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Creative Destruction: How monetary policy could help bringing the economic system to a more efficient plan.

Bachelor thesis

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Abstract

In this paper we show how a contraction in monetary policy affects the process of creative destruction. Thereby we use a rise in the Federal Reserve's policy interest rate as a proxy. We find that firms in the United States on average reduce their long-term debts and that average firm-level productivity increases as a result of a monetary contraction. With the first finding serving as a confirmation of prior research, our second finding validates the theory of creative destruction as firm-level productivity improves after a rise in the policy interest rate. This finding demonstrates a fundamental aspect of the theory of creative destruction. As unproductive firms are not able to meet rising interest expenses anymore, substantial dismissals of employees, divestitures of assets and ultimately liquidations result in a higher average firm-level productivity.

Keywords: *productivity, creative destruction, business cycle, monetary policy, Federal Funds rate.*

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1 – Introduction

Productivity is the efficiency with which the conversion of inputs into output occurs (Syverson, 2011). Interestingly, productivity shows large variety between both countries and businesses (e.g. Hsieh & Klenow, 2009). A great number of empirical studies tries to address the question why countries and businesses differ in their levels of productivity. These studies include elements found in firm-level production practices, such as organizational structure (Schoar, 2002), workers' human capital (Abowd, et al., 2005) and incentive pay (Lazear, 2000), as well as the countries' external operating environment that is mainly determined by the aggregate state of technology (Bloom, Schankerman, & Van Reenen, 2013), competition (Schmitz Jr, 2005), trade (Verhoogen, 2008) and regulations (e.g. Porter & Van der Linde, 1995; Knittel, 2002). These differences in productivity, both on aggregate and firm-level, directly determine firms' profits (Caves, Christensen, & Diewert, 1982); and the differences in aggregate productivity directly determine the standard of living in societies (Abernathy & Clark, 1985). Hence, both for businesses and countries, improving productivity is essential for survival and development. The powerful force behind these productivity improvements – and hence behind the improvements in the standard of living – is technological innovation (Abernathy & Clark, 1985), which, according to Solow (1957), are shifts that increase the output attainable from given inputs.

Over the past decade, OECD countries have experienced a major slowdown in aggregate productivity (McGowan, Andrews, & Millot, 2017). Research on firm level shows that this slowdown is the result of deteriorating productivity across firms (Andrews, Criscuolo, & Gal, 2016), the misallocation of capital to unproductive firms (Calligaris, 2015), and declining business dynamism (Decker et al., 2016). As a result, in the United States, approximately one out of eight companies currently have persistent problems in meeting their interest expenses (De Boer, 2018). These inefficient firms increasingly linger in the market by crowding out the expansion of the productive and innovative firms, which in turn obstructs technological advancement (Andrews & Saia, 2017). This crowding out is the consequence of unproductive firms trapping high-skilled labor (McGowan & Andrews, 2015) and consuming scarce resources (Andrews & Cingano, 2014), and a flow of capital to these inefficient firms which could better be allocated to productive firms (Gopinath et al., 2017). Combined with declining investments in technological innovations following from the global crisis (Paunov, 2012; Lee, Sameen, & Cowling, 2015), economic growth has come under pressure.

How is it possible that these inefficient, so-called zombie firms (e.g. Caballero, Hoshi, & Kashyap, 2008; McGowan, Andrews, & Millot, 2017) still exist? According to the theory of creative destruction (Schumpeter, 1942), firms that lack the productivity to be competitive should disappear over time because of competition in the market. However, as it appears, unproductive firms are far from being creatively destructed. Of all companies in the United States, on average, the ratio of a firm's total debts and net income shows an increasing trend since 2011 (Figure 1; FD, 2018). This clearly emphasizes the aggregate slowdown in productivity: the output – i.e. income – from given inputs – i.e. total liabilities – declined, which means that firms have continuously taken on higher levels of debt without income rising at the same pace (Figure 2; Federalreserve.gov, 2018).

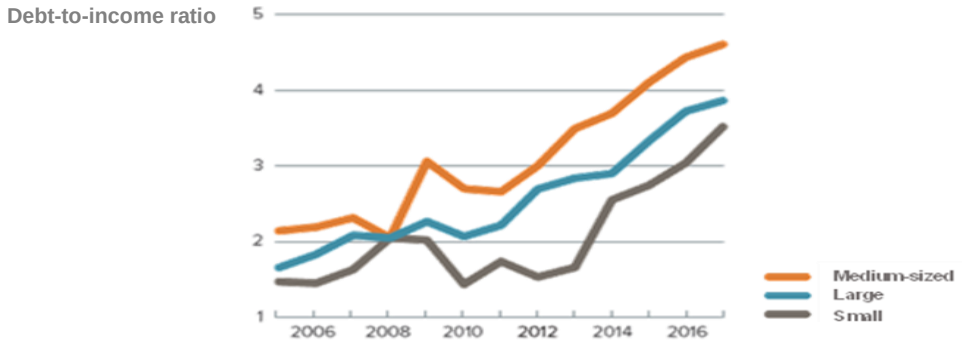

FIGURE 1

Deteriorating firm-level productivity in the United States, measured as the average debt-to-income ratio

The rising levels of corporate debts in the United States are likely the result of the unconventional monetary policy which the Federal Reserve – the central bank of the United States – applied (e.g. Neely, 2015). In reaction to the recession which followed from the financial crisis in 2008, the Federal Reserve dramatically lowered its policy interest rate toward the zero lower bound and pressured commercial banks to extend credits. This resulted in attractive borrowing conditions for which companies could take on debts, since the interest rate lenders charge to borrowers is positively affected by the policy interest rate (Burda & Wyplosz, 2017; pp. 233). And just as low rates encouraged companies to issue more debt, the low returns available on cash following from the same low interest rates tempted investors to buy corporate bonds, regardless of the associated risks.

Under these circumstances, unproductive firms borrowed additional capital and deleveraged existing debts with additional debts at lower costs. As a consequence, inefficient firms have been able to survive ever since, despite the lack of productivity. Following Schumpeter (1942), it seems that the expansionary policy stymied creative destruction from occurring.

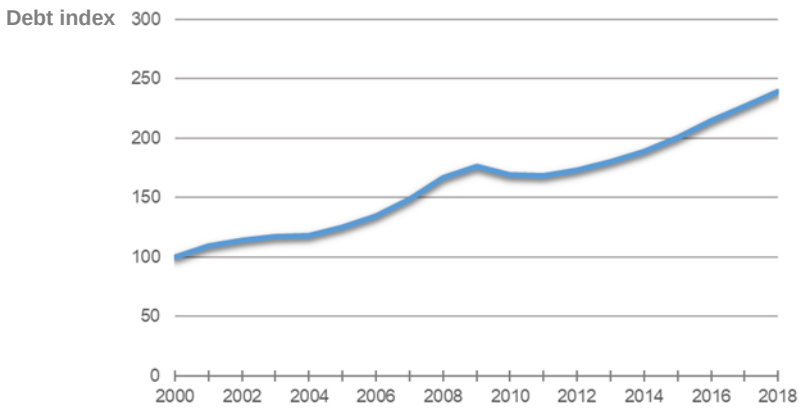

FIGURE 2

Aggregate Level of Corporate Debts in the United States; Year 2000 = 100

1.1 – Problem Definition

With the interest rates at such low levels, zombie firms can survive because of the provided loans on easy terms. However, from December 2015, the Federal Reserve has gradually tightened its monetary policy, raising the policy rate toward a 1.75% nowadays. And with the large number of American companies in mind that have persistent problems in meeting their interest expenses, such an increase could have serious consequences.

If unproductive firms cannot meet their interest expenses anymore, short-term economic growth will come under pressure because of substantial employee dismissals, divestitures of assets or ultimately bankruptcies associated with the worsening performance of such zombie firms. On top of that, lenders see the probability of default rising, which will increase interest rates even more through higher risk premiums (Burda & Wyplosz, 2017; pp. 233). Consequently, the recent tendency of firms deleveraging debts by taking on new debts will not persevere because the higher interest expenses associated with these new circumstances worsens firm performance even more (Gertler & Gilchrist, 1994; Bernanke & Gertler, 1995).

