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“The effects of monetary policy on accumulation, growth, and distribution. A post-Kaleckian perspective on the US and Germany.”

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Abstract

Recently, Kaleckian models of distribution and growth have been extended in order to take monetary aspects into account. The interest rate, the debt-capital and equity-capital ratios of firms, and an interest elastic mark-up have been included in the model. Empirical assessments of how this models depict reality are still rare. This paper seeks to contribute to this research. In the first part, the effects of an exogenous variation of the monetary rate of interest on the equilibrium rates of capacity utilization, capital accumulation, and profits are discussed theoretically within the framework of an extended post-Kaleckian growth model in the vein of Bhaduri and Marglin (1990). In the second part, the model is confronted with annual data on the US and Germany from 1960 to 2007. With a simple ADL approach, the parameters of the post-Kaleckian growth model are estimated and applied to different time periods, i.e. the total period, two sub-periods, six business cycles. For both countries, we identify typical post-Keynesian regimes with demand, accumulation, and profits responding negatively to increasing interest rates. Moreover, we find that demand, accumulation, and profits have been wage-led in the US, whereas the Germany economy has been a wage-led demand and a profit-led accumulation and profit regime. We find that conservative monetary policy contributed to the economic downturn in the US and in Germany, especially in the 1980s and 1990s, respectively.

Preface

One of the greatest challenges for every student sold on the profession is to find a well suited topic for his or her diploma thesis. I am glad that I seized the chance to focus on post-Keynesian economics, a subject of high interest to me which I sorely missed in my degree program. Immersing myself in an unfamiliar theoretical framework allowed me not only to deepen my understanding of mainstream economics, but also to broaden my horizon and to get to know a full set of new views on the economic world. The present diploma thesis would not have been possible if there were not people who kindly provided their generous support. Thus, I want to thank them here.

First of all, I want to thank Eckhard Hein who supervised my diploma thesis and, by doing so, offered me the opportunity to concentrate on post-Keynesian economics in the final stage of my degree program. I am grateful for his ambition to encourage young economists and for all the assistance he offered during the becoming of the present thesis. Moreover, I am grateful to Artur Tarassow who aroused my interest in econometric methodology and who was never reluctant to give helpful advise on theoretical and methodological issues. I also want to thank the rest of the IMK crew in Düsseldorf, the participants of the conference “Macroeconomic Policies on Shaky Foundations - Whither Mainstream Economics?” in Berlin in 2008, and Markus Marterbauer for their willingness to answer my questions as well as for useful and supportive comments on earlier drafts of the diploma thesis. I am indebted to Vroni and Astrid Peterseil who proofread my diploma thesis. Finally, I want to thank Agnes Peterseil for her never-ending emotional support.

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1 Introduction

Why study monetary economics?

The 1970s and 1980s faced a fundamental shift in the leading paradigm of economic policy. *Keynesianism*, the conviction that markets have to be led by government authorities in order to make for high levels of economic growth, employment and distributive justice, was increasingly discredited since it was seen unable to handle the economic turbulences of the 1970s. Promising to get rid of inflationary tendencies, *monetarism* grew to the new leading doctrine of economic policy. The Monetarist program, first implemented by Reagan and Thatcher in the early 1980s, comprised restrictive economic as well as social policy packages. Also the mainstream in monetary policy experienced a significant change. Whereas central banks were particularly concerned about growth and employment under the Keynesian paradigm, they have been concentrating more or less exclusively on the maintenance of price stability in the age of monetarism.

Central banks of the major industrialized countries adopted Monetarist policy instruments already in the mid 1970s.¹ Following Friedman's (1956, 1960 and 1970) Monetarist program, central banks stopped targeting the rate of interest and switched to *monetary targeting* instead. From the commitment to contain the growth of selected monetary aggregates within predetermined limits they expected to be able to reduce inflation. Moreover, central banks were beholden to rely on restrictive monetary policy implying consequent adherence to low monetary growth and high interest rates. As Monetarists deny monetary effects on the long-run performance of the economy, fighting inflation ascended to the primary objective of central banks, while aiming at high levels of growth

