, relative to credit-financing. They further show that the credit growth leads to inflation and to higher exposure of banking systems to default risk, particularly at times of financial crises. It can be therefore observed that in a weak economy with elevated credit-, default-, liquidity- and market risk, a large increase in bo may just translate into re, vc or si, but not into lo.

To examine the effects of monetary expansion on credit creation we devise a model of changes in the U.S. monetary base mb as a function of changes in excess reserves re, vault cash vc, bank credit bc, as well as domestic sid and foreign sif security investments.

$$\text{mb}_t = \beta_0 + \beta_1 \text{re}_{t+\tau 1} + \beta_2 \text{vc}_{t+\tau 2} + \beta_3 \text{bc}_{t+\tau 3} + \beta_4 \text{sid}_{t+\tau 4} + \beta_5 \text{sif}_{t+\tau 5} + \varepsilon_t \tag{3}$$

Respective impact lags between changes in the monetary base and changes in the regressors are denoted by displacement parameters $\tau\,(1, ..., 5)$. Total bank credit bc is used as a broad approximation of total loans. A net balance in investments in foreign securities captures the link between the monetary base and net capital outflows.

4. The empirical results

Before conducting empirical tests of Eq. (3), we examine distributional properties of all tested variables in order to determine a proper testing methodology. The results of stationarity and normality tests for all variables used in our empirical model are shown in Table 1. The augmented Dickey-Fuller (ADF) tests suggest that all variables (with the exception of net investment in foreign securities) suffer from a unit root at their levels. They all become stationary at their first

[4] For instance Sheard (2013) argues that bank loans are created neither out of reserves nor out of deposits, but loans do stimulate deposit growth. However, Agénor and Aynaoui (2010) provide a counterfactual analysis showing that banks are willing to relax credit requirements and offer lower rates to borrowers if they hold more excess reserves. As deposit rates remain relatively stable, excess reserves, through their dampening impact on lending rates, lead to lower net interest margins.

Table 1
Skewness, kurtosis and unit roots.

Variables	Skewness	Kurtosis	Jarque–Bera	ADF unit root
Monetary Base	1.09	2.92	12.37	+1.604
	2.32	*8.49*	*131.21*	*−4.428*
Excess Reserves	1.14	3.04	13.51	+1.228
	2.31	*8.50*	*131.43*	*−4.621*
Vault Cash	0.41	2.25	3.17	+1.496
	−1.99	*15.07*	*410.44*	*−7.176*
Total Bank Credit	−0.21	1.51	6.19	−0.780
	−0.03	*3.48*	*0.59*	*−5.438*
Private Security Investments	−0.35	1.64	6.05	−1.536
	−0.03	*4.22*	*3.81*	*−4.664*
Net Investment in Foreign	−0.79	4.95	16.01	−4.229
Securities	*0.38*	*5.44*	*16.42*	*−8.823*

Notes: 1999Q1–2014Q2 quarterly data (62 observations); upper numbers are for variables at their levels, lower for variables at their first-differences. Augmented Dickey Fuller (ADF) test McKinnon critical value at 5% is −2.911.
Data source: Federal Reserve Bank of St. Louis FRED.

differences. Therefore, in our tests these variables are used in their first-differences (one-period changes). All tested variables follow a leptokurtic, heavy-tailed distribution (kurtosis coefficients are all greater than 3), thus they are subject to considerable tail risks. This means that their fluctuations tend to be subdued, oscillating around the mean at normal market periods, but they are rather explosive at turbulent times[5]. Moreover, changes in the monetary base, excess reserves and net foreign investments tend to be right-skewed, i.e. showing prevalence of positive over negative shocks. The remaining variables that are, however, less significant in our tests, show a negative skewness. In sum, all variables in their first differences do not follow a normal (Gaussian) distribution.

Due to the high leptokurtosis and prevailing positive skewness of the tested variables, OLS regression based on coincident variables and the Gaussian distribution assumption cannot be used for accurate empirical testing. Instead, we apply OLS regression optimized for impact lags (displacement parameters τ). The optimal combination of τ lags is determined by minimizing the Akaike information criterion. Moreover, in order to better reflect the distributional properties of the examined series, we employ the GLM testing, as it produces more robust results than the OLS regression does. GLM tests are based on a vector of correlated random variables rather than on a single scalar random variable. Hence their prediction is based on a maximum likelihood or Bayesian rather than the least squares procedure. A GLM consists of: a random component, a linear predictor, and a smooth and invertible linearizing link function (McCullagh & Nelder, 1989). By employing the GLM model we are able to account for patterns of systemic variations and find an optimal linearizing link function that transforms the expectation of the response variable to the linear predictor. After examining several possible link functions, we select the log link with Pearson chi-square dispersion that is optimal, producing the most robust results in our empirical exercise.

