Trust Shocks, Financial Crises, and Money

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Abstract

A precondition for a well-functioning monetary system is trust. This paper develops a neoclassical general equilibrium model in which public and private money coexist and the impact of trust shocks on the macroeconomy is examined. In this paper, trust is modelled as limited commitment between borrowers and lenders. A borrower who issues private money can credibly commit to repay at most a fraction of his or her future output. The paper shows that a lack of trust can engineer a financial crisis, with substantial effects on both the real and monetary variables. In the model, an unexpected drop in the trust parameter causes young workers to divert less of their savings into investment goods and more of their savings into consumption goods. A fall in capital investment in turn leads to a decline in real output. I also show that trust shocks can have detrimental effects on both workers and entrepreneurs. In addition, the model shows that, to clear the money market, an increase in the real demand for government money causes the price level to fall, inducing transitory deflation. This is in line with the low inflation episodes during and following the Great Recession. The decline in capital investment and the price level also implies that the amount of deposits has to shrink in a financial crisis. Finally, once trust shocks hit the economy, the money multiplier drops. This is due to the decrease in capital investment and the increase in the real demand for government money.

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We think that factoring in a lack of trust, placing a limitation on the degree of commitment, is of primary importance. In particular, we think that it is a fruitful starting point for a theory of money. Hence the title of this paper:"Evil Is the Root of All Money." Evil is a strong word. If the moral category is thought too sever for something as mild as breaking a promise, then the title might be changed to "Distrust Is the Root of All Money" (see Douglas Gale, 1982 [chapters 6 and 7]).

Nobuhiro Kiyotaki and John Moore (2002)

Virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time. It can be plausibly argued that much of the economic backwardness in the world can be explained by the lack mutual confidence.

Kenneth Arrow (1972)

1 Introduction

A precondition for a well-functioning monetary system is *trust*. Without trust, a sovereign currency would quickly lose all of its value and cannot maintain as a unit of account nor a means of payment, the very defining features of money.[1] Note also that most of what people call money is privately-issued *credit* (or debt), which literally hinges on trust.[2] The term credit comes from the Latin *credere*, meaning "to believe" or "to trust". As suggested by the above quote, understanding trust is of primary importance to monetary economics (Kiyotaki and Moore, 2002). The literature, however, contains relatively few formal models to study trust.[3] This is presumably because trust is intangible and hard to model, and it has proved hard to integrate money and credit

[1] The third well-known function of money, i.e., a store of value, although essential, need not be a *distinguishing* feature of money (See Borio, 2019). In fact, any asset, financial and real, is a store of value. For example, housing is generally regarded as a good store of value, but it is far from being money.

[2] Although money and credit (bank credit in particular) are inexorably linked, the difference between the two often gets blurred since credit spends just like money. A key distinction between money and credit lies on the *issuer* (central bank or other). Thus, fiat money is often called *public money* or *outside money* whereas credit is referred as *private money* or *inside money*. See Lagos (2006) for the definitions of inside and outside money. See also Tobin (1963), Freeman (1986), Freeman and Murphy (1989), Freeman and Huffman (1991), Williamson (1999), and Bullard and Smith (2003) for early discussions in the literature, and Brunnermeier and Sannikov (2016), Kiyotaki and Moore (2018), Piazzesi and Schneider (2018), Brunnermeier and Niepelt (2019), Piazzesi et al. (2019), Bianchi and Bigio (2020) for more recent elaborations.

[3] Kiyotaki and Moore (2005) and Kiyotaki and Moore (2018) are two notable contributions.

into a standard general equilibrium framework of macroeconomics.[4]

As stressed by Arrow (1972), trust is crucial to any economic activity and a lack of trust is the cause of much of the economic backwardness in the world. Without trust, cooperation breaks down, financial markets are destroyed, and investment and output suddenly stop (see Guiso et al. 2004, 2008, 2009; Algan and Cahuc, 2010; Bloom et al. 2012). The global financial crisis of 2007-2009 has also witnessed a significant drop in trust (see Guiso, 2010). For example, Guiso (2010) uses the survey data of the Financial Trust Index Survey (FTIS) and the General Social Survey (GSS) and documents that there was a dramatic drop in trust *vis-à-vis* banks and financial institutions in the latest part of 2008 and the beginning of 2009.[5] He also finds that, besides the level of trust in financial markets and institutions, trust towards people in general (i.e., how much people trust other people, which is known as generalized trust) has also fallen during the financial crisis.[6] In the meanwhile, the Great Recession has observed an unprecedented drop in economic activity, such as the fall in investment and output on the real side of the economy, and the decline in credit and broad money supply on the financial side (see Reinhart and Rogoff, 2009; Schularick and Taylor, 2012).

What is the role that trust can play in financial crises? Could trust be one important dimension that triggers a financial crisis? What are the macroeconomic effects of trust? Motivated by these questions, this paper develops a neoclassical general equilibrium model in which public and private money coexist and the impact of trust shocks on

[4] In monetary economics, for a theory to be workable to study trust, money and credit need to be modelled explicitly.

[5] To study the evolution of trust during the Great Recession, Northwestern University and the University of Chicago conducted a telephone survey on a representative sample of about 1,000 American households, known as the FTIS. In the survey, a first set of questions asked how much the respondent trusts certain types of people or institutions with a focus on financial institutions, such as the stock market, banks, bankers, brokers, and pensions funds (see Guiso, 2010). Similarly, the GSS has been asking people whether they have a great deal of confidence (or trust) in banks and financial markets. See also the World Values Survey (WVS) for a similar measure of trust (Sapienza et al. 2013).

[6] Guiso et al. (2009) conduct a phone survey similar to the FTIS on a sample of investors of a large Italian bank (UniCredit) which was launched in June 2009. As in the US, in this survey trust in financial institutions has also decreased substantially.

the macroeconomy is examined. Following Kiyotaki and Moore (2005, 2019), trust is modelled as a *limited commitment* problem between debtors and creditors. A debtor who issues IOUs (private money) can credibly commit to repay at most a fraction θ of his or her future output.[7] The parameter θ thus captures the effective degree of commitment, or "trust", in the economy. The focus of the paper is to explore both the real and monetary effects of exogenous variations in trust.

The model builds on Freeman and Huffman's (1991) overlapping generations model (OLG) with inside and outside money, augmented with limited commitment between borrowers and lenders *à la* Kiyotaki and Moore (2005, 2019). The economy is populated by four types of agents: young workers, young entrepreneurs, old workers, and old entrepreneurs. All agents value consumption only in their second period of life. Workers are endowed with y units of output when young and nothing when old. Output can be used for consumption or investment. In the model, young workers can save in government money (public money). They can also store their wealth in private deposits (private money) if they lend to young entrepreneurs. Entrepreneurs have no endowment of good but have access to a standard investment technology. They issue IOUs (private money) and borrow from young workers. However, since trust plays a crucial role in the economy, how much young entrepreneurs can borrow is affected by the trust parameter θ.