¹To be precise, the implementation of monetarism to monetary policy was unique in each country and varied significantly in the radicalness by which it was indoctrinated: The Federal Reserve officially switched to monetary targeting in 1975, but never lost track of the interest rates and never followed the Monetarist program dogmatically (cf. Volcker and Gyohten 1992, pp. 163-86, Wood 2005, pp. 375-89 and Bernanke and Mishkin 1992). The Bank of England gradually introduced monetary targeting in the 1970s reaching its climax under the Thatcher-government in the early 1980s (cf. Bernanke and Mishkin 1992 and Hall 1986, ch. 5). The Banque de France began to target monetary aggregates in 1976. However, targets were set by the government and thus not followed very effectually (cf. Galbraith 1982). The German Bundesbank implemented monetary targeting in the mid 1970s. Apart from some exchange rate considerations, the Bundesbank forcefully followed its strategy of containing monetary growth in the 1980s and maintained conservative monetary policy throughout the 1990s (cf. Bernanke and Mishkin 1992 and Arestis and Chortareas 2006, pp. 380-4).

and employment was either eclipsed or simply removed from the agenda.

In the 1990s a host of central banks switched to *inflation targeting*², which is still the predominant strategy of monetary policy today.³ Since there is no reliable relationship between the targeted monetary aggregate and goal variables, such as inflation, central banks that were seriously engaged in monetary targeting found themselves systematically missing their desired monetary policy goals (Bernanke and Mishkin 1992). Thus, central banks adopted a policy framework which allowed them to target inflation directly without necessarily considering monetary aggregates (Rochon and Rossi 2006). The interest rate of short term money markets turned out to be the operating instrument of central banks.

Whilst central banks adopted conservative monetary policy, many Western economies faced a slump in economic growth in the 1980s implying sustainable economic stagnation and an increase in unemployment especially of the European economies (cf. Schulmeister 1996). For two selected countries - the US and (West-)Germany⁴ - the relationship between the monetary and real variables is depicted in figure 1 and figure 2. The trends of the real short-term interest rate (i_s) have been contrasted with the trends of the rate of accumulation (g^I), i.e. the growth rate of the net capital stock, and of the growth rate of real net domestic income ($\dot{y}$) from 1960 to 2007.⁵ The real short-term interest rate is assumed to be strongly influenced by the central bank.⁶ Both economies considered start with comparatively low interest rates in the 1960s, which changed fundamentally with the upsurge of monetarism in the late 1970s and early 1980s when interest rates sharply increased. While the FED relaxed its monetary policy from the 1990s, German interest rates remained on a high level until the late 1990s.⁷ As for accumulation and economic growth, falling trends can be observed in each economy over the entire period

²Inflation targeting essentially implies the central bank's accountable commitment to price stability as the primary objective of monetary policy and the commitment to achieve inflation targets which have to be announced in public regularly. Emphasis is put on high transparency regarding monetary policy strategies (Bernanke et al. 1999, p. 4).

³The Federal Reserve does not officially target inflation. However, as Mishkin (2004) points out, the FED follows a strategy which is implicitly highly concerned with containing inflation in the long run.

⁴In the following, *Germany* refers to West Germany until 1990 and, thereafter, to unified Germany.

⁵As we are interested in the trends, all variables have been smoothed by applying a Hodrick-Prescott filter ($\lambda = 100$).

⁶Skott (1989, p. 57) and Lavoie (1996b, p. 538) argue that central banks can determine the real interest rate provided prices are sticky, at least in the short run.

⁷The German Bundesbank justified its contractory monetary policy by referring to a demand shock caused by the German unification in 1991.