Hence, could it be that a contraction in monetary policy will destroy the old economic structure through its effect on inefficient firms? This bachelor thesis seeks to explore this possible consequence. Therefore we define the following problem statement: **does a contractionary monetary policy influence the repeating process of creative destruction in a positive way?** This statement forms the guideline for our study.

1.2 – Research Objectives

Although we do not aim to cover the entire subject just mentioned, this study is still valuable because of the two objectives it aims to achieve. The first objective is academic in nature and entails a contribution to the existing research on the effects of a contractionary monetary policy. By examining the effects on firm level of a rise in the policy interest rate, we aim to enhance current knowledge on the changes in aggregate economic variables as a consequence of a monetary contraction. Currently, it appears that the existing literature overlooks the fact that it is the behavior of the individual firm and consumer who initiate the changes in aggregate values. We emphasize this individual behavior as the foundation of the potential creative destruction by applying the real business cycle theory to our problem statement.

The second objective is economic in nature and implies a recommendation for both policymakers and company strategists. Knowledge on the possible consequences raises the question if it is wise for the monetary authorities to sustain the monetary tightening. It seems not, as aggregate demand falls relatively quickly after a rise in the policy interest rate (Bernanke & Blinder, 1992). And as production follows aggregate demand, real output declines, leaving the economy in a recession with higher levels of unemployment (Christiano, Eichenbaum, & Evans, 1994) – although the persistence of this decline is ambiguous (Uhlig, 2005). On the other hand, keeping interest rates at a low level might obstruct

productivity and – as a consequence – economic growth even more. And what should firms do in such risky circumstances? Is it wise to keep investing in technological innovation, knowing that the company could not even stay afloat when the interest rate rises?

Interestingly, despite the relevance of this topic because of the recent increase in the policy interest rate and the persistent slowdown in productivity, existing literature does not provide much evidence on the firm-level consequences of a monetary policy contraction. This bachelor thesis seeks to extend current insights on this research topic by placing the individual firm under the magnifying glass. Therefore our intention is to find a direct relationships between a rising interest rate and firm aggregates; we are not looking to reveal or analyze any possible trends between variables over time. We do so by answering the following research question:

"What are the firm-level consequences of a rise in the short-term policy interest rate on companies in the United States?"

In the study to come, we will derive two hypotheses and test these hypotheses empirically in order to provide an answer to the research question.

1.3 – Paper Outline

In this Chapter we introduced the topic of this bachelor thesis together with the research objectives we aim to achieve. These objectives differ from those in prior research since we concentrate on the direct consequences for individual firms generally, thus seeking a direct relationship between a contractionary monetary policy and firm-level indicators. To find this relationship, we start by reviewing the existing literature on the topic in Chapter 2. We pay attention to current knowledge on business cycles and the theory of creative destruction, the rules and instruments of monetary policy and prior research on the effects of monetary policy. Thereby we stress the uniqueness of our research by showing that firm-level productivity effects are relatively unexplored. This theoretical background results in the formulation of two hypotheses and the description of the expected relationships suggested by these hypotheses.

After that, we start our empirical analysis to examine whether the expected relationships are present. We do so by applying a panel data study on data provided for companies in the United States over a time period from 2004 until 2017. The technique used for this study is a regression analysis, which is a way to predict an outcome variable from one or several predictors (Field, 2009). We explain the use of this procedure in the third Chapter, starting with a description of the conceptual model together with a specification of the hypothesized relationships between variables used. Subsequently, we clarify these variables and describe the process of gathering data for these variables. We finish Chapter 3 with a justification of the proposed methodology. Chapter 4 describes the sample characteristics, together with the modifications of the dataset that are necessary for obtaining statistically reliable results. We also present the findings of the hypotheses tests in this fourth Chapter. In Chapter 5, we discuss the results,

together with the implications based on these findings. We end this bachelor thesis with a conclusion in Chapter 6.

2 – Theoretical Background

In this chapter, we explore the nature of creative destruction and the business cycles as a fundamental characteristic of this iterating process. We discuss how monetary policy affects this process, thereby explaining how monetary policy works and what its main purposes are. Subsequently, we discuss scientific research which emphasize the implications of monetary policy on all aspects of economic life. Thereby we show that current literature largely overlooks the firm-level consequences of a monetary contraction, which paves the way for formulating our hypotheses.

2.1 – Business Cycles and the Theory of Creative Destruction

Business cycles are recurrent fluctuations in economic activity (Cooley & Prescott, 1995) and are a fundamental characteristic of the capitalist economy (Schumpeter, 1942). These fluctuations show two broad regularities (Long & Plosser, 1983). First of all, measured as deviations from its trend value, fluctuations exhibit considerable persistence. Given that a variable is currently above or below the trend, it tends to stay above or below for some time. Secondly, measures of various economic activities move together. At times when one important measure is above its trend value, other measures also tend to be above their trend values. Thinking on business cycles thus implies combining long-term growth theory for explaining trends with theories on fluctuations around a trend value (Cooley & Prescott, 1995).

Knowledge on recurrent fluctuations in economic activity has been present ever since the existence of mankind; for example because certain professions are only carried out in specific times of the year[1]. Such alternations of periods are no surprise, since we can easily explain them by the weather, inventory movements, seasons of the year and probably a thousand other things (Mitchell, 1959). What genuinely calls for explanation is why fluctuations appear in long waves and swing in both directions around a trend (Von Haberler, 1937; pp. 167) – which Long & Plosser (1983) identified as the first broad regularity. Hence, in studying business cycles, the aim is not to explain short-term fluctuations in economic aggregates (e.g. Comin & Gertler, 2006).

2.1.1. – The Evolution of Business Cycle Theories

The quest for explaining these long-wave business cycles started a century ago when Mitchell (1913) introduced a descriptive approach in which he decomposed a large number of economic time series into sequences of cycles. This decomposition revealed that in general, cycles consist of four distinct phases: an expansionary phase, leading to a general recession, a contraction phase thereafter, and finally a

[1] Sedlacek (2011), Burda & Wyplosz (2017; pp. 18) and many others describe some interesting discoveries on cyclical activities throughout history.

revival period which constitutes the expansionary phase of the new cycle. But despite the continuation of his work (e.g. Mitchell, 1923; Burns & Mitchell, 1946), his approach failed to fully account for business cycles (Kydland & Prescott, 1990), since it did not include the tendency of the economy to move toward an equilibrium. Additional theories to this approach (e.g. Schumpeter, 1934; Kalecki, 1935; Metzler, 1941) could not resolve the important questions associated with the equilibrium behavior of the economy either (Cooley & Prescott, 1995). Alternatively, theories which emphasized random shocks as the sole driver of economic fluctuations (e.g. Frisch, 1933; Slutzky, 1937) could not explain the iteration in the business cycle phases and, as a consequence, fell short as well.

The first model which addressed these issues into one, economywide model – and hence to understand business cycles with large empirical accuracy (Lucas, 1995) – is the *General Theory of Employment, Interest and Money* (Keynes, 1936). However, with the introduction of the *General Theory*, attention turned away from thinking about the long-wave business cycle and the long-term trends in economic aggregates associated with these cycles (Aghion & Saint-Paul, 1998; Burda & Wyplosz, 2017; pp. 276). Instead, the focus now became to explain forces that determine the short-term fluctuations in output associated with these cycles (Cooley & Prescott, 1995). This made thinking on the long-term trends largely irrelevant, since understanding the determinants of output suggested the possibility of designing policies that would attenuate the business cycle in such a way that policies could prevent the recurrence of economic crises (Lucas, 1995). As a result, economists considered shocks to monetary and fiscal policy as both the main cause of business cycles and the means to prevent them from occuring (Kydland & Prescott, 1990; King & Rebelo, 1999; Burda & Wyplosz, 2017; pp. 297).