I show that in this economy an evaporation of trust (modelled as an unexpected drop in θ) can engineer a financial crisis, with substantial effects on both the real and monetary variables. On the real side of the economy, since there is less trust between agents, young entrepreneurs are able to borrow less and young workers would divert more of their savings into consumption goods. This means that young workers would save less in investment goods, which in turn leads to a fall in real output in the economy.

[7] This can be rationalized by moral hazard problems or strategic defaults of debtors.

In their portfolio, trust shocks cause the demand for public money to increase and the holdings of private money to fall. An increase in the demand for public money also means the government has to raise more real taxes to balance the budget. As old workers (the previous young workers) bear the tax burden, the expected consumption (or welfare) of young workers unambiguously falls.

It is important to note that since the model characterizes an environment where money and credit coexist, the model can be used to explore any monetary effects, which are often neglected by standard general equilibrium models. One salient feature of the model lies on the price level determination. Complementary to the explanation of the New Keynesian framework on inflation (deflation) dynamics, the behavior of prices in this economy is reminiscent of the quantity theory of money.[8] In this model, as the real demand for government money increases, to clear the money market, the price level simply has to fall, inducing transitory deflation in a financial crisis. This also means the real value of money has to increase. In addition, the fall in capital investment and the price level causes the amount of deposits to shrink. Finally, the money multiplier is endogenously determined in the model. When trust shocks hit the economy, I show that the money multiplier falls due to the decline in capital investment and the increase in the real demand for government money. In a nutshell, the model shows how trust shocks can induce a financial crisis, with significant effects on both the real and monetary variables.

Trust is crucial to economic development and its absence is the cause of much of the economic backwardness in the world (see Arrow, 1972). Fortunately, the past two decades have witnessed an increasing interest in the role that trust plays in economic activity, in many fields of economic science. From economic growth (Knack and Keefer,

[8]Several economists have argued that existing DSGE models cannot properly account for the evolution of prices during and following the Great Recession (see, for example, Ball and Mazumder, 2011; Hall, 2011; King and Watson, 2012).

1997; Algan and Cahuc, 2010) to the organization of firms (La Porta et al. 1997; Bloom et al. 2012), from financial development (Guiso et al. 2004, 2008) to international trade and investments (Guiso et al. 2009), from individual's behavior (Butler et al. 2015) to individual economic performance (Butler et al. 2016), many interesting phenomena in economics have been related to the level of trust.[9] However, the role of trust in analysis of monetary economics and business cycle fluctuations has not been thoroughly studied.

This paper makes three contributions to the existing literature. Firstly, this paper develops a simple neoclassical model which introduces a limited commitment friction into the standard overlapping generations framework (OLG) with public and private money *à la* Freeman and Huffman (1991). The Great Recession of 2007-2009 has reignited a new interest in money and credit in the economy and the crucial rule they could play in shaping business cycle fluctuations and propagating macroeconomic shocks (see Jordà et al. 2011, 2013; Schularick and Taylor, 2012).[10] This boosts a new line of research which models money and credit explicitly in a general equilibrium framework of macroeconomics, see Brunnermeier and Sannikov (2016), Kiyotaki and Moore (2018), Piazzesi and Schneider (2018), Brunnermeier and Niepelt (2019), Piazzesi et al. (2019), Bianchi and Bigio (2020) for recent contributions.[11]

Secondly, this paper provides a formal analysis of the impact of trust shocks on business cycle fluctuations. Noted by Kiyotaki and Moore (2002), understanding trust is of great importance to macroeconomic thinking. However, the existing literature in macroeconomics contains few formal models to study trust.[12] This is perhaps because

[9] Since trust is playing a crucial role in economic analysis, understanding of how to measure trust is also important, see Glaeser et al. (2000) and Sapienza et al. (2013) for contributions.

[10] For example, using data on 14 developed countries between 1870 and 2008, Jordà et al. (2013) find that credit plays an important role in the modern business cycle. They find that more credit-intensive expansions tend to be followed by deeper recessions and slower recoveries.

[11] Note that, however, the dominant New Keynesian DSGE framework typically adopts a cashless economy and abstracts from money and credit altogether (see Woodford, 2003).

[12] Kiyotaki and Moore (2005, 2019) are two notable exceptions. However, they conduct their research in a model where agents are infinitely-lived and focus on the impact of liquidity shocks on the real economy. In this paper, I adopt an OLG model with heterogenous agents and study both the real

trust is an intangible concept and thus hard to model. This paper provides an attempt at formally evaluating the effects of trust shocks on the macroeconomy. In particular, I follow Kiyotaki and Moore (2005, 2019) and model trust as a limited commitment problem between borrowers and lenders.[13] I show that negative trust shocks can generate a financial crisis in which capital investment and real output fall. In addition, from a welfare perspective, my results show that an evaporation of trust can have detrimental effects on both workers and entrepreneurs.

Thirdly, this paper explores the monetary effects of trust shocks. In particular, this model offers a simple and intuitive explanation of price level dynamics, that is complementary to the standard macroeconomic models. Unlike the New Keynesian literature which emphasizes on sticky prices, the behavior of prices in this model is consistent with the quantity theory of money.[14] In a low trust state, as the real demand for government money increases, to clear the money market, the price level has to fall, which causes transitory deflation and an increase in the real value of money. The economy then features a "flight to quality" and secular deflation, which are observed in the Great Recession (see Beber et al., 2009; Ball and Mazumder, 2011; Hall, 2011; Baele et al., 2020). In this model, it is the real demand for government money that ultimately influences the price level.

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and monetary effects of trust shocks.

[13] Needless to say, this is not the only way to introduce trust into a formal model. Alternatively, in a monetary economy, trust can be captured by asset's liquidity. For instance, one reason why money is more liquid than capital is because money is backed by the government, and hence it is more trustworthy (see Bigio and Schneider, 2017; Kiyotaki and Moore, 2019). Such an argument can be justified by assuming there exists asymmetric information about the quality of capital, which translates into a cost to obtain liquidity (see Bigio, 2015).

[14] Note that the New Keynesian framework has struggled with explaining the low inflation (deflation) episodes after the Great Recession (see Ball and Mazumder, 2011; Hall, 2011; King and Watson, 2012). That is, it seems hard to rationalize the fact that the rate of inflation has remained low for too long after real output has picked up. For example, Hall (2011), in his Presidential Address, has called for a fundamental reconsideration of models in which inflation depends on a measure of slack in economic activity. He argues that standard DSGE models based on New Keynesian Phillips Curve cannot explain the stabilization of inflation at positive interest rates in the presence of long-lasting economic slack.