The empirical results of optimized OLS and GLM tests of Eq. (3) are shown in Table 2. All variables are stationary, i.e. entered in their first differences. The OLS estimation adjusted for

[5] For evidence on extreme tail risks in interbank credit, equity and foreign exchange markets during the global financial crisis, see Orlowski (2012).

Table 2
Monetary Base of the U.S. Federal Reserve and the Banking System Asset Allocations *Dependent variable: a change in the Federal Reserve monetary base (in $billion).*

	Estimation method	
	Generalized linear model (GLM) with quadratic hill climbing	OLS with displacement parameters τ
Independent variables ($bln changes in)	Coefficients × 1000	
Excess reserves	**10.160** (14.05)***	**0.390** (3.32)***
Vault cash	**30.361** (1.33)	$\tau 2 = 0$ **3.538** (0.93)
Total bank credit	**-4.277** (−9.54)***	$\tau 3 = +1$ **-0.318** (−2.48)**
Bank private security investments	**15.905** (5.59)***	$\tau 4 = 0$ **-0.599** (-1.04)
Net investment in foreign securities	**2.816** (5.86)***	$\tau 5 = +5$ **0.167** (0.76)
Constant term	**2.979** (16.28)***	**69.339** (3.71)***
	Diagnostic statistics	
	Pearson SSR 36,519 Deviance stats. 676 Akaike Info. Crit. 9.45 LR stats. 1045.8 Log likelihood −277	R-squared 0.352 F-statistics 5.645 Akaike Info. Crit. 11.99 Durbin-Watson 1.73 Log likelihood −342

Notes: 1999Q1–2014Q2 quarterly data; z-statistics for GLM and t-statistics for OLS are in parentheses; GLM test assumes log link and Pearson chi-square dispersion.
Data source: Federal Reserve Bank of St. Louis FRED.
Significance is *** at 1%, ** at 5% and * at 10% probabilities.

optimal lags shows a significant, positive association between changes in the monetary base and one-quarter forwarded changes in excess reserves. More importantly, from the standpoint of our underlying hypothesis, it shows a significant inverse relationship between changes in the monetary base and one-quarter forwarded changes in the total bank credit.

The GLM results imply that the growth in the U.S. monetary base during the sample period 1999Q1–2014Q2 (62 quarterly observations) is significantly and positively associated with an increase in excess reserves. It is also significantly and positively linked to an increase in banks' investments in both domestic private sectors as well as in net foreign security investments. The association with changes in vault cash is inconclusive. There is a significant, inverse relationship between changes in the monetary base and total bank credit. A $1 billion increase in bank credit is associated with a $4.3 million contraction of the monetary base. This negative relationship points to the detrimental effect of a prolonged expansionary monetary policy on credit creation. Evidently, the credit channel of monetary policy transmission seems to be ineffective when such monetary policy is pursued[6].

[6] Similar effects of quantitative easing policies for expanding broader money aggregates are also shown by Fawley and Neely (2013) who demonstrate that QE programs pursued by the Federal Reserve, the European Central Bank, the Bank of England, and the Bank of Japan have all led to large increases in bank reserves, and not to the credit growth.

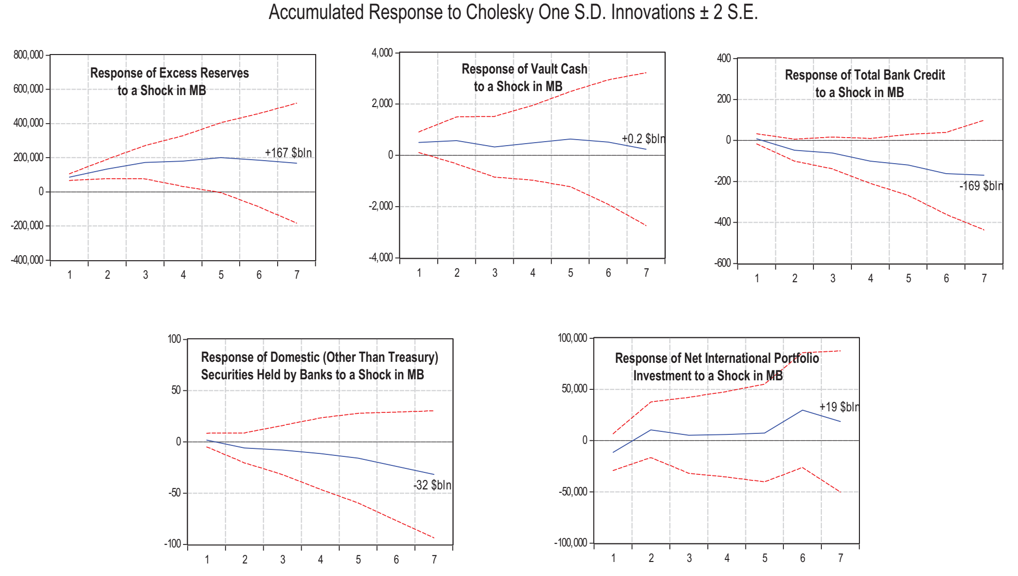

Fig. 2. Accumulated Impulse Responses of Changes in Individual Variables to Cholesky One Standard Deviation Shock in the Monetary Base MB.
Notes: Impulse responses generated from a multivariate VAR with 5 lagged terms, Monte Carlo distribution of errors, accumulated over 7 quarters, based on 1999Q1–2014Q2 quarterly data.
Data Source: Federal Reserve Bank of St. Louis FRED.