However, with the slowdown of the growth in the world economy in the 1980's, academic literature exhibits a strong interest in the business cycle again (e.g. Elliot, 1985; Freeman & Perez, 1988). At that time, the prevailing Keynesian conceptions of business cycles could not explain the deep recessions together with the high levels of unemployment this decade experienced (Freeman & Perez, 1988). This led to renewed interest in studying the long-wave business cycle and the growth path of the economy as a unified phenomenon (Aghion & Saint-Paul, 1998) – an idea that Schumpeter (1934) already developed. The program prevailing from this interest is one that combines the development of ideas as described above with emperical knowledge on the choice theoretic framework of microeconomics (Plosser, 1989). Since its introduction, this so-called real business cycle framework serves as the fundamental building block in the current approach to studying business cycles (Cooley & Prescott, 1995).

2.1.2. – Business Cycle Practices nowadays

The current synthesis of views in studying business cycles entails a consensus between two important theories: the stochastic view on business cycles and the real business cycle theory (e.g. Freeman & Perez, 1988; Burda & Wyplosz, 2017; pp. 440).

The stochastic view states that purely random factors generate fluctuations in economic activity. This idea originates from the works of Frisch (1933) and Slutzky (1937), who found that random disturbances

in both demand and supply repeatedly change the demand or supply conditions in the economy. Once a disturbance occurs in the the economy, market mechanisms make the economy move back to equillibrium again by following deterministic adjustments. These movements are dynamic in nature, which means that the economy does not jump immediately from one equilibrium into another once it is hit by a shcok (Burda & Wyplosz, 2017: pp 439). Hence, business cycles emerge when random shocks continuously strike the economy.

However, most of these shocks in demand and supply are far from random. They are often the consequence of shocks in total factor productivity (King & Rebelo, 1999). The real business cycle theory represents this view. Business cycles emerge because certain types of technical changes – innovation (Abernathy & Clark, 1985) – shift productivity in such a way that it has major consequences for the economy as a whole (Freeman & Perez, 1988). Firstly because these shifts drive relative price movements (Lucas, 1995). As a result, individual expectations on these continuously changing relative prices shift consumer preferences in favor of the newly produced goods and the goods reduced in costs as a result of the technological advancement (Long & Plosser, 1983). This in turn constitutes the business cycle since it drives resources away from other goods. But more importantly, when a productivity shock occurs, both profits and wages rise in the future (King & Rebelo, 1999). The result is a higher level of aggregate consumption, which explains the increasing standard of living (e.g. Solow, 1957; Abernathy & Clark, 1985).

The current synthesis on business cycles thus compiles long-term growth theory with theories on recurrent fluctuations of economic activity.

2.1.3. – The Theory of Creative Destruction

Eighty years ago, Schumpeter already arrived at this synthesis: "Cyclical fluctuations are no barrier to economic growth, and depressions are not necessarily indicators of capitalist failure or breakdown. Indeed, cycles are the normal means by which capitalism develops and thereby grows." (Schumpeter, 1934). In his later works, Schumpeter clarifies this synthesis by explaining how cyclical fluctuations take shape: "Economic life goes on in a changing environment which changes, and by its change alters the data of economic action." (Schumpeter, 1942; pp. 82). This changing environment, as Schumpeter continues, could be the result of all sorts of shocks (see also Mitchell, 1959). But "the fundamental impulse … comes from the new consumers, goods, new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprises create." Fragerberg (2003) describes this fundamental impulse as processes of qualitative change, driven by innovation. These processes of qualitative change are the main source of economic growth and improvements in the quality of life since they incessantly destroy the old economic structure and incessantly create a new structure (Schumpeter, 1942; pp. 83). It is this ongoing change of economic structure – and not exogenous disturbances – that give rise to cyclical behavior (Stiglitz, 1993). Schumpeter (1942) calls this development the process of creative destruction.

In 1939, Schumpeter already explained why innovation is the fundamental impulse of business cycles. In his book *Business Cycles*, Schumpeter identifies four phases in business cycles[2]. Firstly an expansion phase; a long period of sustained growth occurring in many economic activities at the same time. Innovations, clustered in certain sectors of the economy, drive these expansion phases (Schumpeter, 1939; pp. 98). However, despite the expansion and the great increase in output associated with innovations, innovations also impose hardship – as a symptom of depression (Fragerberg, 2003) – on all parts of the economy that are unable to adapt to the new conditions (Schumpeter, 1939; pp. 9-10). When firms cannot react adaptively to the new state of things, they come under the pressure of competition and start to borrow additional resources in order to stay afloat (Schumpeter, 1939; pp. 93, 152-153). Hence, innovations also explain why expansions inevitably result in the second phase of the cycle: a general recession. In this phase, the disturbances of the equilibrium proceed far enough to upset existing relations of prices, costs and quantities. Consequently, interest rates decline, together with a rise in credit volumes and prices, but with real output not necessarily falling (Kuznets, 1940). These conditions of easy money during recessions supply the economy with plenty of unproductive loans: households borrow for consumption purposes and businesses borrow merely to expand on old lines (Schumpeter, 1939; pp. 152). In these cases there is no increase in productivity at all; actual income does not increase permanently, and the rise in demand shows no persistence over time. What follows is a period of liquidation, known as the depression phase (Kuznets, 1940). A painful adjustment in prices, quantities and values occurs, together with the elimination of obsolete firms that are beyond the possibility of adaption. However, this is only the start of the economic slump. As unsuccessful enterprises cannot stand the tests transmitted by the recession, a considerable part of operations starts to crumble. Consequently, the adjustments in prices and values enforce liquidations of unproductive operations, which mechanically induces more liquidations. To cite Schumpeter, it is at this point in the business cycle "that the economy realizes how much there is to liquidate" (Schumpeter, 1939; pp. 155).

However, despite the large amount of liquidations throwing people into unemployment and driving firms into bankruptcy, the depression phase also has positive effects because it reconstructs the economic system on a more efficient plan (Schumpeter, 1934; pp. 113). Aghion & Saint-Paul (1998) identify two important reasons why depressions have a positive impact on productivity: depressions eliminate less productive firms, and stimulate productivity-improving activities such as reorganizations. As a result, average productivity increases during and after a depression. This provides the foundation for the fourth phase: a revival period in which the economy returns to what now the normal quantities and values are (Schumpeter, 1939; pp. 162).

Although there is much to say about the validity of this basic process (e.g. Freeman, Clark, & Soete, 1982; Fagerberg, 2003), the underlying notion of innovation as the main driver of the business cycle is still prevalent (Plosser, 1989; Burda & Wyplosz; pp. 440). On top of that, the characteristics which Schumpeter ascribes to the recession phase – e.g. deteriorating productivity, increasing credit levels and

[2] See Kuznets (1940) for a summary on this work.

declining interest rates – currently prevail, or prevailed until recently, in the United States' economy (McGowan, Andrews, & Millot, 2017; De Boer, 2018). Consequently, if Schumpeter is right, the liquidation of inefficient firms is just a matter of time, and the economy could quickly shift into a severe depression. And as a contraction in monetary policy could cause these liquidations, more liquidations follow beyond a doubt (Schumpeter, 1939; pp. 155). Therefore it is highly relevant to apply the theory of creative destruction on the present state of the economy, and specifically to the possible consequences of a rise in the interest rate.

2.2 – Monetary Policy

To understand why monetary policy could affect the process of creative destruction, we first need to explain what monetary policy is and how it works. Monetary policy is the set of actions with which the monetairy authorities – i.e. the central bank (Burda & Wyplosz, 2017; pp. 244) – control the supply of money (Johnson, 1962). Such control is socially desirable for two reasons (Burda & Wyplosz, 2017; pp. 251). Firstly because the neutrality of money in the long run implies that a rise in money supply leads to inflation. Secondly – since money is not neutral in the short run – because a rise in money supply positively affects employment and output in the short run. Accordingly, control is necessary to keep inflation low, but in such a way that it prevents the stagnation of economic activity. Therefore the purpose of monetary policy is to keep prices stable and to stimulate output and employment (Friedman, 1968).

