

2 Can Monetary Policy Delay the Reallocation of Capital?*

Abstract

This chapter examines the medium-run effects of monetary policy and focuses its analyses on the consequences of distorted (in the sense of exogenously influenced) real interest rates that are currently observed in many industrialized countries. In our model, real interest rates that are too low hinder economic recovery because such rates allow relatively unproductive firms to remain in the market. Monetary policy should increase interest rates after a negative macroeconomic shock to force a reallocation of production factors to more productive firms. We show that there is a trade-off between the short-run and medium-run preferences of the central bank as a consequence. From a welfare perspective, the impact of monetary policy depends on the long-run interest rate relative to the welfare-maximizing interest rate because of the preference for variety in the model.

Keywords: Monetary Policy Design, Reallocation of Capital, Structural Change, Heterogeneous Firms

JEL-Classification: E32, E43, E50, E52

*I thank Reto Föllmi, Johannes Fritz, Jürg Müller, Frédéric Pittet, Rafael Plessow, Lukas Schmid, Darius Stuker, and the participants of the 2012 congress of the Swiss Society of Economics and Statistics in Zurich, the May 24, 2012, Sinergia-Seminar at the University of Zurich, and the 2013 “Structural Change, Dynamics, and Economics Growth” conference in Livorno for helpful comments. All remaining errors are mine.

2.1 Introduction

After the recent financial crisis, monetary authorities around the world resolutely intervened and have thus far prevented the world economy from suffering through a second Great Depression (as was experienced in the 1930s). Nevertheless, it is sobering that the US, the countries in the Euro area, and other industrialized economies are in their seventh year of less-than-potential growth (as indicated by the output gap according to measures of the International Monetary Fund (IMF)).² A quick turnaround is not in sight. Central banks have reacted to these ongoing recessional tendencies with more monetary *stimuli* as part of an unconventional monetary policy (i.e., “quantitative easing”). Data on interest rates show that at least the US Federal Reserve (FED) has been successful with its policy regarding its impact on interest rates. Figure 2.1 depicts the development of real interest rates for several maturities (illustrated by inflation-protected T-Bills) in the US between 2003 and 2014, which reveals a continuous and sustainable decrease in the real interest rate for all maturities considered.³ Thus, central banks seem to be able to influence real interest rates to the extent that they are not lower for real, structural reasons.

²cp. IMF (2014).

³This impression is supported by empirical evidence. In a regression of the real interest rates on their lags, a constant, and the official federal funds rate, a Quandt-Andrews test indicates that there is a structural break in the constant for the entire sample, whereas it does not demonstrate a similar finding for a time-restricted pre-crisis sample (the latter result is consistent with Gerlach and Moretti (2011)). This implies a statistically significant decrease in real interest rates for 5- and 7-year maturities. No significant result can be depicted for the other 20- and 10-year maturities. See appendix 2.A for the detailed results of the econometric analysis.

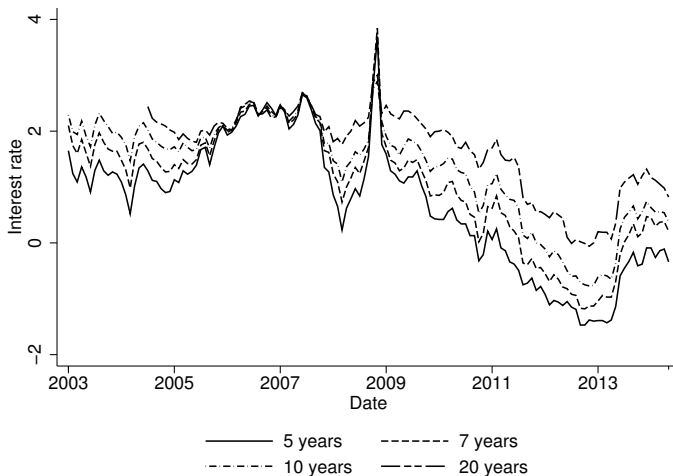


Figure 2.1: US monthly real interest rates (inflation-protected T-Bills).

Data are available for the 2003M01-2014M05 period, and for 20-, 10-, 7-, and 5-year maturities. Data on 20-year maturities from 2004M07 onwards. *Source:* US Department of the Treasury.