In addition, the fall in the price level and the decline in intermediated capital would cause the amount of private money to shrink. That is, the model generates a contraction in private credit and money supply during economic recessions. Finally, the money multiplier also falls in a financial crisis, due to the fall in capital investment and the increase in the demand for government money. These financial features are well in line with the evidence on financial crises in history (see Kindleberger, 1978; Reinhart and Rogoff, 2009).

The rest of the paper is organized as follows. In Section 2, I lay out the physical structure of the model–individual preferences, demographics, and technologies. I derive the equilibrium of the model in Section 3. Section 4 evaluates the real effects of trust shocks on the macroeconomy. In Section 5, I discuss the monetary impact of trust shocks. Section 6 offers concluding remarks.

2 The model

The physical environment is based on Freeman and Huffman's (1991) overlapping generations model (OLG) with inside and outside money, augmented with *limited commitment* between borrowers and lenders *à la* Kiyotaki and Moore (2002, 2005, 2018, 2019). According to Kiyotaki and Moore (2005), an agent (a borrower) can credibly commit to repay at most a fraction θ of his or her future output. The parameter θ thus captures the effective degree of commitment, or "*trust*", in the economy. The focus of the paper is on the effects (both real and monetary) of an exogenous drop in θ, in order to mimic an environment where there is a lack of trust between agents.

2.1 Preferences and technology

Time is discrete and denoted $t = 1, 2, ..., \infty$. The economy is populated by a sequence of two-period-lived overlapping generations. At each date $t \geq 1$, $2N$ young agents enter the economy and $2N$ old agents leave the economy. In the initial period, $t = 1$, there are $2N$ old individuals (the initial old), who live only for one period. The total population is fixed at $4N$ across time and is at every date t divided evenly between the young and the old. In addition, the population of young agents is divided evenly between *workers* and *entrepreneurs*, so that there is a mass of N of each type. Hence, at any given point in time $t > 1$, the economy is populated by four types of agents: (i) young workers, (ii) young entrepreneurs, (iii) old workers, and (iv) old entrepreneurs. Throughout the paper, I make the normalization that $N = 1$.

Workers are endowed with y units of output when young and nothing when old. Alternatively, one can think of the young workers as being endowed with y units of nonstorable labor or time that can be used inelastically to produce y units of output. Output can take the form of a consumption good or investment good. Entrepreneurs have no endowment of good but have access to an investment technology that takes k_t units of output invested at date t and transforms it into $f(k_t)$ units of output at date $t + 1$. The investment function yields a rate of return $f'(k) > 0$ that diminishes with the scale of the capital investment, $f''(k) < 0$. Also assume that $f'(0) = \infty$, so that agents would always prefer to have some investment. Here, I assume a standard production function $f(k_t) = k_t^{\alpha}$, where $0 < \alpha < 1$. Furthermore, assume that capital depreciates fully after it is used in production.

I assume that an individual (a worker w or an entrepreneur e) who enters the economy at $t = 1, 2, ..., \infty$ values consumption only in the second period of life. For simplicity, I also assume that preferences are linear, so that agents are risk-neutral. Preferences are given by $U_t^i = c_{t+1}^i$, $i \in (w, e)$, for $t \geq 0$. As a result, young workers

face a trivial consumption-saving decision: it will always be optimal for them to save all of their income. This simplified consumption-saving problem allows me to focus on a portfolio effect, which I would like to emphasize later.[15]

2.2 Public money and private money

In this economy, workers are the natural savers whereas entrepreneurs are the natural borrowers. The pattern of welfare-improving trade is clear. Young entrepreneurs want young labor (supplied by young workers) in exchange for a share of the future output that can be produced only through their joint effort. Note that, since labor is non-storable, workers also need to find a means to store the value of their goods. So the basic problem facing young workers is how to arrange for consumption when they are not endowed. One option is to purchase government money from old agents to be sold for goods when the purchaser is himself old. A second option is to deposit goods with an entrepreneur, who can create capital from which a return can be paid in the next period. In other words, there are two ways in which young workers can store their wealth: public money and private money, which I now turn to the discussion.

Public money. Public money (or *outside money*) is a form of government debt, issued by the government, with a gross nominal interest rate R_t. Here, I consider a consolidated monetary/fiscal authority and make no distinction between nominal government debt and central bank liabilities. Assume that a stock of nominal debt M_0 is injected into the economy to the initial old.[16] Note that the government debt M_t will also be used as a means of payment. That is, in each period, young workers deliver consumption goods (produced by their labor efforts) in exchange for government money

[15] Incorporating a non-trivial consumption-saving problem is easy. But doing so would only complicate the analysis without adding anything to the main points I intend to make in this paper.

[16] One could think this as a social security program to the old generation.

(or government debt) M_t from the old workers.[17]

Private money. To acquire investment goods from young workers, assume that young entrepreneurs use a privately-issued IOU that entitles the bearer to a specific quantity of future output. In this way, young entrepreneurs *create* private money. These IOUs are a form of private debt (or credit), circulating as *inside money* in the economy. Equivalently, one could think that young workers make a deposit of investment goods with entrepreneurs (or at a bank), against which, entrepreneurs issue a piece of private paper (IOU) that promises to pay a certain quantity of output in the next period (see Freeman and Huffman, 1991). These deposits, just like bank deposits, are private money. I assume that each IOU promises the bearer r_t units of output in the following period, where r_t denotes the gross rate of return on deposits. In a competitive equilibrium deposits will pay the rate of return on capital, so r_t equals the real return on capital. It is also important to note that, ultimately, it is intermediated capital that serves as inside money in this economy.

2.3 Limited commitment

Next, I make a critical assumption to introduce *limited commitment* between workers and entrepreneurs. Following Kiyotaki and Moore (2002, 2005, 2018, 2019), I assume that, for moral hazard reasons, entrepreneurs who produce output and issue IOUs (or private money) lack the commitment necessary to honour their unsecured promises.[18] To capture this limited commitment in a simple way, assume that an investing entrepreneur can credibly pledge at most a fraction θ of the future returns $f(k_t)$. Consequently, entrepreneurs are subject to a credit constraint (a borrowing constraint) that takes the

[17] One may think that government money trades for consumption goods on competitive spot market in each period.