However, none of these objectives is directly under control of the central bank. The challenge is to affect these variables by controlling the money supply. The central bank does so by directly managing three instruments: the policy interest rate, the supply of reserves which banks lend to each other, and the required reserve ratio (Bernanke & Blinder, 1992; Burda & Wyplosz, 2017; pp. 251). The difference between objectives and instruments implies an important distinction between instrument rules and targeting rules in the application of monetary policy (Svensson, 1999). Instrument rules aim to attain a predetermined value of a chosen instrument; e.g. a certain policy interest rate (Taylor, 1993). Such rules serve as a frame of reference for the actual policy. Targeting rules aspire to reach a targeted value of an objective variable, for example a predetermined level of inflation (Clarida, Gali, & Gertler, 1998). Such rules serve as a kind of commitment to the central bank which uses its monetary instruments to bring the realized value as close as possible to the target.

Although not always explicitly, the Federal Reserve employs targeting rules for guiding its policy (Hayat & Mishra, 2010; Burda & Wyplosz, 2017; pp. 255). These policy rules typically call for changes in the policy interest rate (Taylor, 1993), primarily because it proves to be too difficult to control the quantity of money (Burda & Wyplosz, 2017; pp. 255)[3]. These rules also mean that movements in

[3] However, it is not impossible, as we saw with the quantitative easing program the FED adopted after the crisis hit. Hence, central banks alternate between the use of instrument. It is important to notice that controlling both the supply of reserves and the interest rate at the same time is not possible (Burda & Wyplosz, 2017; pp. 235).

macroeconomic conditions largely explain the changes in Federal Reserve policy (Bernanke et al., 1997) since monetary policy aims to keep economic aggregates around its target levels. More specific: that the Federal Reserve – and central banks in general – responds to deviations of inflation, output gap and employment gap from their targets by changing the short-term policy interest rate (Henderson & McKibbin, 1993; Fuhrer & Moore, 1995). The Taylor Rule expresses this relationship (Taylor, 1993).

As noted before, monetary policy not always operates through a direct change of the policy interest rate. However, despite the use of other instruments on occasion, the policy rate serves as a good indicator of monetary actions (Bernanke & Blinder, 1992) because the use of other instruments positively affects the policy rate[4] (Friedman, 1968; Burda & Wyplosz, 2017; pp. 251-256). Hence, following Bernanke & Blinder, a contraction in monetary policy means a rise in the short-term policy interest rate throughout this study[5].

2.3 – Impact of Monetary Policy

The question next is how monetary policy affects economic activity. Of course, as we described in the previous Section, through using its instruments. Without a change in instruments, monetary policy does not alter economic activity. However, changes in policy instruments are not the sole reason why monetary policy impacts the economy, for it is the private sector's decisions on spending, saving and investing that initiate real economic activity (Burda & Wyplosz, 2017; pp. 194) – and not the changes in policy instruments. Expectations on the future motivate these decisions (Burda & Wyplosz, 2017; pp. 144). Hence, for monetary policy to have an impact, the central bank needs to convince the markets of its future actions (Clarida, Gali, & Gertler, 1999; Burda & Wyplosz, 2017; pp. 260). More precise, changes in policy instruments should be credible for the private sector, so people can understand the policymaker's incentives – i.e. the rules which the central bank employs – and form their expectations accordingly (Barro & Gordon, 1983). This is the fundamental aspect why monetary policy influences economic activity.

Monetary policy transmits its effects on the economy through four interrelated mechanisms (Bernanke & Blinder, 1992): the real interest rate channel (Taylor, 1995), the credit channel (Bernanke & Gertler, 1995), the asset price channel (Bernanke & Gertler, 2000), and the exchange rate channel (Obstfeld & Rogoff, 1995). These channels are the mechanisms through which a change in the short-term policy interest rate affects individuals' and firms' decisions on spending, investing and saving (Burda & Wyplosz, 2017; pp. 259).

We do not go into detail regarding in what manner each channel affects private sector's decisions. Instead, we highlight by what means a monetary contraction affects the process of creative destruction

[4] Positively means that if the central bank uses any other instrument in a contractionary way – i.e. restrict the amount of bank reserves – the policy interest rate rises as a result; and vice versa: in an expansionary way leads to a decline in the policy interest rate.

[5] See also Clarida, Gali, & Gertler (1999).

– and hence the business cycle in general – combined with a brief elaboration on empirical evidence concerning the consequences of a monetary contraction.

2.3.1. – Impacts on the Creative Destruction

As explained in Section 2.1, the process of creative destruction is a process in which technological advance is the main source of economic growth and improvements in the quality of life (Schumpeter, 1942). There we introduced the idea that a monetary contraction could eliminate unproductive firms through higher cost of capital, hence helping to destroy the old economic structure. This is the first reason why a rise in the policy interest rate amplifies – or at least accelerates – the process of creative destruction, in particular the depression phase.

The second reason is more fundamental. With a rise in the interest rate and the expectations adjusting accordingly, the amount of investments decline (Mundell, 1963; Bernanke & Gertler, 1995) since the increase in interest rates implies higher opportunity cost for investments (Burda & Wyplosz, 2017; pp. 207). This impacts the process of creative destruction – and the United States' economy in general – in two ways. Firstly by amplifying the business cycle, since instability in investments is one of the main sources of economic fluctuations (Freeman & Perez, 1988; Greenwood, Hercowitz, & Krusell, 1997). Secondly, as the private sector allocates less resources into technological investments because of the higher opportunity cost, technological progress decelerates (Rosenberg, 1994; pp. 11; Greenwood, Hercowitz, & Krusell, 1997) and the economy starts to lack innovations (Von Hippel, 2007). Since innovation and technological progress are essential for establishing long-run economic growth, a monetary contraction might therefore obstruct the United States' economy from expanding. The intensity of this impact depends on investment adjustment costs, the feasibility of variable capital utilization, and habit formation in consumption (Christiano, Eichenbaum, & Evans, 2005).

Hence, a rise in the policy interest rate affects the process of creative destruction both directly and indirectly. Directly through higher cost of capital which results in the liquidation of unproductive firms that are unable to meet their interest expenses; and indirectly by discouraging investments, which amplifies the business cycle and obstructs the expansion phase in the business cycle from taking place.

2.3.2. – Other Consequences

As becomes clear from Section 2.3, a contraction in monetary policy affects a variety of economic activities. The main reason for this is that monetary policy is an important source of disturbances in aggregate demand (Gertler & Gilchrist, 1994). Disturbances as a result of a monetary tightening result in a lower level of aggregate demand (Burda & Wyplosz, 2017; pp. 195) and fiscal adjustments in the form of tax hikes and spending cuts by the government (Reinhart & Rogoff, 2010). Consequently, real GDP starts to decline (Bernanke & Gertler, 1995) and unemployment rises (Bernanke & Blinder, 1992), both declines usually lagging two quarters behind the policy change (Christiano, Eichenbaum, & Evans, 1999). It then takes another two to four quarters before the policy shock, combined with the related

outcomes just mentioned, generates a persistent decline in the aggregate price level (Christiano, Eichenbaum, & Evans, 1999).

Of course, a monetary contraction has a strong impact on financial markets. As a change in the policy interest rate positively affects the yield curve (Neely, 2015), financial markets immediately respond by rising financial asset prices (Rigobon & Sack, 2004; Li, Iscan, & Xu, 2010).

However – as we already noticed – it is the private sector's decisions on spending, saving and investing that initiate those aggregate effects. Analyzing the impact of a monetary contraction thus becomes interesting when we decompose the aggregate effects by allocating it to the producers. This is what the real business cycle theory propagates. Remarkably, only few studies have incorporated this decomposition until now. For example, Gertler & Gilchrist (1992) show how manufacturing firms react to a monetary contraction, thereby differentiating between large and small manufacturing firms. According to them, small manufacturing firms account for a large share of the decline in industry sales. Another firm-level effect is that firms across all industries alter their capital structure by lowering the volume of bank deposits immediately after the policy shock (Titman & Wessels, 1988; Bernanke & Blinder, 1992). Another good example is the research performed by Christiano, Eichenbaum and Evans (1994; 1999). They provide evidence for a decline in real wages in firms across eight different industries after a contractionary policy shock, as well as persistent declines in manufacturing inventories and profits of non-financial corporations.