To check for robustness of the OLS and GLM tests and to examine causal effects between the model variables we verify these results by using a reduced form VAR model along with impulse response functions. The VAR model is composed of a set of linear functions in which each variable is explained by its own lagged values and the lagged values of the remaining variables. Our VAR test encompasses the set of variables included in Eq. (3), all in their first differences. In our case, the VAR order of five lagged terms is optimized by minimizing the Akaike Information Criterion. Impulse response functions generated from VAR(5) assume a Monte Carlo distribution of error terms, and the responses are accumulated over 7 quarters. From the set of all obtained impulse reactions, we show only the responses that provide meaningful results for our analysis (Fig. 2). They include responses of excess reserves, vault cash, total bank credit, as well as domestic and net foreign security investments to Cholesky one standard deviation shock in the monetary base.

As evidenced in Fig. 2, a positive shock in the monetary base results in a positive increase in excess reserves, accumulated to about $167 billion over the 7-quarter period. Although the ± 2 standard errors band is widening and the response factor is not very stable, the lower bound does not significantly fall below zero. Therefore, one can argue that a positive shock in the monetary base translates into a strong growth of excess reserves. This direct relationship is not surprising, considering the fact that excess reserves of depository institutions have recently exploded from a fractional value of $2 billion at the start of the QE policy implementation to the level of $2.7 trillion (an equivalent of 15.4% of nominal GDP) at the end of August 2014. The impact of a positive shock in the monetary base on vault cash is slightly positive, yet very unstable.

Notably from the standpoint of our analysis, a positive shock in the monetary base results in a cumulative decline of total bank credit, and this inverse relationship is rather conclusive, as the standard errors band hardly exceeds zero. In contrast to the outcome of the OLS and GLM tests, the impulse responses of security investments show a different, albeit inconclusive result. Namely, a positive shock in the monetary base causes a decline in private domestic securities held by U.S. banks, although this declining pattern is surrounded with a wide error band. Consistently with the GLM result, a shock in the monetary base translates into an increase in net portfolio investments in foreign securities. It is worth noting that this reaction is subject to a longer response lag that accelerates in a six quarter timeframe.

Both the GLM tests and the impulse reaction functions generated from VAR(5) imply that increases in the monetary base are associated with higher excess reserves and higher investments, mainly in international securities. They are also associated with a decline in total bank credit, which questions the effectiveness of the credit channel in the presence of QE strategy.

These analytical findings confirm our underlying hypothesis that monetary expansion, particularly as implemented through the Fed balance sheet management policies, neutralizes the credit channel of policy transmission that is otherwise known to stimulate the economic growth. Therefore, despite some initial findings (Gagnon, Raskin, Remache, & Sack, 2011; Bernanke, 2012) that the Fed managed to stimulate the economy through the portfolio balance channel, further studies are necessary to confirm sustainability of these effects in the long run.

5. Concluding remarks and policy recommendations

This study suggests that massive liquidity injected by the Fed into the banking system, particularly in the aftermath of the financial crisis, has restrained bank credit. We test empirically our model of allocation of borrowed liquidity by the U.S. banks during the 1999–2014 sample period. We employ OLS, GLM and VAR tests with impulse response functions optimized for lags and find the following effects of monetary expansion:

- Strong increase in excess reserves.
- Slight increase in vault cash.
- An increase in international investments.
- Discernible reduction in domestic bank credit.
- Mixed results for investments in private domestic securities.

In essence, the empirical tests of our underlying analytical model consistently show a negative association between the growth in the monetary base and total bank credit. They suggest that U.S. banks have been prone to allocating the borrowed liquidity to excess reserves and to investments in securities (predominantly foreign) but not to loans. Thus we provide evidence that monetary expansion, particularly as implemented through quantitative easing does not contribute to the bank credit growth. It shall be noted that this paper is not intended to question the overall rationale and validity of QE, as such policy has proven to be effective for averting systemic risk and a potentially deep economic recession in the aftermath of the recent financial crisis. Our evidence confirms only that monetary expansion through the Fed balance sheet policies deactivates the credit channel of monetary policy transmission. Such deactivation seemed plausible as the household debt reached a dangerously high level at the onset of the financial crisis in mid-2007.