[18] In fact, it seems natural to be sceptical about the promises that entrepreneurs make. After all, the privately-issued IOUs (inside money) are created "out of thin air".

following form:

$$r_t k_t \leq \theta f(k_t). \tag{1}$$

In what follows, I assume that the credit constraint binds. That is, the principle and interest repayment that young workers expect to safely secure is determined by $\theta f(k_t)$. The parameter $\theta \in (0,1)$ indexes the effective degree of commitment, or "*trust*", in the economy, and it is assumed to be exogenously given. The smaller the θ, the tighter the borrowing constraint that an investing entrepreneur faces. The main objectives of this paper are to examine whether an unexpected drop in θ, i.e., *a trust shock*, could generate a financial crisis, and to explore any monetary effects of this experiment.

2.4 Government policy

As noted before, I consider a consolidated monetary/fiscal authority, the government. And I make no distinction between government bonds and central bank liabilities, since they are all a form of government debt. Assume that government money is a perpetual instrument that yields a gross nominal rate of return equal to $R_t > 1$.[19] The monetary authority chooses the nominal interest rate it is willing to pay on its debt. For simplicity, I consider an interest peg policy:

$$R_t = R. \tag{2}$$

The stability of monetary equilibrium is checked later.

Assume that the interest and principal owed on maturing government debt $R_{t-1}M_{t-1}$

[19] Note that there are several ways to interpret government money M_t. First, one can think that M_t is government bonds which not only earn an interest but also can be used in peer-to-peer transactions. Second, one could imagine M_t as a central bank digital currency (CBDC), which delivers a positive, or negative, interest rate (see Jia, 2020 for a discussion on CBDC).

must be financed by a combination of new debt M_t and a lump-sum tax $T_t > 0$, that is,

$$R_{t-1}M_{t-1} = T_t + M_t. \tag{3}$$

In this modelling environment, I assume that the fiscal authority determines the path of M_t and T_t. Assume that the fiscal authority grows the nominal government debt (or government money) at a fixed rate μ, so that,

$$M_t = \mu M_{t-1}. \tag{4}$$

I also assume that the fiscal authority passively adjusts the lump-sum tax T_t to satisfy the government budget constraint (3), that is, fiscal policy is Ricardian.[20] In addition, I make the assumption that the lump-sum tax falls entirely on old workers.

As it proves to be convenient to express variables in real terms, I let p_t denote the price of output at date t, measured in units of government money, and define $\tau_t = T_t/p_t$, $m_t = M_t/p_t$, which represent real taxes and real holdings of government money, respectively. Note that, government money serves as the unit of account, being the measuring rod for all prices and contracts in this economy. Following (4), the government budget constraint is rewritten as follows:

$$\tau_t = \frac{R_{t-1}m_t}{\mu} - m_t. \tag{5}$$

Note that the long-run inflation rate is pinned down by μ.

[20] Note that T_t can also be interpreted as government surplus if one includes government spending into the model.

2.5 Optimal behavior

Young workers at date t enter the economy with y units of output, which is *worth* of $p_t y$ dollars.[21] Since consumption is not valued when young, all income is saved, with savings divided between the two available assets: government money and private deposits. Specifically, at date t, if a young worker sells m_t units of goods for government money, he earns $p_t m_t = M_t$ dollars. This involves transactions between young workers and old workers who are born at date $t-1$. If a young worker makes a deposit of investment goods k_t with young entrepreneurs, he receives a privately-issued IOU, which is worth of $p_t k_t$ in nominal terms. If one distinguishes money and credit, then $p_t k_t$ is only measured in dollars–it is not actual dollars (government money). But, note that private IOU is a means of payment and it spends just like money.[22] Of course, young workers expect the value of their deposits to grow, and the gross return on deposits is r_t. Thus,

$$p_t m_t + p_t k_t = p_t y. \tag{6}$$

Workers then face a simple portfolio problem: how much of savings to hold in the form of government money and private deposits. If a young worker is willing to hold both public and private money, the two securities will have to earn the same expected rate of return. This no-arbitrage condition can be expressed as:

$$r_t = R_t(p_t/p_{t+1}). \tag{7}$$

Note that in this economy, the real return on deposits (or capital) is controlled by a combination of monetary and fiscal policy, with monetary policy determining the

[21] Note that there are less than $p_t y$ actual dollars (government money) in the economy. That is, $M_t = p_t m_t < p_t y$.

[22] Thus, private money is part of broad money supply, as discussed later.

nominal interest rate and fiscal policy determining the expected rate of inflation.

Recall that the credit constraint (1) binds in equilibrium, i.e., $r_t k_t = \theta f(k_t)$, given that $f(k_t) = k_t^{\alpha}$, capital investment k_t is determined by the following equation:

$$k_t^{1-\alpha} = \frac{\theta}{r_t}. \tag{8}$$

The above condition makes it clear that in this modelling environment, capital investment is influenced by two forces: the trust parameter and the real return on government money (or deposits). On the one hand, a higher degree of trust implies that young workers are willing to safely lend investment goods to young entrepreneurs. On the other hand, a lower real return on government money also means agents are motivated to hold more investment goods since government money becomes less attractive.

An old worker's budget constraint is therefore given by:

$$c_{t+1}^{w} = R_t(p_t/p_{t+1})m_t + r_t k_t - \tau_{t+1}. \tag{9}$$

Given (6) and (7), the above equation can be simplified as $c_{t+1}^{w} = r_t y - \tau_{t+1}$.

An old entrepreneur's budget constraint is:

$$c_{t+1}^{e} = f(k_t) - r_t k_t. \tag{10}$$

3 Equilibrium

The focus of my analysis is on the stationary equilibrium. In equilibrium, the market for government debt must clear. The market clearing condition is given by:

$$M_t = p_t m_t. \tag{11}$$

It is important to note that equation (11) determines the price level in this model. The behavior of prices in this economy is reminiscent of the *quantity theory of money* (see Friedman and Schwartz, 1963). In this way, given that the path of money is controlled by the fiscal authority, any increase (decrease) in the real demand for government money will cause a decrease (increase) in the price level, see Section 5 for a detailed discussion.[23] Because $M_t = \mu M_{t-1}$, the expected rate of inflation satisfies:

$$\Pi_{t+1} = p_{t+1}/p_t = (M_{t+1}/M_t)(m_t/m_{t+1}) = \mu(m_t/m_{t+1}), \tag{12}$$

where $\Pi_{t+1} \equiv p_{t+1}/p_t$ is defined as the gross inflation rate.