This chapter analyses the potential effects of “distorted” real interest rates in a simple industrial model with heterogeneous firms, as developed by Hopenhayn (1992) and advanced by Melitz (2003). Both models assume heterogeneous productivity. Whereas Melitz (2003) focuses on the implications of trade on the structure of an economy, we consider the influence of monetary policy on the allocation of capital in an economy through its impact on firms’ cost structures. We mainly contribute to the literature by proving existence and uniqueness of an equilibrium where increasing interest rates make the cost of borrowing too expensive for relatively unproductive firms, which forces them to exit the market. Thus, the resources of these firms can be reallocated to more productive use. Higher interest rates therefore increase average productivity and quantitative output but reduce variety. Taking into account households’ preference for variety, which is given in our model, this implies that there is a welfare-maximizing interest rate.

We assume that central banks are able to influence the allocation of capital in the economy (and therefore its medium-term development) through monetary policy. Indeed, the model suggests that the extent of the reaction of a central bank to fluctuations (regarding price level and output stability) has an impact on output and price level. This impact is shown to be inverse in the medium-run economy compared to the classic short-run influence that is typically considered for central banks, i.e., a stabilizing monetary policy after a long-lasting negative shock must increase interest rates in the medium-run economy when output is below its natural level, and vice versa.⁴ Thus, our model suggests a trade-off between short-term and medium-term goals for a central bank.

This important observation stems from the tasks and measures typically faced by central banks in nearly all industrialized countries: stabilizing consumer prices and dampening the effects of business cycles, particularly of recessions.⁵ To fulfill these goals, it is common wisdom that interest rates are lowered in a recession, stimulating investment and helping economic development to recover. Conversely, when fighting inflation and stabilizing prices, central banks reduce the money supply, which implies increasing interest rates. Nevertheless, this situation might only hold for the short-run because of the abovementioned trade-off. However, it appears that central banks do not consider this potential conflict and its impact on capital allocation. During long-lasting recessions, ignoring this conflict may delay economic recovery to a certain extent and may derogate future growth possibilities because productive firms cannot actualize their full potential.

Our work relates to the literature that addresses the fact that we currently observe neither an economic recovery nor extraordinary inflation despite low interest rates in many industrialized countries. Some authors argue that this is because

⁴Note that Schmitt-Grohé and Uribe (2012) also postulate a policy of increasing interest rates in their model with a liquidity trap to escape a jobless recovery.

⁵There is an ongoing discussion in the literature on whether central banks should also consider other goals, such as fighting asset price bubbles or stabilizing the financial system; see, e.g., Bernanke and Gertler (2001).

we are in a liquidity trap (e.g., Schmitt-Grohé and Uribe (2012); Werning (2011); Mertens and Ravn (2011)).⁶ Others require certain additional assumptions, such as credit constraints (e.g., Guerrieri and Lorenzoni (2011) or Hall (2011)). Whereas these papers continue to use a short-run perspective, we provide an explanation for the phenomenon of an economy that no longer reacts to monetary *stimuli* from a medium-run perspective (i.e., flexible prices but sluggish capital stock or input shares used), as postulated by Solow (2000) or Blanchard (1997).

The rest of the chapter is organized as follows. Section 2.2 provides an overview of the existing literature on the conventionally proposed medium- and long-run impacts of monetary policy. In section 2.3, the components of the new model proposed in this chapter are developed, and section 2.4 describes how the long-run steady state is determined. Section 2.5 incorporates the central bank as a policy maker. For demonstrative purposes, a simulation is performed in section 2.6 to show the consequences of different monetary policies. Section 2.7 finally concludes.

2.2 Review of related literature

Monetary policy generally finds its place only in research on business cycles in which new Keynesian models have been the primary workhorse for many years. This is a logical consequence of the generally accepted neutrality of monetary policy in the long-run economy. Authors who address the medium- or long-run impacts of monetary policy typically propose an indirect analysis by focusing on the potential consequences of the stabilizing effect of monetary policy.

Given the stabilizing effect of monetary policy, the relevant question now concerns the general relationship between business cycles and growth. The intellectual father of this idea is Joseph Schumpeter (1939), who formulated this concept as the “theory of creative destruction” in the 1930s. He stipulates that recessions are necessary to establish new technologies and production processes that will increase

⁶There are similar papers for the case of Japan; see, e.g., Krugman (1998).

the long-run output of the economy. Whereas Schumpeter (1939) provides only a qualitative description, Aghion and Howitt (1992) bring the idea into a tractable model. The driving force of this model is the prospect of potential monopoly profits from new innovations that crowd out old inventions (representing the literal process of “creative destruction”). A similar mechanism is used in an earlier work by Aghion and Saint-Paul (1991).