There are additional factors that might elucidate the negative association between monetary easing and bank credit. They include the Fed paying interest on excess reserves, banks preferences to hold reserves in the high financial risk environment and stricter macroprudential regulations, including tighter lending requirements. Moreover, banks have been prompted to accumulate substantial excess reserves as regulators recently imposed large and somewhat unpredictable fines on some of them for non-compliance. In addition, stricter regulations on domestic investments and restrictions on asset securitization might have explained higher investments in foreign securities, particularly in emerging financial markets as investors search for higher returns.

In hindsight, we suggest that U.S. monetary authorities consider restoring the credit channel of monetary policy transmission. This may necessitate abandoning the ultra-easy course of monetary policy with its zero-lower-bound interest rate and replacing it with a more conventional monetary policy framework, preferably one based on forward-looking inflation targeting (as also advocated by Svensson, 2014). In addition, we caution other policy makers attempting to replicate the U.S.-style QE policies to be mindful of our finding that QE does not contribute to credit creation. It is worth noting that the European Central Bank has adopted its own version of QE strategy as of January 22, 2015. Considering a strong reliance of consumption and investment in the euro area on bank credit, it becomes apparent that implementation of the new ECB monetary expansion cannot be carried through the portfolio balance channel.

References

Agénor, P.-R., & Aynaoui, K. E. (2010). Excess liquidity, bank pricing rules, and monetary policy. *Journal of Banking and Finance*, *34*(5), 923–933.

Bernanke, B. S. (2010). Opening remarks: the economic outlook and monetary policy. In *Federal Reserve Bank of Kansas City: Proceedings of the economic policy symposium* August 26–28, Jackson Hole, Wyoming, (pp. 1–16).

Bernanke, B. S. (2012). Opening remarks: monetary policy since the onset of the crisis. In *Federal Reserve Bank of Kansas City: Proceedings of the economic policy symposium* August 30–September 1, Jackson Hole, Wyoming, (pp. 1–22).

Cúrdia, V., & Woodford, M. (2011). The Central-Bank balance sheet as an instrument of monetary policy. *Journal of Monetary Economics*, *58*(1), 54–79.

Fawley, B. W., & Neely, C. J. (2013). Four stories of quantitative easing. *Federal Reserve Bank of St. Louis Review*, *95*(1), 51–88 (January/February 2013).

Gagnon, J. E., Raskin, M., Remache, J., & Sack, B. (2011). The financial market effects of the federal reserve's large-scale asset purchases. *International Journal of Central Banking*, *7*(1), 3–43.

Kydland, F. E., & Prescott, E. C. (1990). Business cycles: Real facts and a monetary myth. *Federal Reserve Bank of Minneapolis Quarterly Review*, *14*(2), 3–18.

McCullagh, P., & Nelder, J. A. (1989). *Generalized linear models*. Berlin, Germany: Springer-Science+Business Media B.V.

Orlowski, L. T. (2008). *Stages of the 2007/2008 global financial crisis: Is there a qandering asset-price bubble?* Kiel Institute for the World Economy (Discussion Paper No. 43).

Orlowski, L. T. (2012). Financial crisis and extreme market risks: Evidence from Europe. *Review of Financial Economics*, *21*(3), 120–130.

Rousseau, P. L., & Wachtel, P. (2011). What is happening to the impact of financial deepening on economic growth? *Economic Inquiry*, *49*(1), 276–288.

Sheard, P. (2013). Repeat after me: Banks cannot and do not "Lend Out" reserves. *Standard and Poor's Economic Research* (August 13).

Svensson, L. E. O. (2014). Inflation targeting and "Leaning Against the Wind". *International Journal of Central Banking*, *10*(2), 103–114.

Thornton, D. L. (2012). Evidence on the portfolio balance channel of quantitative easing. Federal Reserve Bank of St. Louis: Research policy division. In *Working paper no. 2012-015A*.

Thornton, D. L. (2014). QE: Is there a portfolio balance effect? *Federal Reserve Bank of St. Louis Review*, *96*(1), 55–72.

White, W. R. (2012). Ultra easy monetary policy and the law of unintended consequences. In *Working paper no. 126*. Federal Reserve Bank of Dallas: Globalization and Monetary Policy Institute.

Woodford, M. (2012). Methods of policy accommodation at the interest-rate lower bound. In *Federal Reserve Bank of Kansas City: Proceedings of the economic policy symposium* August 30–September 1, Jackson Hole, Wyoming, (pp. 185–288).

Please cite this article in press as: Orlowski, L.T. Monetary expansion and bank credit: A lack of spark. *Journal of Policy Modeling* (2015), http://dx.doi.org/10.1016/j.jpolmod.2015.03.013