Next, combine (2), (7), (8), and (12), together with $k_t = y - m_t$, to get:

$$(y - m_t)^{1-\alpha} = \frac{\theta\mu}{R}(\frac{m_t}{m_{t+1}}). \tag{13}$$

Finally, from the government budget constraint, we have:

$$\tau_t = \frac{Rm_t}{\mu} - m_t. \tag{14}$$

An equilibrium in this model consists of bounded sequences for m_t and τ_t, given a policy vector (R, μ), that satisfy (13) and (14), for $t \geq 1$. A stationary equilibrium is defined as an equilibrium that satisfies $(m_t, \tau_t) = (m, \tau)$, for all t. In this model, equation (13) determines the sequence of m_t. With $\{m_t\}$ determined, equation (14) then determines the lump-sum tax τ_t that is used to balance the government budget. In addition, with $\{m_t, \tau_t\}$ so determined, equations (6) and (11) can be used to work out the sequences of k_t and p_t.

[23] Note that standard New Keynesian DSGE framework (e.g., Clarida et al., 1999) has been struggling with explaining inflation (deflation) dynamics in the aftermath of the 2007-2009 financial crisis. This approach offers an alternative explanation for why inflation has remained low since the Great Recession. According to this model, low inflation (or deflation) is caused by a high demand for government money.

Let us now characterize the equilibrium path of m_t. Denote m as the equilibrium value of government money. In addition, let us assume $0 < m < \infty$, this means in the steady state equilibrium the real purchasing power of government money never goes to zero, and $m \to \infty$ is also ruled out because it violates feasibility constraint: $m_t < y$, for all t. Define $A \equiv \frac{\theta\mu}{R} > 0$, and (13) is rewritten as:

$$m_{t+1} = \frac{A}{(y - m_t)^{1-\alpha}} m_t \equiv G(m_t). \tag{15}$$

It is easy to verify that there exists a unique (non-zero) stationary equilibrium, satisfying $m = y - A^{\frac{1}{1-\alpha}}$.[24] That is, there is a monetary equilibrium m that satisfies:

$$m = y - (\frac{\theta\mu}{R})^{\frac{1}{1-\alpha}}. \tag{16}$$

Then, one can use equations (14), (6), and (11) to solve for τ, k, and p. Note that according to equation (14), $\tau = (\frac{R}{\mu} - 1)m$, for $\tau > 0$ to hold, I shall assume $R > \mu$.

4 Trust shocks and financial crises

Consider a thought experiment in which there is a sudden drop in the trust parameter θ. This is meant to engineer a "lack of trust" environment. One could imagine that an economy is initially at a high trust state, agents are then shocked by a surprised and permanent drop in θ, and the economy enters a low trust state. The focus of the paper is to examine the real and monetary effects of such trust shocks. Specifically, I compare the equilibrium values of variables in a high trust regime, marked by a ($\hat{}$), with the steady state equilibrium in a low trust regime, denoted by a ($*$), and that

[24] The stability properties of the equilibrium are familiar in OLG models with fiat money, where the return on money is pegged. Note that, technically, there also exists a degenerate equilibrium, $m = 0$, which is ruled out by our assumption.

$\theta^* < \hat{\theta}$.

Let us start by characterizing the steady state level of government money m^*, when the trust parameter suddenly drops. From equation (16), we get:

$$m^* = y - (\frac{\theta^* \mu}{R})^{\frac{1}{1-\alpha}}. \tag{17}$$

This leads to the following proposition.

Proposition 1. *When the trust parameter drops unexpectedly, $\hat{\theta} \to \theta^*$, and $\theta^* < \hat{\theta}$, workers will hold more government money, i.e., $m^* > \hat{m}$.*

Proof. The proof of $m^* > \hat{m}$ follows immediately from equation (16).

The economic intuition behind this proposition is simple. Note that there exists a binding credit constraint $k^{1-\alpha} = \frac{\theta}{r}$ in the economy. As the trust parameter θ falls, young workers are willing to safely lend less investment goods k to young entrepreneurs. Given that young workers are endowed with a fixed amount of output y, they would then divert more of their savings into consumption goods in their portfolio. In this model, consumption goods are saved using government money, which is owned by old workers, thus the demand for money unambiguously increases.[25] This also has important implications for inflation (deflation) dynamics, as I shall explain in Section 5.

Note that the real return on capital r is not affected by trust shocks. By no-arbitrage condition, $r_t = R_t(p_t/p_{t+1})$, the real rate of return on capital equals the real return on government money, which is determined by the joint behavior of monetary and fiscal authorities. In this model, interest rate is pegged, whereas the path of money, and hence the long-run inflation rate, is controlled by the fiscal authority.[26] Thus, as the

[25] Note that there exists a spot market in which young workers sell their consumption goods to old workers and thus receive government money.

[26] In equilibrium, interest rate is R, and the rate of inflation $\Pi = \mu$, so the real return on capital $r = \frac{R}{\mu}$.

trust parameter unexpectedly falls, young workers would unambiguously reduce their capital investment.

Lemma 1. *If there is a lack of trust, young workers would reduce their capital investment*, i.e., $k^* < \hat{k}$.

Proof. See above discussions.

Following Freeman and Huffman (1991), total real output (or GDP) at t equals the total endowment (Ny) of young workers plus output generated by capital investment that was created in the previous period. Because in period $t-1$ each young entrepreneur created k_{t-1} units of capital and there were N of those individuals, real GDP in period t equals:

$$GDP_t = Ny + Nf(k_{t-1}). \tag{18}$$

Proposition 2. *A lack of trust causes a drop in real output in the steady state, i.e.,* $GDP^* < \widehat{GDP}$.

Proof. Note that $f(k) = k^\alpha$ and $f'(k) = \alpha k^{\alpha-1} > 0$, a higher level of capital investment would lead to an increase in real output. From (18), as N and y are exogenously given, real output in the steady state depends solely on the level of capital stock. Following the result of Lemma 1 $k^* < \hat{k}$, one gets $GDP^* < \widehat{GDP}$.

Next, let us turn to the examination of the effects of trust shocks on agents' consumption (or welfare in a parsimonious way). Suppose that the trust shock arrives at date t, for those (both workers and entrepreneurs) who are born at t, their consumption at the steady state would be clearly affected, as indicated by equations (9) and (10).

Proposition 3. *A sudden drop in the trust parameter θ would reduce consumption for young workers who are born at date t, whereas the change in consumption for young entrepreneurs is ambiguous.*[27]

[27]Note that agents do not consume in the period when they are born, consumption here refers to

Proof. For young workers, according to (14), in the steady state, $\tau^* = (\frac{R}{\mu} - 1)m^* > \hat{\tau} = (\frac{R}{\mu} - 1)\hat{m}$. From equation (9), one gets $(c^w)^* = ry - \tau^* < \widehat{(c^w)} = ry - \hat{\tau}$. For young entrepreneurs, following equation (10), $c^e(k) = f(k) - rk$, so that $\frac{dc^e(k)}{dk} = f'(k) - r = \alpha k^{\alpha-1} - r$. Thus the sign of $\frac{dc^e(k)}{dk}$ could be positive or negative, depending on the initial values of k and r.