Other authors have supported this view on the positive effects of recessions and therefore provide, at least implicitly, a critical view of the stabilizing policies of monetary authorities. Notably, the theoretical motivations differ substantially. Caballero and Hammour (1994) argue that creation or innovation is a costly process that is optimally smoothed over time. On the contrary, destruction is a cost-free process. Consequently, recessions (simply modeled as exogenous demand shocks) have a cleansing effect on the economy. Outdated units are destroyed, and there is simultaneously a relatively high rate of innovation. Essential to the outcome of the predictions by this model is the cost function of creation, which is treated as an exogenously given black box. Mortensen and Pissarides (1994) find similar results in the context of a search model that focuses on unemployment.

Conversely, there is also a wide body of literature that postulates a negative relationship between economic fluctuations and long-term growth. The theoretical reasoning for this branch of the literature resides in the effects of so-called “learning by doing”, which has been first proposed by Arrow (1962). A more recent model based on this idea is developed by Martin and Rogers (1997). Its rationale may be described as the positive external effect of production on future productivity. Given that this effect decreases with increasing production, there is a negative relationship between business-cycle volatility and productivity in the economy. Blackburn (1999) represents an essential contribution to the literature because he incorporated the “learning-by-doing” effect in a model with “creative destruction”; he merges the two models, which results in the finding that stabilization policy has a negative impact on growth capability.

Empirical results reveal an unclear picture and do not support either view. Gali and Hammour (1993), Saint-Paul (1993), and, more recently, Broda and Weinstein (2007) favor Schumpeter’s hypothesis. The contrary position is mainly represented by Ramey and Ramey (1995), who find clear evidence of a negative relationship between volatility and growth in a sample of more than 95 countries. Martin and Rogers (2000) find a similar result when focusing on the cyclicity of unemployment. Although the empirical results are not conclusive, there is a tendency for micro-data, in particular, to support the “creative destruction” view (also postulated by Caballero and Hammour (1994)).

Due to developments following the financial crisis, more recent work focuses on the potential stabilizing impact of monetary policy in conjunction with the consequences of low interest rate policies and/or unconventional monetary policy instruments.⁷ Aghion et al. (2012) provide an empirical investigation that demonstrates that pro-cyclical real interest rates in interaction with credit constraints have a positive effect on labor productivity. Chu and Cozzi (2014) introduce a cash-in-advance constraint in a Schumpeterian R&D model. Due to the possibility of encouraging overinvestment in R&D, a policy of low interest rates may be welfare decreasing. Contrary to the previous literature, we consider the medium-term effects of low interest rates by focusing on the survival rate of firms. Nevertheless, the proposed impact of monetary policy is related to the “creative destruction” hypothesis in a broader sense.

2.3 The model

The model presented here draws on Melitz (2003) and incorporates heterogeneous firms in the same style. The model is assumed to describe medium-run development in an economy as proposed by Solow (2000) or Blanchard (1997). As

⁷Some earlier studies did this implicitly by analyzing the welfare consequences of the Friedman rule. See Bhattacharya et al. (2005) for an overview and a recent example.

related to the model, a fixed capital stock is assumed that cannot be decreased or increased in reaction to changing real interest rates that are determined by the central bank.⁸ Houses or machines cannot simply be liquidized or enhanced to a great extent, as it is frequently modeled in macroeconomic research. In fact, these are time-consuming processes.

The model consists of a two-sector economy with monopolistic competition. Unanticipated shocks are the source of economic fluctuations and therefore are the justification for an active monetary policy. The model is static.

2.3.1 Households

It is assumed that the economy consists of a constant population of identical households normalized to one. These households own the total capital stock (denoted by $\bar{K}$) and all technologies in the economy. The preferences of a representative household are given by a Stone-Geary-style utility function over a continuum of goods indexed by ω ,⁹

$$U = \int_{\omega \in \Omega} [\ln(c(\omega) + q) - \ln(q)] d\omega, \quad (2.1)$$

where $c(\omega)$ describes consumption of a specific variety, and q is a common preference parameter. The budget constraint reads as $\int_{\omega \in \Omega} p(\omega)c(\omega)d\omega \leq I$, where I denotes the income of a household. Total consumption is the integral over the consumption of all consumed varieties and denoted as C . It is assumed that M varieties are produced in the economy. Households maximize their utility, which

⁸This is generally a well-established approach and is used in older monetary models, in particular. See, for example, Barro and Gordon (1983) or Rogoff (1985).