Regarding the reaction of households to a rise in the policy interest rate, Bernanke & Gertler (1992) find that residential investments and spending on consumer goods decline. And with consumers spending less, consumer loans and real estate mortgage loans both fall after the shock (Christiano, Eichenbaum, & Evans, 1999).

2.4 – Hypotheses

Our research tries to append on the firm-level studies. As it appears, research mostly focuses on economic aggregates, the financial sector and manufacturing companies – as described above. On top of that, only few studies involve firms across all industries in the analysis. Most importantly, none of these studies incorporate a possible effect of a tightening in monetary policy on the productivity of individual firms as an important determinant of aggregate productivity. To investigate the possible consequences on firm-level productivity, it is important to determine the effect of the policy interest rate on firms' capital structure in the first place. We aim to find an answer on this question by means of the following hypothesis:

H 1: An increase in the interest rate is negatively associated with firm-level long-term debts.

This hypothesis follows the logical reasoning that firms have an incentive to deleverage as soon as possible in case the Federal Reserve increases its policy interest rate. Possible means to do this are reductions in – cash – reserves or divestments. In this first part of our empirical research we follow

Titman & Wessels (1988) and Bernanke & Blinder (1992), who provided evidence for a decrease in firm-level long-term debts as a result of a monetary contraction. Hence, the first hypothesis serves as a means to emphasize the reliability of our sample if we find the hypothesized relationship to be true,

After we find the effect of the interest rate on long-term corporate debt, we go into detail regarding the consequences on firm-level productivity. The hypothesis dealing with this second part of our empirical research is the following:

H 2: An increase in the interest rate is positively associated with firm-level productivity.

We expect a positive impact – i.e. a higher productivity in case of a rise in the interest rate – because firms have to become more productive in order to meet rising interest expenses. More specifically: firms have to earn more income with the same amount of liabilities in order to prevent a decline in profits. This is fully in line with Schumpeter's prediction regarding an increase in productivity for the aggregate economy (Schumpeter, 1939; pp. 113; Aghion & Saint-Paul, 1998). Hence we provide firm-level evidence for the validity of the theory of creative destruction if we find the hypothesized relationship to be true.

3 – Concepts and Methodology

The problem statement and corresponding hypotheses defined in the previous chapters require that we obtain information about the effect of the Federal Reserve policy interest rate on firm-level debts and productivity over time. Therefore, the policy interest rate, companies' amounts on long-term debts and return on assets as a measure of firm-level productivity (e.g. Barua, Kriebel, & Mukhopadhyay, 1995; Hitt & Brynjolfsson, 1996) comprise the central concepts of this study. This chapter deals with explaining these central concepts together with the quantification of these variables. After that, we clarify the hypotheses by a mathematical expression of the expected relationships between the variables. Finally, we describe the empirical method used to test the hypotheses. We present the results of these tests in Chapter 4.

3.1 – Dependent Variables

As mentioned, we use companies' long-term debts and return on assets for testing the hypotheses. These are the dependent variables (e.g. Stock & Watson, 2012), with long-term debts being the dependent variable for the first hypothesis, and return on assets for the second hypothesis.

Company's long-term debts provide valuable insight on the debt position of firms in the United States. A firm uses debts to finance its assets. Such liabilities are separated in owners' equity and debt, which are the liabilities to the stockholders of the firm and the liabilities to external parties, respectively. Hence, a firm can fund its investments both by equity financing and by taking on debts (Donaldson, 1961). This implies an important issue: in certain situations it could be advantageous for companies to

fund investments by equity instead of debts, vice versa (Myers, 1984; Titman & Wessels, 1988). For example, Masulis & Korwar (1986) show how firms tend to issue equity following an increase in stock prices; and Hovakimian, Opler, & Titman (2001) provide evidence on less profitable firms often using more debt financing relative to equity financing.

To rule out dealing with the difficulties associated with this capital structure puzzle in our research, we use companies' long-term debts as an indicator of the debt position of firms. We specify this variable as the sum of total stockholders' equity and non-current liabilities; the latter being debt obligations with maturity at least one year after the company's balance sheet date. Hence, this definition does not capture all changes in capital structure since the dataset does not include amounts on companies' interest-bearing current liabilities. De Jong, Kabir & Nguyen (2008), justify this exclusion by the fact that companies' short-term debts largely consist of trade credits which are under the influence of determinants completely different from interest rates. According to them, the examination of total debts instead of long-term debts will likely generate results which are difficult to interpret. Therefore we decide not to incorporate short-term debts in the analysis on firms' debt positions.

The dependent variable for testing the second hypothesis is company's return on assets, which is the ratio between earnings before interest, taxes, amortization & depreciation – EBITDA – and the firms' average total assets. This variable is particularly interesting for testing the effect of the policy interest rate on firm-level productivity since EBITDA does not include the interest expenses in the calculation of income. Otherwise, quite logically, a rise in interest rate would negatively affect firm profits because of the higher interest expenses associated with a rise in the policy interest rate. This measure however captures the hypothesized relationship that firms must be more productive in order to prevent a decline in net profits. Note that, contrary to the earnings which a firm generates throughout the year, total assets are snapshots in time. Therefore we need to use the average of the total assets recorded at the start and the end of each year as denominator in calculating return on assets.

3.2 – Independent Variable

With this research, we aim to find the firm-level consequences of a monetary contraction. As described in Section 2.2, this means analyzing the effect of a rise in the short-term policy interest rate – the Federal Funds rate as it is called in the United States (e.g. Bernanke & Blinder, 1992; Burda & Wyplosz, 2017; pp. 233). Therefore, this policy interest rate is the independent variable for testing both hypotheses. The Federal Reserve provides numbers on the policy interest rate.

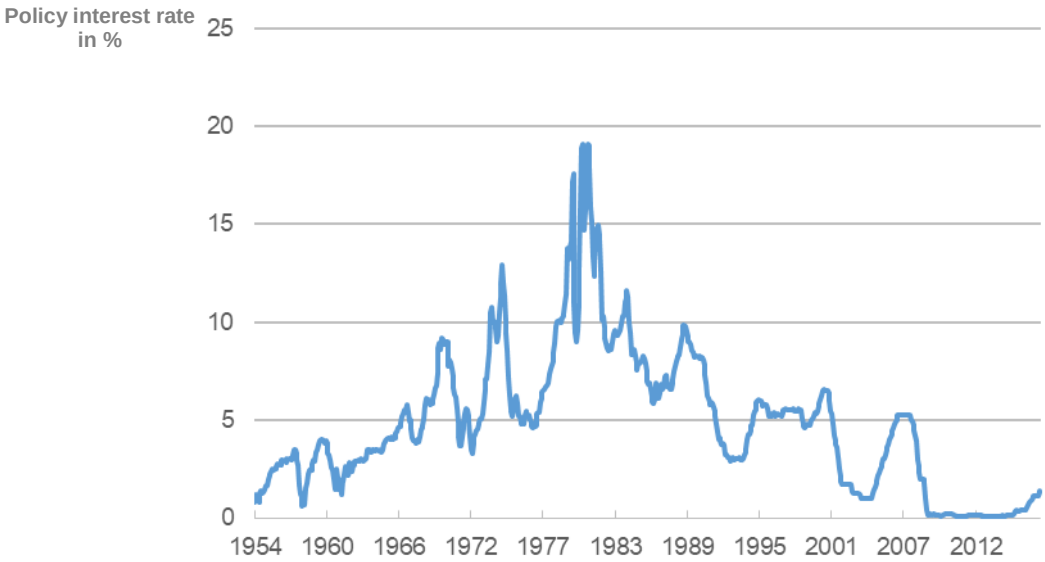

FIGURE 3
The Federal Funds rate over time

3.3 – Control Variables

To find an unbiased estimator for the effect of the interest rate on the dependent variables, we add two firm-specific variables to the analysis: firm size and a one-year lag in the return on assets. These indicators function as control variables in our analysis since they will likely influence a company's amount of long-term debts and productivity (e.g. Hall & Weiss, 1967; Titman & Wessels, 1988; Hawawini, Subramanian, & Verdin, 2003). We use the number of employees as a proxy for the size indicator and distribute firm size into three categories: small, medium-sized and large firms. A small firm employs less than 50 employees; medium-sized firms between 50 and 499 employees; and large firms employing 500 employees or more (see also Acs & Audretsch, 1987; Axtell, 2001).