Intuitively, once the economy enters a low trust state, young workers would choose to increase their holdings of government money. As public debt increases, to balance the budge, the government need to increase tax revenues. Since old workers (who were young previously) bear the tax burden, their consumption would fall. In addition, in the steady state, consumption for young entrepreneurs depends solely on capital investment. A higher level of capital investment would increase future output but would also increase the cost of borrowing. In an economy where the marginal cost of borrowing is determined by government policy, an additional unit of investment may increase or decrease consumption for young entrepreneurs, depending on the initial levels of investment and cost of borrowing.[28]

In sum, the decline in the trust parameter θ corresponds to an evaporation of lender confidence. Workers then do not trust entrepreneurs as much as before. This generates a "credit crisis" or "financial crisis". In particular, such shocks have real effects on the economy. In the financial crisis, workers are willing to lend less to entrepreneurs so that there is a decline in capital investment. This in turn leads to a fall in real output. Consumption for young workers also falls, since they have to pay higher real taxes during the crisis. My analysis also shows that the welfare effects of trust shocks can be detrimental to both workers and entrepreneurs.

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the expected level of consumption when they become old.

[28]Note that there are also old workers and old entrepreneurs who live in the economy. However, the welfare analysis of these types of agents is largely uninteresting. This is because they are born at date $t-1$, whereas the shock hits the economy at date t. For example, according to equation (10), expected consumption (or welfare) for old entrepreneurs is defined as: $c_t^e = f(k_{t-1}) - r_{t-1}k_{t-1}$. It is clear that their welfare is not affected by trust shocks which arrive only at date t.

5 Monetary effects of trust shocks

Let us turn to the discussion of the monetary effects of exogenous variations in θ. As before, the key exercise is to compare the equilibria with and without an exogenous drop in creditor sentiment θ. I shall start by studying the steady state price level.

Proposition 4. *An exogenous drop in credit sentiment θ causes a fall in the price level, i.e., $p^* < \hat{p}$.*

Proof. The money market clearing condition (11) requires that $M_t = p_t m_t$. Recall that in this economy, the path of M_t is determined by the government (or the fiscal authority) through $M_t = \mu M_{t-1}$, which also implies that the long-run inflation is anchored by μ. Since $m^* > \hat{m}$, following the result of Proposition 1, and that $p^* m^* = \hat{p}\hat{m}$, one gets $p^* < \hat{p}$, which completes the proof.

The above result shows that exogenous variations in trust can generate a business cycle with a procyclical price-level. That is, a fall in real output is associated with a decline in the price level. Note that the result of a procyclical price-level is consistent with the canonical New Keynesian model with nominal rigidities (see, for example, Clarida et al., 1999). The underlying mechanism, however, is quite different from this model. In the textbook New Keynesian Phillips Curve (NKPC), inflation today depends on inflation expectations and current output. Lower output portends lower inflation (or deflation). This line of reasoning, however, struggles with explaining the low inflation episodes during and following the Great Recession (see Ball and Mazumder, 2011; Hall, 2011; King and Watson, 2012). Inflation has simply remained low and below the target for too long after output has picked up. For instance, Hall (2011) argues that standard DSGE models based on NKPC, according to which prices are set on the basis of a markup over expected future real marginal costs, cannot properly account for the evolution of prices. He has called for a fundamental reconsideration of

macroeconomic models in which inflation depends on a measure of slack in economic activity.

This model provides a useful alternative to explaining inflation (deflation) dynamics. In this model, the path of government money is controlled entirely by the fiscal authority, thus as the real demand for money increases, to clear the money market, the price level simply has to fall. This implies that the value of money (i.e., $1/p_t$) has to increase. An evaporation of trust thus induces transitory deflation in the economy. It is also worth noting that the model is in the same spirit of the "quantity theory of money" (see Jia, 2020 for a discussion). In a nutshell, in this model, it is the real demand for government money that ultimately influences the price level.

Intuitively, in a low trust state, young workers divert more of their savings into consumption goods. To store the value of goods, it leads to an increase in the real demand for government money. Since the path of money is controlled by the government, an increase in the demand for money would cause a fall in the price level, inducing transitory deflation. One may interpret the situation as a "flight to quality" or "flight to liquidity", along with a decline in output (due to a fall in investment), as often observed in financial crises (see Beber et al., 2009; Baele et al., 2020).

Next, I turn to the discussion of the impact of trust shocks on monetary aggregates (or credit aggregates). The financial crisis of 2007-2009 has reignited a new interest in money and credit in the economy and the crucial rule they could play in shaping business cycle fluctuations, and propagating and amplifying macroeconomic shocks (see Reinhart and Rogoff, 2009; Schularick and Taylor, 2012). Economic historians have argued that monetary aggregates contain valuable information about financial crises and should be paid more attention by researchers and policymakers (e.g., Kindleberger, 1978; Minsky, 1986; Jordà et al. 2011, 2013, 2015a, 2015b; Schularick and Taylor, 2012). In particular, credit plays an important role in shaping the business cycle,

notably the intensity of recessions as well as the likelihood of financial crisis (see Jordà et al. 2011, 2013).[29] However, the dominant New Keynesian synthesis typically adopts a cashless approach in which monetary aggregates are either absent or passive (see Woodford, 2003).

Following Freeman and Huffman (1991), the nominal money stock at date t is the sum of government money (public money) and deposits with entrepreneurs (private money):

$$\underbrace{MS_t}_{\text{money stock}} \equiv \underbrace{M_t}_{\text{public money}} + \underbrace{Nk_tp_t}_{\text{private money}}. \tag{19}$$

Let us define private money $Q_t \equiv Nk_tp_t = k_tp_t$.[30] And one can interpret MS_t as "broad money".

Proposition 5. *An exogenous drop in the trust parameter θ causes a shrink in private money, i.e., $Q^* < \hat{Q}$.*

Proof. Given that $Q = kp$, since $k^* < \hat{k}$ and $p^* < \hat{p}$, we immediately have $Q^* < \hat{Q}$.

In this model, recall that private money (in real terms) is fundamentally capital investment (or intermediated capital). It is determined by the amount of investment goods that young workers choose to save. In other words, it is only when workers save their endowed labor in investment goods that entrepreneurs create the exact same amount of deposits, i.e., inside money. Once the trust shock hits the economy, capital investment drops, so does private money. Note that although Q, a form of debt and created by young entrepreneurs *ex nihilo*, is measured by dollars, it does not constitute of actual dollars.

