



## Debt deflation effects of monetary policy<sup>☆</sup>

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### ABSTRACT

We assess the role that monetary policy plays in the decision to default using a General Equilibrium model with collateralized loans, trade in fiat money and production. The monetary authority extends long-term credit against risky collateral along with its traditional monetary operations. The value of collateral depends on traditional monetary policy and agents can optimally choose to default depending on the relative value of the collateral to the face value of the loan. Default results in foreclosure, higher borrowing costs, inefficient investment and a decrease in total output. We show that pre-crisis contractionary monetary policy interacts with Fisherian debt-deflation dynamics and can increase the probability that a crisis occurs.

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## 1. Introduction

The financial crisis of 2007–2008 has renewed the interest in the ability of monetary policy to mitigate the adverse consequences that financial frictions can have on real economic activity. Mishkin (2009) and Gertler and Karadi (2011) argue that accommodative monetary policy is helpful during financial crisis episodes. This paper takes a step back and examines whether pre-crisis

contractionary monetary policy can increase the likelihood that a crisis occurs in the future and, if yes, what are its real effects.

Our model can succinctly nest competing visions of the causes of the Great Depression (and of similar episodes) where debt-deflation dynamics act as an amplification mechanism.<sup>1</sup> On the one hand, Friedman and Schwartz (1963) find a high positive correlation between money supply and output and conclude that the decline in the money stock before the Great Depression was a substantial factor for the subsequent deflation and decline in GDP. On the other hand, Bernanke (1983) establishes that the Great Depression can be better explained when one explicitly models the financial frictions, which can impede the supply of credit to the real economy and, thus, GDP growth. Our analysis suggests that monetary forces are capable of inducing debt-deflation dynamics, but only when they exacerbate the underlying financial frictions, which

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<sup>1</sup> The origin of this view can be traced back to Fisher (1933). His analysis is based on two fundamental conditions, over-indebtedness and deflation. He argued that over-indebtedness can precipitate deflation in future periods and subsequently liquidation of collateralized debt and bankruptcy, which can lead to fire sales suppressing the value of the collateral even further. Hence, the initial deflationary pressures are exacerbated and they precipitate to even higher default, and, ultimately, to lower output.

in our model lead to default. Thus, we propose a “debt-deflation” channel of monetary policy.

We examine the effects of monetary policy on total output within a framework of fully flexible prices. The underlying friction is that we allow agents to (endogenously) default on their long-term loan obligations. Thus, there is a need for collateral to back these loans. In all other respects, we maintain all the structural characteristics of General Equilibrium analysis, i.e. optimizing behavior, perfectly competitive markets and rational expectations.

We show how an adverse monetary shock in the present can lead to over-in-debtedness and future deflation that in some state of the world can result in default, collateral liquidation, reallocation of capital and finally reduction in GDP. Market incompleteness is central to our analysis, since agents cannot write comprehensive contracts and hedge the possibility of default. We consider a two period economy populated by entrepreneurs, who both consume and produce, and show under what conditions the system can move to a state which is characterized by defaults on collateralized loan obligations. Agents engage into long-term borrowing to buy the productive assets, which they pledge as collateral to secure their loan. The decision to default is endogenous and depends on the difference between the value of the collateral and the loan as in [Geanakoplos \(2003\)](#). We introduce money to emphasize how a nominal shock, and not only a productivity or financial shock, can lead to financial fragility and a reduction in GDP.

The main mechanism can be summarized as follows. Consider an entrepreneur, who is poor in capital goods, and uses both short-term and long-term (collateralized) funding to acquire the capital goods in period one, which are then pledged as collateral for the long-term loan. Further trade in capital goods continues in the future (period 2), which ultimately ensures an optimal allocation of capital goods in the economy in the absence of default. The entrepreneur’s default decision is based on comparing the nominal value of their contractual obligation against the value of their pledged collateral. We show that a decrease in short-term money supply in period one could cause a decline in the value of collateral in period two.

How does this happen and how does the contractionary monetary policy at present cause lower collateral values tomorrow? First, the lower short-term funding in period one leads to higher leverage in the long-term loan since trade in capital goods or, equivalently, the amount of collateral pledged for the long-term loan decrease. Second, the volume of trade in capital goods shifts to the future so as to achieve the optimal allocation. In other words, the price of capital goods drops in period two since the same quantity of money is chasing more goods in the market.