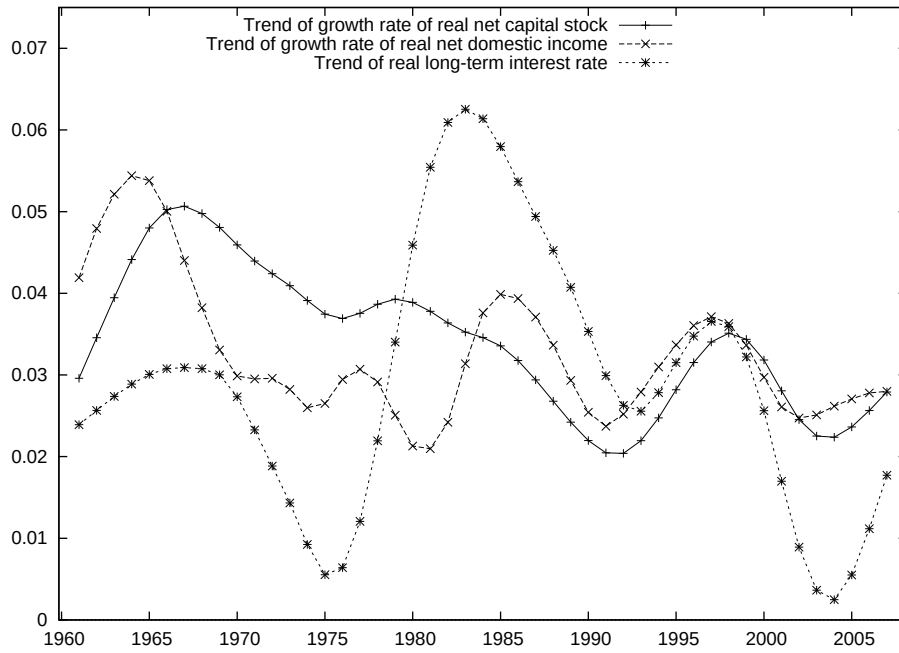


Figure 1: *The rate of accumulation (g^I), the growth rate of real net domestic income ($\dot{y}$) and the real short-term interest rate (i_s) in the US, 1960-2007; Sources: Cf. table A1*

of time. Especially in the 1980s, the slowdown of accumulation and growth is associated with increasing rates of interest. From the 1990s, a relaxation of the US monetary policy comes along with a stabilization of accumulation and growth on a medium level. In Germany, interest rates stayed on a relatively high level throughout the 1990s. A further slowdown of the economic dynamics can be observed in this period. It is also interesting to note that by trend real short-term interest rates have been higher than real economic growth up from the 1980s whereas in the preceding period this relationship was reversed (cf. Schulmeister 1996).

Several essential questions arise from the trends in figure 1 and figure 2: First, can the economic performances of the US and Germany be explained by their respective monetary policy? Second, did the 1980s shift in the doctrine of monetary policy contribute to the deterioration of the economic dynamics? If so, to what extent? Third, given the different degrees of ambition by which the FED and the ECB plus her sister, the Bundesbank, have been pursuing Monetarist objectives, can differences in US-American and German economic growth be related to discrepancies in the respective alignments of monetary policy? The question whether monetary policy has long-term impacts on the performance