In addition, an increase in money stock, through private money creation, need

[29] Using data on 14 advanced economies between 1870 and 2008, Jordà et al. (2013) document that more credit-intensive expansions tend to be followed by deeper recessions and slower recoveries.

[30] Note that I have made the harmless normalization that $N = 1$.

not affect the overall price level, if the supply of private money is matched by an increase in demand. This is an interesting result, since it is at odds with the celebrated argument that credit creation increases the price level.[31] My result shows that this does not necessarily have to be the case. In this model, even though money stock (broad money) is increased by credit creation, the increase in money supply is exactly matched by an increase in money demand. That is, young workers demand private money to store the value of their goods and use it as a claim check for future output. In this economy, it is still equation (11) that determines the price level.

Another misunderstood concept in monetary economics is the "money multiplier" in standard economic textbooks. According to this view, policy changes are implemented via open market operations that change the amount of reserves (the so-called high-powered money). Binding reserve requirements, in turn, limit the issuance of deposits to government money. As a result, there is a tight, mechanical, link between government money and the level of deposits (see Disyatat, 2011). In this classic description, the money multiplier is equal to the inverse of the reserve requirement.

However, this close relationship between public and private money has called into question and clearly been broken down during the Great Recession (see, for example, Disyatat, 2011; Carpenter and Demiralp, 2012). In the global financial crisis, many central banks around the world have implemented "Quantitative Easing", which leads to a dramatic increase in the amount of money. At the same time, however, credit growth has been *declined* and picked up slowly (see Anderson et al., 2017). This contradicts with the money multiplier theory, which would suggest a big increase in credit growth.[32] Next, I turn to the description of the money multiplier in this model.

[31] Of course, excessive credit creation can and often do cause inflation.

[32] It is also puzzling to note that central banks have been struggling with bringing up inflation, despite the fact that a huge amount of reserves has been injected into the economy. According to the logic of my model, it is simply because the real demand for government money increases by a large amount.

Let us rewrite equation (19),

$$MS_t = M_t(1 + \frac{k_t}{m_t}), \tag{20}$$

where $MM_t \equiv \frac{k_t}{m_t}$ can be interpreted as the money multiplier in this model. It is important to note that in this modelling environment, the money multiplier is not a constant and is *endogenously* determined in the economy.

Proposition 6. *In a financial crisis where there is a lack of trust, the money multiplier falls, i.e.,* $MM^* < \widehat{MM}$.

Corollary. *For a given stock of fiat money, a fall in the money multiplier would imply a fall in total money stock, i.e.,* $MS^* < \widehat{MS}$.

Proof. Since $MM \equiv \frac{k}{m}$, and that $k^* < \hat{k}$, $m^* > \hat{m}$, one gets $MM^* < \widehat{MM}$. And from equation (20), $MS = M(1 + MM)$, we have $MS^* < \widehat{MS}$.

Intuitively, in this model, once the stock of government money is set by the government, the total money stock is determined by the ratio of private to public money, $\frac{k_t}{m_t}$, i.e., the money multiplier. Due to a lack of trust, young workers would save less investment goods and choose to hold more government money in their portfolios, thus the money multiplier unambiguously falls. This, in turn, causes a contraction in the total money supply. Unlike the traditional formulation of the money multiplier, the money multiplier is endogenously determined in this model, as a result, as it falls, so does the total supply of money. And there does not exist a tight relationship between government money and the money stock. My result is also consistent with the evidence that both the total money stock and the money multiplier typically fall during a period of financial distress (see, for example, Disyatat, 2011; Anderson et al., 2017).

A Numerical Example. Suppose that $U_t^i = c_{t+1}^i$, $i \in (w, e)$. Let $f(k_t) = k_t^\alpha$, so that $f^{'}(k_t) = \alpha k_t^{\alpha-1}$. The model is calibrated on the assumption that one period represents

30 years. I set $R = (1.03)^{30} = 2.4273$, $\mu = (1.02)^{30} = 1.8114$. In addition, I choose $\alpha = 0.35$, $\theta = 0.8$, and $y = N = M_0 = 1$.

Let us first characterize the stationary equilibrium without unexpected variations in the trust parameter, that is, the steady state when $\hat{\theta} = 0.8$. Following equation (16), we get $\hat{m} = y - (\frac{\hat{\theta}\mu}{R})^{\frac{1}{1-\alpha}} = 0.5478$. Real taxes are then solved by using equation (14): $\hat{\tau} = \frac{R\hat{m}}{\mu} - \hat{m} = 0.1863$. With $\hat{m}$ and $\hat{\tau}$ so determined, we then use equations (6) and (11) to solve for $\hat{k}$ and $\hat{p}$: $\hat{k} = 0.4522$ and $\hat{p} = 1.8256$. In addition, following the definition of GDP, total real output $\widehat{GDP} = Ny + Nf(\hat{k}) = 1.7575$. Using equations (9) and (10), expected consumption (or welfare) for young workers and young entrepreneurs are given by: $\widehat{(c^w)} = ry - \hat{\tau} = 1.1538$ and $\widehat{(c^e)} = f(\hat{k}) - r\hat{k} = 0.1515$, respectively[33] Finally, private money (credit) $\hat{Q} = \hat{k}\hat{p} = 0.8256$, and the money multiplier $\widehat{MS} = \frac{\hat{k}}{\hat{m}} = 0.8256$.

Now, let us consider the thought experiment to mimic a financial crisis, which is engineered by a lack of trust. Suppose that there is an unexpected drop in the trust parameter θ (trust shocks), from $\hat{\theta} = 0.8$ to $\theta^* = 0.6$.[34] That is, we consider a big drop, 25%, in trust, which is our benchmark experiment. Figure 1 reports both the real and monetary effects of trust shocks on the macroeconomy. The horizontal axis is the trust parameter θ, which ranges from 0.4 to 0.8, measuring the size of trust shocks.[35]

On the real side of the economy, in this experiment, since entrepreneurs become less trustworthy and hence are less able to borrow, young workers would divert less of their savings into investment goods, which leads to a fall in capital investment by 35.76%. This, in turn, causes real output to fall by 6.19%. Young workers would demand more government money and m increases by 29.52%. As public debt increases, the government now has to increase real tax revenues τ to balance the budget. Since old

[33]Note that the real return on capital r can be solved by using either equation (7) or equation (8). Specifically, $r = \frac{R}{\mu} = 1.34$, or $r = \frac{\hat{\theta}}{(\hat{k})^{1-\alpha}} = 1.34$.

[34]Notice that trust shocks are assumed to be unexpected and permanent.