However, there are many other factors which affect both the amount of long-term debts and firm-level productivity. Titman & Wessels (1988) for example provide evidence on economic growth, non-debt tax shields and volatility as drivers of a firm's debt position. Other factors that affect the dependent variables are differences in management practices (Shah & Ward, 2003); the presence, power and management style of a CEO (e.g. Bertrand & Schoar, 2003; Adams, Almeida, & Ferreira, 2005); ownership structure (Demsetz & Villalonga, 2001); and competition (Nickell, 1996). Following Carpenter & Frederickson (2001), incorporating such factors in our analysis is not necessary since we only look at the average effect of a monetary contraction for American firms.

3.4 – Data and Analysis

To carry out this research, we construct a panel data set which allows us to track different variables regarding the debt position and productivity of American companies over a time period from 2004 until 2017. This time period is specifically interesting since, during this period, the Federal Reserve has changed the Federal Funds rate multiple times in reaction to different economic circumstances (Figure

3; federalreserve.org, 2018). We start our analysis in 2004, because in June 2004 the Federal Reserve finally started to raise its interest rate again after three years of fighting the recession which resulted from the dot-com bubble bursting in 2000.

As for the other variables that are necessary for analyzing the debt positions and productivity of US companies, the WRDS database – and specifically CompuStat North America – provides the required data. Wharton Research Data Services (WRDS, 2018) is a business intelligence, data analytics and financial research platform for global institutions and entails data across multiple disciplines. We restrict the attention to the accounting and finance disciplines, and specifically to the company financials. The sample in this database contains a total of 117,818 observations on 13,756 different American companies over the period mentioned. These companies form the unit of analysis. We provide an overview with all the variables that we use to describe the companies in Appendix A

As our dataset contains cross-sectional observations on each firm over time, we must apply a panel data study. Since we are interested in the within-firm differences, fixed effects model analysis is the appropriate method to test the hypotheses (Allison, 2009). Such models ensure that the independent variable only explains the within-firm variation in companies' long-term debt and profitability (e.g. Hsiao, 1986; Searle, Casella, & McCulloch, 2009). The following regression mathematically expresses the relationship between the policy interest rate and the dependent variable of our first hypothesis:

$$D_{i,t} = \alpha_i + ß_1 * R_t + ß_2 * S_i + ß_3 * RoA_{i,t-1} + \varepsilon_{i,t} \qquad (3.1)$$

with $D_{i,t}$ being the amount of long-term debts for firm i in year t; R_t the policy interest rate in year t; S_i being a categorical variable for the size of firm i; $RoA_{i,t-1}$ the one-year lag of the return on assets of firm i; and $\varepsilon_{i,t}$ the error term for firm i in year t. If our reasoning is true, we should find a negative relationship between the policy interest rate and companies' long-term debts.

To investigate the effect of an increase in the policy interest rate on firm-level productivity, we use the same equation as (3.1), but with the company's amount of long-term debt replaced by the current return on assets:

$$RoA_{i,t} = \alpha_i + ß_1 * R_t + ß_2 * S_i + ß_3 * RoA_{i,t-1} + \varepsilon_{i,t} \qquad (3.2)$$

As explained in the Chapter 2, we should find a positive relationship between the policy interest rate and return on assets.

Our dataset allows us to use fixed effects analysis since the observations in our dataset only represent a given group of American companies during the 2004-2017 period. On top of that, Petersen (1993) emphasizes that fixed effects models are preferred over random effects models for providing more robustness in parameter estimates since the parameters are not biased by constant differences in other firm-specific variables. Examples of such constant differences are the industry in which a firm is active

or the geographical location of the firm. However, it is still important to statistically ensure whether we could regard individual effects as random. Therefore, before we start the regression analyses, we first perform a Hausman test on both hypothesized models (Heij et al, 2004). The highly significant outcomes ($P < 0.0001$) in both models indicate that we cannot regard the effects in our dataset as random. Hence, this also provides statistical evidence for fixed effects model analysis to be the appropriate approach for our research. In addition, we use robust standard errors for all the regressions to rule out the effects of any heteroscedasticity (Stock & Watson, 2012). However, robust standard errors do not account for possible autocorrelation in the variables. Therefore we use bootstrap sampling and estimation in addition to control for the effects of autocorrelation in any of the variables. The standard errors resulting from this test hardly differ from the robust standard errors, indicating that there is no significant autocorrelation present in the data.

4 – Results

We start this Chapter by describing our dataset and the modifications necessary to prevent biases in our estimations. The second part presents the empirical results of our fixed effects regression models. We interpret the results in the Chapter 5.

4.1 – Sample Description

In the dataset, not all firms have been active for the entire period. Some firms are acquired by other companies, others ended its business activities in the past. Therefore we incorporate firm dynamics in the data. This means that we do not include any observations on a company after it is acquired by another firm or after a company ended its business activities. However, since the observations in the period in which these firms were active are still valuable for our research, I keep these observations in the dataset. On top of that, there are also active firms without sufficient information on the company financials. We exclude these observations from the dataset. The resulting sample contains a number of 68,957 observations on 9,269 different American companies, ranging over the same period of time. Hence, the result is an unbalanced dataset (e.g. Hsiao, 1986; Stock & Watson, 2012). To account for this, we run regressions (3.1) and (3.2) with a matrix of dummies for each year of observations (Baltagi, 2008).

The first important question is whether this sample resembles the population of companies in the United States. The short answer is: not very accurate. Throughout the United States, approximately 99.7% of all 29 million companies have less than 500 employees (SBA, 2016). Conversely, Table 1 shows that in our sample, observations on companies with less than 500 employees only averages 46.8% of the total number of observations. Hence, the comparison between the total population and our sample indicates that our sample is biased in favor of large companies. A possible explanation for this overrepresentation is the fact that Small- and Medium-sized Enterprises (SME's) are often not obliged to report their company financials (Storey & Greene, 2010). On top of that, a lot of small firms might not even be registered at the authorities because of the high registration thresholds the owners of these

firms experience (Storey & Greene, 2010). It is therefore difficult for researchers to gather any information on SME's. As a result, our dataset shows a large underrepresentation of SME's

What we also find is that firms active in the agricultural sector, construction- and public administration firms are highly underrepresented with regard to the total number of observations in each year. This comparison indicates that our sample is very likely to be biased in favor of the manufacturing, services, and finance, insurance & real estate industries. However, as discussed in Section 3.3, this research aims to find the effect of a change in monetary policy on firms in general. Since we are not interested in the effects of differences in firm size and between-industry differences, these biases will not influence our results. Nevertheless, one must be cautious in applying the findings of this research on specific firms with a particular size or within a particular industry.

TABLE 1
Total number of observations per size category

Firm Size	Frequency	Percentage
Large	36,687	53.2
Medium-sized	20,685	30.0
Small	11,585	16.8
Total	68,957	100

Another point that needs attention is the total number of observations in the final year. The number of observations in 2017 is significantly lower than the number of observations in prior years. Possible reasons are that the results over 2017 are not published yet or that it takes a longer time to incorporate the data into the databases. Hence, we exclude all observations made in 2017 from the analysis.