⁹The Stone-Geary-style utility function is chosen because it allows for a more generalized form (i.e., variable elasticity of substitution) than the standard constant elasticity of substitution (CES) utility function, which is used by Melitz (2003), for example. Kongsamut et al. (2001) describe it as a short way to “embed different income elasticities in a parsimonious way” (p. 875). They also claim that this type of utility specification is supported empirically.

results in the following demand function for a specific variety, ω :

$$c(\omega) = p(\omega)^{-1} \left[\frac{I}{M} + q\bar{p} \right] - q, \quad (2.2)$$

where $\bar{p} \equiv \frac{1}{M} \int_{\omega \in \Omega} p(\omega) d\omega$ is the average price of the consumed goods. Demand increases with average price, which can be interpreted as the relative price of the other goods, and higher income, and it decreases with higher price and greater product variety. These are standard properties in models with differentiated goods.

2.3.2 Production

Each firm produces a different variety, ω . Capital must be borrowed from households at a common (net) interest rate, r . Production occurs by a linear constant-return-to-scale production function. All firms face identical fixed costs, $f > 0$, but different marginal costs or, more precisely, different productivity levels that are denoted by $\varphi > 0$. Firms draw their initial productivity, φ , from a common continuous probability distribution, $g(\varphi)$, which is defined over the interval $[0, \infty)$. The continuous cumulative distribution is $G(\varphi)$. Individual production is given by $y(\varphi) = \varphi(k(\varphi) - f)$. Thus, the pricing rule for every firm is

$$p(\varphi) = \sqrt{\frac{r}{\varphi q} \left[\frac{I}{M} + q\bar{p} \right]}, \quad (2.3)$$

based on its profit maximization considerations and depending on its individual productivity, φ . Given this pricing rule, the profit function of an individual firm reads as

$$\pi(\varphi) = \left(\sqrt{\frac{I}{M} + q\bar{p}} - \sqrt{\frac{rq}{\varphi}} \right)^2 - rf. \quad (2.4)$$

This can be interpreted as the profit from regular production minus payment for fixed costs. Note that payment for fixed costs depends on the interest rate or, more technically, on the common marginal cost factor, which is how the interest rate can be interpreted. This is because fixed costs are paid in units of capital whose price varies with the interest rate.

2.3.3 Zero cut-off profit condition

To make profits, a firm must reach a minimum productivity level, φ^* (cut-off productivity). Otherwise, the firm would drop out of the market. The price that a firm facing this cut-off productivity level charges is normalized to one ($p(\varphi^*) = 1$), i.e., this firm produces the numéraire. The cut-off productivity level is calculated by setting the profit function equal to zero and solving for φ . Thus, we have

$$\varphi^* = \frac{r}{1 - \frac{rf}{\frac{1}{M} + q(\bar{p}-1)}} = \frac{rc(\varphi^*)}{c(\varphi^*) - rf}. \quad (2.5)$$

It follows that $\frac{\partial \varphi^*}{\partial r} > 0 \forall r > 0$.¹⁰ This result is economically intuitive because it simply posits that the cut-off firm must reach a higher level of productivity with increasing costs of borrowing capital to stay in the market. The most important consequence of this process is that some capital resources become available after an increase of the interest rate, r , that can be reallocated to other firms that are more productive. Furthermore, for every producer that drops out of the market, unproductive fixed costs can be avoided. Unfortunately, one would also have to accept a reduced number of varieties because production is more expensive.

2.3.4 Aggregation

As previously discussed, an equilibrium is characterized by a mass, M , of firms (and therefore varieties). This mass is based on a finite total number of potential goods, $\omega \in \Omega$, which is defined as M_0 . The term “firm” should be interpreted in a broad sense in our context, it could also refer to particular technologies or sectors. It is self-evident to assume the existing technologies - and therefore the potential varieties - as given in a static medium-run model because developing new technologies is a time-consuming and dynamic process.¹¹ Because a fraction

¹⁰Formal proof is part of appendix 2.B.1.

¹¹Note that Dixit and Stiglitz (1977) implicitly use the same approach.

Heterogeneity in Macroeconomics and its Implications
for Monetary Policy

Schnell, F.

2015, XVIII, 166 p. 11 illus., Softcover

ISBN: 978-3-658-09730-1