[35]To interpret the numbers, for example, $\theta = 0.4$ reports the results when there is a bigger drop, 50% (from $\theta = 0.8$ to $\theta = 0.4$), in the trust parameter.

workers (the previous young workers) bear the tax burden, their consumption would unambiguously fall.[36]

To examine the monetary effects of trust shocks on the economy, note that, to clear the money market, an increase in the real demand for government money would cause the price level to fall, inducing transitory deflation. This also means the real value of money $(1/p)$ has to increase. In our benchmark experiment, the price level falls by 22.79%. In addition, private money (deposits) Q falls by around 50%. This is because both capital investment and the price level fall in the financial crisis. Finally, note that the money multiplier is endogenously determined in this model, i.e., $MM \equiv \frac{k}{m}$, a decline in capital investment and an increase in the real demand for money would both cause the money multiplier to fall; in our benchmark experiment, the money multiplier drops by 50.41%. Thus, this model generates a contraction in private money and a fall in the money multiplier, which are often observed in economic recessions (see Disyatat, 2011). In sum, the model shows that trust shocks can have significant effects on both the real and monetary variables, with salient features that are in line with financial crises in history (see Kindleberger, 1978; Reinhart and Rogoff, 2009).

6 Conclusion

Understanding trust is of primary importance to the theory of money and business cycle fluctuations. However, the literature has provided few formal models upon which the impact of trust on the macroeconomy can be studied. This is presumably because trust is intangible and hard to model, and it has proved difficult to incorporate money and credit into a standard general equilibrium framework of macroeconomics.

[36] Note that, however, the welfare effects of trust shocks on young entrepreneurs' consumption are ambiguous, as indicated by Proposition 3. In this experiment, the expected consumption of young entrepreneurs actually increases.

This paper develops an overlapping generations model (OLG) with public and private money and studies the effects of trust shocks on the economy. In this paper, trust is modelled as limited commitment between borrowers and lenders. I assume, for moral hazard reasons, a borrower who issues IOUs (private money) can credibly commit to repay at most a fraction of his or her future output. The fraction thus captures the effective degree of commitment, or "trust", in the economy. The paper shows that an evaporation of trust can engineer a financial crisis, with substantial effects on both the real and monetary variables.

In the model, an unexpected drop in the trust parameter causes young workers to divert less of their savings into investment goods and more of their savings into consumption goods. A fall in capital investment in turn leads to a decline in real output. As young workers demand more public money, the government has to raise more revenues through taxation and thus the real taxes increase. In the model, since old workers (the previous young workers) pay the tax, the expected consumption of young workers unambiguously falls. I show that, from the perspective of welfare, trust shocks can have detrimental effects on both workers and entrepreneurs.

Equipped with a modelling device where public and private money coexist, the model is able to examine the monetary effects of trust shocks. In particular, the model offers an explanation of inflation dynamics, complementary to the standard New Keynesian DSGE framework. The model shows that, to clear the money market, an increase in the real demand for government money causes the price level to fall, inducing transitory deflation. This also means the real value of government money has to increase. This result is in line with the secular deflation during and following the Great Recession. In addition, the decline in capital investment and the price level also implies that the amount of deposits has to shrink in a financial crisis. Finally, the money multiplier is endogenously determined in this model. I show that, once trust

shocks hit the economy, the money multiplier drops. This is due to the decrease in capital investment and the increase in the demand for government money. In a nutshell, the model shows how a lack of trust can mimic a financial crisis, with significant effects on both the real and monetary variables in the economy.

Two final remarks are in order. First, studying trust in a monetary economy is a fruitful starting point for macroeconomics. This paper models trust as a limited commitment friction and provides an attempt at formally evaluating the impact of trust shocks on the macroeconomy. However, this is only one approach to introduce trust into a monetary model. Trust can also be captured by asset's liquidity (see Bigio, 2015; Kiyotaki and Moore, 2019). For example, the reason why one asset is more liquid than another asset is because the asset is more trustworthy. Cash and reserves are the most liquid assets because they are backed by the government. Thus, understanding trust in a model where assets differ in their liquidity characteristics is also interesting.

Second, the low-inflation (deflation) episodes of the Great Recession have posed a great challenge on New Keynesian DSGE models (see Hall, 2011). The "missing disinflation" presents a big puzzle for many economists. This paper offers an alternative explanation on the secular deflation during and following the financial crisis of 2007-2009. In this model, it is the real demand for government money that ultimately influences the price level. However, more research should be conducted to explain the "missing disinflation" from the Great Recession.

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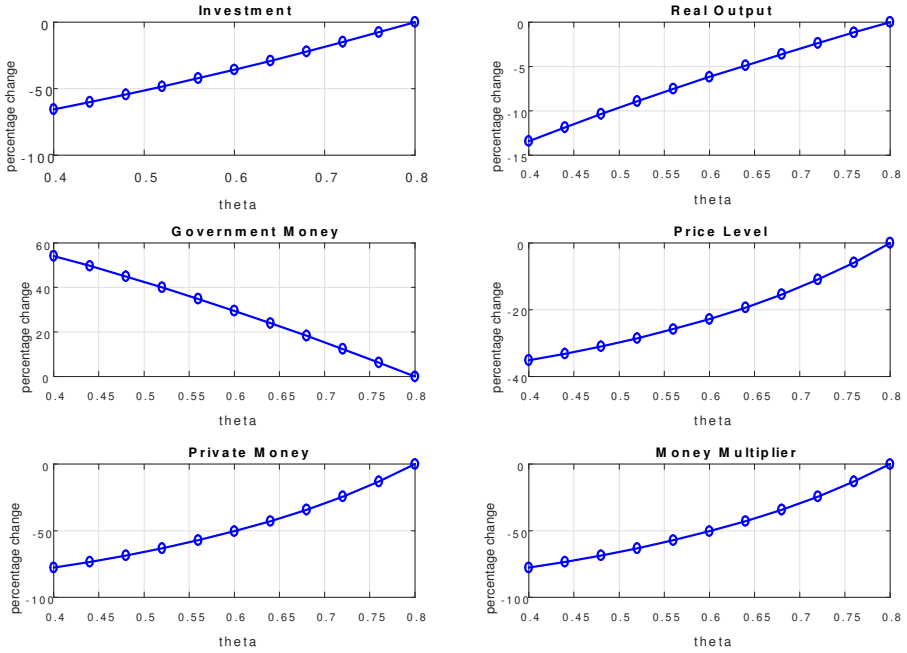
Figure 1
The Real and Monetary Effects of Trust Shocks on the Economy



Note that: The horizontal axis represents the level of trust, θ, in the economy. The vertical axis reports percentage deviations from steady state (when $\hat{\theta} = 0.8$), once θ drops unexpectedly form 0.8 to the current level.