We also find some interesting characteristics in the financial variables. First of all, the sample averages of total assets, long-term debts and earnings before interest, taxes, depreciation & amortization all show increasing trends over the years. The figure in Appendix C shows this trend for the average long-term debts and EBITDA. Normally when using time-variant data, such non-stationary variables require adjustments in order to account for autocorrelation. Yet, because of the panel dataset we use, simply adding dummy variables for each year should rule out autocorrelation in the variables (Stock & Watson, 2012). We already did so because of the fact that our dataset is unbalanced.

Secondly, a shortcoming in the calculation of return on assets is the possibility that the ratio approaches infinity with average total assets equaling approximately zero. We find such outliers in small companies that sell intangibles like a franchise, internet services, (social) applications, and so on. Examples are Major League Football Inc. and Eventure Interactive Inc. These unusual observations are likely to influence the analysis by significantly affecting the statistical results (e.g. Orr, Sackett, & Dubois, 1991; Zuur, Ieno, & Elphick, 2010). A simple transformation of the data is not an option, since we find outliers on both sides of the distribution (Zuur, Ieno, & Elphick, 2010). We therefore exclude

all observations for which both the absolute value of the return on assets exceeds 25 and the amount of average total assets falls below $ 10,000.

Table 2 shows the descriptive statistics of the variables included in the analyses, including the correlation coefficients between these variables. To prevent the table from getting too comprehensive, we omit the variables representing year-specific effects. What is clearly visible is the large standard deviations in all financial variables included. After plotting histograms over time, we find out that the distribution of total assets and long-term debts are both right-skewed. Hence, for our analysis, we transform both the total assets variable and the long-term debts variable into logarithms in order to reduce skewness in the data. This is particularly important for testing the first hypothesis, since skewness in the dependent variable violates the assumption of a normal distribution in the data (e.g. Benoit, 2011; Stock & Watson, 2012). Hence, transforming into logarithms prevents us from wrongly estimating our coefficients in the first hypothesis.

As theoretically expected, we find a negative correlation between the policy interest rate and companies' long-term debts, and a positive correlation between the policy interest rate and firm-level productivity. Also interesting, as Titman & Wessels (1988) found, is the significantly positive correlation between productivity in the previous year and current years' profits. However, contrary to what Titman & Wessels prove, the correlation between the first lag of the return on assets and long-term debts shows no significance.

Finally, the correlation coefficients show that the firm size, measured in the number of employees, significantly influences long-term debts, return on assets, total assets and profits, all in a positive way.

4.2 – Hypotheses Testing

After this basic exploration, we carry out our analysis as described in Section 3.4. Table 3 presents the results of the fixed effects model analyses performed for both hypotheses. The Table shows both the estimated coefficients of the variables in the model and the robust standard errors displayed in parentheses. For the first hypothesis, we first run a fixed effects regression that solely consists of the control variables. Model 1 represents this basic model. Model 2 also includes the independent variable, hence making it the extensive regression model which we use for testing the first hypothesis. For the second hypothesis, we also run a fixed effects regression with only the control variables included. This is the third Model in Table 3. The fourth Model represents the extensive regression model we use for testing the second hypothesis. Note that the number of observations in the first and second Model differs from the number in the third and fourth Model. This is because the logarithmic transformation of the dependent variable in the first models which implies that observations on companies with long-term debts equal to zero are automatically excluded from the regression.

A significant finding of the baseline Models 1 and 3 is that firm size is a significant predictor of both long-term debts and firm-level productivity, with larger companies on average having higher amounts

TABLE 2

Descriptive statistics and correlations between the variables after modification of the dataset[a]

	Variables	Mean	Std Dev	Min	Max	1	2	3	4	5	6	7
1	FED Rate	0.015	0.018	0.001	0.050	1.000						
2	Long-term Debt[1]	3,369.491	40,701.28	-63,653.35	3,232,808	-0.018*	1.000					
3	Return on Assets	-0.307	5.149	-468	45.368	0.010*	0.006	1.000				
	Control											
4	Firm Size[2]	7,751.717	41,347.86	1	2,300,000	-0.014*	0.148*	0.015*	1.000			
5	d_RoA	-0.197	3.294	-328.822	45,368	0.007	0.007	0.320*	0.017*	1.000		
6	Total Assets[1]	7,632.989	72,567.44	0	3,287,968	-0.015*	0.805*	0.007	0.225*	0,008	1.000	
7	EBITDA	490.026	2,937.723	-76.735	130,622	-0.018*	0.733*	0.014*	0.386*	0.016*	0.754*	1.000

[a] N = 67,102; [1] Amounts in million USD; [2] Measured in number of employees; * Correlation is significant at the 5 % level (one-tailed)

of debts and better performance compared to smaller size categories. Another interesting finding is that, contrary to the expectations (e.g. Titman & Wessels, 1988; Berger & Di Patti, 2006), productivity does not impact next years' long-term debts (| ß | < 0.001; P = 0.948). We already provided evidence for this in Table 2.

The unchanged explanatory power after including the independent variable gives the impression that the policy interest rate does not help in explaining the variance in the dependent variables. However, as Achen (2000) proves, lagged variables inserted as control variables often acquire the significant improvements in variance explanation instead of the variable of interest. We find evidence for this explanation since leaving out the one-year lag of return on assets indeed increases the explanatory power of both the second and fourth model. Hence, the policy interest rate is still valuable in explaining the variation in long-term debts and firm-level productivity.

The results of the regression analyses show that we cannot reject both hypotheses. Model 2 provides evidence for the hypothesized relationship between the policy interest rate and firms' long-term debts (P < 0.001); and Model 4 provides evidence for the validity of the second hypothesis (P = 0.039). Note that an absolute interpretation of the coefficients in the first and second model is not applicable because of the logarithmic transformation (Benoit, 2011).

TABLE 3

Results of the fixed effects multiple regression models with robust standard errors

	Model 1[a]	**Model 2[a]**	**Model 3**	**Model 4**
FED Rate		-8.1815*** (0.3979)		4.2299* (2.0514)
Medium-sized	-0.5942*** (0.0322)	-0.5942*** (0.0322)	-0.0320* (0.0163)	-0.0320* (0.0163)
Small	-1.3319*** (0.0558)	-1.3319*** (0.0558)	-0.1927* (0.0588)	-0.1927* (0.0588)
d_RoA	-0.0007 (0.0105)	-0.0007 (0.0105)	0.2531*** (0.0658)	0.2531*** (0.0658)
Constant	5.8265*** (0.0176)	6.2326*** (0.0183)	-0.0377 (0.0503)	-0.24767*** (0.0735)
Observations	46,118	46,118	48,822	48,822
R^2	0.1270	0.1270	0.0503	0.0503

[a] Logarithmic model; * p < 0.05; ** p < 0.01; *** p < 0.001 (all one-tailed tests); Standard errors in parenthesis. Control variables for year-specific effects are included in the analysis but not displayed in this Table.

5 – Discussion

This Chapter discusses the results which we presented in Section 4.2. Thereby we start with an interpretation of the results of the empirical analysis. After that, we discuss the implications that, based on our findings, could arise from a monetary contraction, together with some recommendations for both policymakers and firm strategists. We end this Chapter by discussing the limitations of our research and suggesting some possibilities for future research.

5.1 – Interpretation of the Results

We started our empirical analysis by asking what the firm-level consequences of a rise in the policy interest rate – as a proxy for a monetary contraction – are. Thereby we elaborated on prior research that showed how a monetary contraction in general results in a decline in industry sales, inventories and profits of non-financial corporations, deteriorating real wages for employees and changes in the capital structure of firms. On top of that, we employed a dataset containing cross-sectional observations on companies in the United States over a time period from 2004 until 2017. Based on the information this database provides, within the context of a one percent point increase in the Federal Funds rate, we find that American companies on average reduce their long-term debts. It is important to notice that we must not interpret this number in an absolute way since we only find an association between the policy interest rate and long-term debts. However, it is still valid in confirming our first hypothesis because of its high significance ($P < 0.001$). On top of that, it also validates prior research performed by Titman & Wessels (1988) and Bernanke & Blinder (1992). Hence, it appears that firms tend to reduce long-term debts after a monetary contraction in order to prevent a rise in interest expenses in the future.