The impact on the real economy occurs when the entrepreneur defaults and loses the capital asset that is pledged as collateral. Then, he needs to attract new capital under more stringent financial conditions that results in suboptimal allocation of capital goods. Ultimately, capital is misallocated to firms that are not liquidity constrained, but have a lower marginal product of capital. We refer the reader to [Gilchrist et al. \(2013\)](#) for an empirical assessment of the magnitude of the loss in aggregate resources due to such misallocation and for a review of the related literature.

Our work relates to the strand of literature that argues that the financial crisis and in particular defaults on financial contracts can lead to economic recessions. [Bernanke and Gertler \(1989\)](#) and [Bernanke et al. \(1999\)](#) model a credit constraint, arising from costly state verification, whereby the firm is only able to obtain collateralized loans and the amount of credit to the firm shrinks in the presence of deflationary pressures on the prices of its assets. This introduces an external finance premium, which increases with a decrease in the relative price of capital. In turn, an increase in the

cost of capital will result in a decrease in the marginal product and a reduction in GDP. Our paper differs because there is no deadweight loss associated with default and capital misallocation is the mechanism through which default affects output. Finally, our focus is on the debt-deflation pressures of monetary policy.

Our approach is also related to the work on the debt deflation theory of Sudden Stops ([Mendoza, 2006, 2010](#); [Mendoza and Smith, 2006](#)). These papers introduce collateral constraints similar to [Kiyotaki and Moore \(1997\)](#) in an RBC model of a Small Open Economy to show that when debt is sufficiently high, an adverse productivity shock triggers the constraints and results in a fire-sales spiral, falling prices and a reduction in output. Our results point to the same direction, though contrary to them we consider a monetary economy with nominal contracts and focus on monetary shocks, which have not been thoroughly studied in the literature. In addition, they do not allow for the possibility of default. The latter is crucial for our analysis, since it is the reason that capital gets reallocated to result in inefficient production. Due to fully flexible nominal prices, monetary policy only affects the price level in the final period and not the total output in the absence of default.<sup>2</sup> However, default makes credit conditions more adverse and capital is not allocated efficiently.

We contribute to the aforementioned papers by studying the effect of nominal loan contracts on the propagation of shocks and output. Importantly, [Bernanke et al. \(1999\)](#) focus on real contracts and argue that the modeling of nominal ones is an important step for future research. In our work, nominal long-term loans play a crucial role, since their face value is invariant to deflationary pressures, while the value of collateral that backs them is not. Moreover, we explicitly examine how pre-crisis monetary policy affects the probability of a crisis.

Closer to us is the work of [Goodhart et al. \(2004, 2006\)](#) and [Tsomocos \(2003\)](#), which we extend in several ways. First, we introduce production and, consequently, the real effects of monetary policy occur through the production sector of the economy. Monetary policy causes default and misallocation of capital and, ultimately, inefficient productive decisions. Unlike the aforementioned papers the default channel operates not through the household sector but through debt financing of firms. Second, in stark contrast with [Goodhart et al. \(2010\)](#), our framework yields additional implications for the normalization of monetary policy within an environment that central banks hold long-term risky assets. It is precisely the interaction of liquidity, collateral requirements on central bank loans, and production that allows us to study debt deflation effects of monetary policy we have in mind. This analysis could not be performed using the previous work on the subject by Goodhart and co-authors.

To reiterate, our framework is distinct from the aforementioned work and other studies in the literature following the DSGE tradition (for example, [Cúrdia and Woodford, 2011](#); [Gertler and Karadi, 2011](#), who also study unconventional monetary policy), because we bring the possibility of default on the central bank into the forefront of our analysis. Importantly, we model long-term loans by the central bank, which are collateralized and can be defaulted upon, alongside the conventional short-term monetary operations. On one hand, default on long-term collateralized extended by the central bank has important normative implications for the value of money and the determination of the price level, which we do not address in this paper, but are extensively studied in [Lin et al. \(2015\)](#). On the other hand, default on long-term assets held by the central bank can have important positive implications, one of which is the inefficient reallocation of productive

<sup>2</sup> [Eggertsson and Krugman \(2012\)](#) show that when prices are sticky, deleveraging and deflation will still affect output due to a reduction in aggregate demand.

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