What we also find is that a one percent point increase in the Federal Funds rate on average results in higher firm-level productivity in the United States. The significant outcome of the second test ($P = 0.039$) validates this finding, hence confirming our second hypothesis. But again, an absolute interpretation is not appropriate.

The weak explanatory power in both models suggests that there is a large number of other variables not included in our analysis which affect both firms' capital structure and productivity. The reason why we did not include any additional variables is because we are looking for the average effect of the policy interest rate. This independent estimator appears not to be correlated with firm-specific variables – as the differences between the estimators in the basic and the extensive models indicate. On top of that, variables such as the industry and geographical location do not change over time, which makes adding such variables in the fixed effects models useless (e.g. Hsiao, 1986; Carpenter & Fredrickson, 2001). The same applies to any nationwide factors such as inflation since they affect all firms at the same time, hence not explaining within-firm variance. Therefore, the variables which our fixed effects model accounts for only explain a minor part of the changes in the dependent variables.

5.2 – Implications

We can derive some meaningful academic and practical implications from this study. First, the fact that we cannot reject the second hypothesis implies that average firm-level productivity increases because of a monetary contraction. This could mean that firms improve their productivity (e.g. Aghion & Saint-Paul, 1998), or that a contraction eliminates inefficient firms that are beyond the ability of adaptation (e.g. Gertler & Gilchrist, 1994). Schumpeter identifies both phenomena to be occurring in the same period in the business cycle: the depression phase. However, the first phenomenon mainly has positive effects on the economy as a whole, whereas the second phenomenon has severe negative consequences for production and employment.

Which effect prevails? Our analysis fails to distinct to what extent the rising average firm-level productivity is attributable to the measures firms take to improve their productivity, or to the liquidation of unproductive firms. However, as it appears from Bernanke & Blinder (1992) and Bernanke & Gertler (1995), the latter phenomenon prevails. Hence, a monetary contraction might not be wise given the current circumstances. However, we learned from Section 2.2 that central banks must also prevent inflation from rising. By pegging the interest rates at low levels for a longer period of time, inflation will inevitably rise as a result (Friedman, 1968). In other words, it appears necessary for the Federal Reserve to apply a monetary contraction, regardless of the negative consequences this will have on economic activity.

According to Schumpeter (1934), these negative consequences are not necessarily bad for economic activity in the long run since they could also be the means to reconstruct the economic system on a more efficient plan (e.g. Stiglitz, 1993). Resources, capital and high-skilled labor could then be allocated to more efficient firms and activities, thus creating sustainable growth in the long run. The interesting question is whether we the effects in the short run of a contraction are offset by the expansion of the economy in the long run. Uhlig (2005) provides a model to quantify the effects of a shock in monetary policy on aggregate output over time.

5.3 – Recommendations

To prevent a depression without inflation rising too much, policymakers should consider the following options (e.g. Schumpeter, 1939; Borio & Hofmann, 2017). Firstly, policies should prevent capital from flowing to unproductive firms and activities by making a distinction between debts according to purpose. And secondly, related to the first recommendation, policies should restrain the rising debt levels of the private sector in order to alleviate the impact on debt servicing and cash flows that could cause the elimination of firms. A possible way is to make borrowing fiscally less attractive, since interest expenses are tax deductible in many circumstances.

However, simply making firms not to borrow only treats the symptoms of the problem, not its cause: the deteriorating productivity. Therefore, firm strategists need to rethink the business strategy the firm currently employs and understand it in respect of the process of creative destruction. Every piece of

business strategy only acquires its true significance against the background of the newly created market conditions. Whether this is by improving productivity or by gaining a competitive advantage through innovation is a question for further research.

5.4 – Limitations and Future Research

The relatively uncharted research topic implies that our study has some conceptual and methodological limitations. First of all – as we already indicated in Section 4.1 – Small- and Medium-sized Enterprises as well as agricultural, construction and public administration firms are largely underrepresented in our sample. This likely biases our findings in favor of the large firms as well as firms active in other sectors. Hence, we must be cautious in applying our findings on specific firms with a particular size or within a particular industry.

Secondly, we used a rising policy interest rate as a proxy of a monetary contraction. However, we saw that monetary policy guides its effects through four different channels, thus implying possible interaction effects between these channels. On top of that, it could be the case that different channels have larger firm-level impacts following a monetary contraction. Since we only looked for a general effect, we did not include such effects in our analysis. At the same time, these limitations can act as an incentive for additional research in order to make our findings more concrete.

A topic that demands further attention is the time perspective. How long does it take for firms to react to a rise in the interest rate? And do the effects we found persist over time? Such questions are highly relevant for policymakers and firm strategists in order to alleviate the negative impacts on the aggregate economy and firms' capital structures. Another interesting question that needs answering is whether our results are externally valid – i.e. could be applied to other economies as well. Currently, the European Central Bank pegs its policy interest rate at the zero lower bound for quite some time. Hence, for the same reason, it could be necessary for the ECB to rise its policy rate in the near future. If that happens, what will be the effect on European companies? Will European firms also show improvement in productivity? We leave this topic for further research as well.

6 – Conclusion

Does a contractionary monetary policy influence the process of creative destruction in a positive way? As it appears from the literature, both directly and indirectly. Directly through higher costs of capital associated with a contraction, which results in worsening performances of firms and the liquidation of companies that are not productive enough to meet their interest expenses. And indirectly by discouraging investments, which amplifies the business cycle and obstructs the expansion phase in the business cycle from taking place. In theory, firms will prevent a possible liquidation by improving their productivity. We provide empirical evidence for this analysis by using a dataset which contains observations on firms in the United States over a period from 2004 until 2017. From this data, it becomes clear that a rise in the Federal Reserve's policy interest rate positively affects firm-level productivity. However, unproductive firms that are beyond the ability to adapt to the rising costs of capital will likely face liquidation, hence improving average firm-level productivity as well. It is in this way that a monetary contraction positively affects the process of creative destruction. Our analysis fails to prove to what extent the rising average firm-level productivity is attributable to the liquidation of unproductive firms or to the measures firms take to improve their productivity. Therefore we hope that our findings trigger further research on the interesting effects of monetary policy on firm level.

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APPENDIX A

Variable Description

Variable	Description	Remarks
Total Assets	Book value of the company	In USD Millions
Stockholders Equity	Entails a company's common equity, preferred equity and non-redeemable non-controlling interest	In USD Millions
Total Liabilities	Sum of all current liabilities plus non-current liabilities, including deferred taxes and investment credit tax	In USD Millions
Non-current Liabilities	Debt obligations due more than one year from the company's balance sheet date	In USD Millions
Long-term Debt	Sum of Non-current Liabilities and Stockholders' Equity	In USD Millions
EBITDA	Earnings Before Interest, Taxes, Depreciation & Amortization	In USD Millions
Employees	Number of employees employed by the company and its consolidated subsidiaries	In 1,000
Average Total Assets	Average amount of assets recorded on the company's balance sheet at the start and the end of the year	In USD Millions
Firm Size	Categorical variable indicating the firm size	Small, medium-sized, large
Industry	Industry in which the company is active	See Appendix B
State	State in which the company's headquarters is located	
RoA	Return on assets	Average Total Assets / EBITDA
FED rate	Federal Reserve's policy interest rate	in %
Prime rate	Base rate which lenders charge to borrowers	in %

APPENDIX B

Standard Industry Classification Codes

SIC code - First Two Digits	Industry
01-09	Agriculture
10-14	Mining
15-17	Construction
20-39	Manufacturing
40-49	Transportation & Public Utilities
50-51	Wholesale
52-59	Retail
60-67	Finance, Insurance & Real Estate
70-89	Services
91-99	Public Administration

APPENDIX C

Trends in the financial variables over time