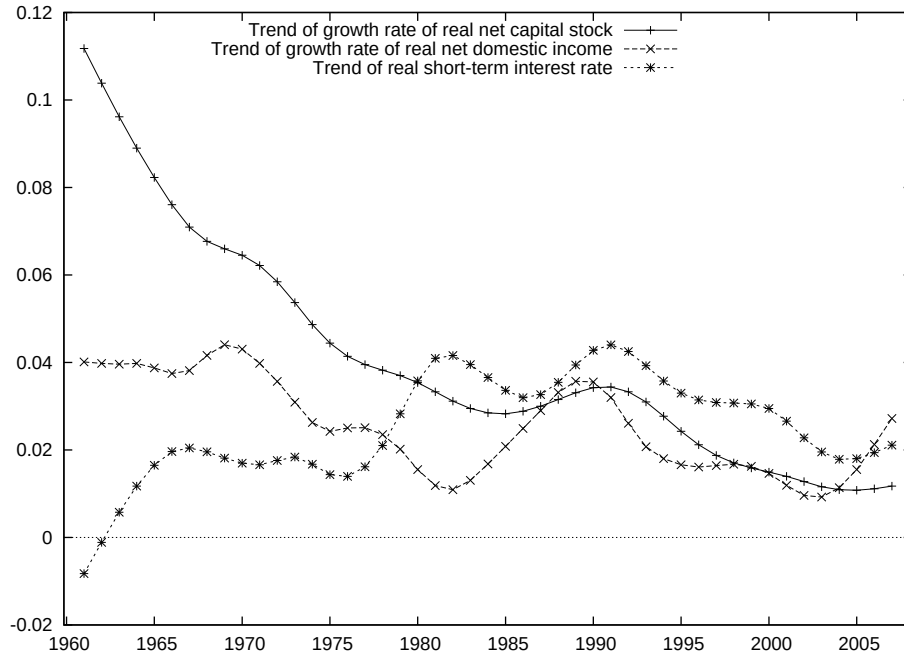


Figure 2: *The rate of accumulation (g^I), the growth rate of real net domestic income (y) and the real short-term interest rate (i_s) in Germany, 1960-2007; Sources: Cf. table A1*

of the economy is crucial especially for public authorities who are supposed to utilize policy instruments in such a manner that high economic growth and employment are enforced. Finding a negative long-run relationship between the short-term interest rate, a variable which is to a great extent controlled by the central bank, and the real sphere of the economy would challenge both previous political practice and orthodox economic theory.

Studying monetary economics: in which framework?

Although orthodox economics consists of several competing traditions with varying prominence in time, all of these currents are unified by the claim that monetary policy is *neutral* in the long run. This is obvious for the Monetarist program à la Friedman, which was dropped, however, by most central banks in the 1990s since the difficulty of steering monetary aggregates became apparent. It was succeeded by the *new Keynesian consensus view* on macroeconomics which is the leading economic paradigm today and according to Taylor (2000, p. 90), “pervasive in policy-research projects at universities and central banks around the world”. It constitutes the theoretical foundation of inflation targeting regimes which were adopted by most central banks in the 1990s. Since it incorporates pol-

icy reaction functions into macroeconomic analysis and implicitly assumes an endogenous money stock, the new consensus view deviates from traditional neo-Classical economics (Palley 2007). However, while Keynesian by name, the new consensus view is Monetarist by nature (cf. Rochon 2006 and DeLong 2000): Inflation is conceived as a strictly demand determined phenomenon. It is believed to emerge only when aggregate demand exceeds aggregate supply, i.e. when unemployment under-runs its natural level which is determined on the labor market. Since the economy is assumed to be expanding alongside a natural growth path, monetary policy cannot affect output and employment in the long run. Thus, new-Keynesians in Monetarist fashion, believe that loose monetary policy, in particular easing key interest rates, necessarily and solely leads to inflation in the long run (Palley 2007, p. 69). As monetary authorities do not have the possibilities to stimulate growth in the new consensus view, they are suggested to specialize in the only objective they can really handle: to contain inflation through restrictive monetary policy.⁸

Proceeding to the core of the new consensus model, we find well known classical and neo-Classical concepts, such as the natural rates of output and unemployment which are both associated with the Monetarist NAIRU theory (Arestis and Sawyer 2002, p. 536). Assuming a vertical long-run Phillips curve and employing a natural rate of interest induce monetary policy to cause inflation and to be neutral in determining long-run growth of output (Arestis and Sawyer 2002, p. 530 and Lavoie 2004, pp. 21-2). However, heterodox economists expressed lurking doubts regarding the feasibility and reasonability of the macroeconomic content of these concepts (cf. Shulman 1989, Setterfield 2006 and Niggle 2006) and their microeconomic foundation (cf. Lavoie 1992a, pp. 6-41). The neo-Classical economy is driven by utility maximizing individuals who base their decisions on unlimited knowledge of all alternatives and their payoffs. As for future events, they form rational expectations and maximize intertemporal optimization problems. In aggregate, markets devoid of government intervention, trade unionism and other distortions cause prices to fully reflect market preferences and to equilibrate supply and demand to clear the market. In the neo-Classical framework, free markets involve optimal economic outcomes, such as

⁸Inflation targeting central bankers are well aware of negative short run effects of tight monetary policy which they intend to measure by *sacrifice ratios*. However, they merely care about short run stability as long as inflation targets are not jeopardized (Rochon 2006, p. 552)

full employment and unimpeded output growth. Rigidities in the labor market prevent the real wage from conciliating supply and demand, thus causing unemployment. Introducing money to the neo-Classical framework does not change the characteristics of the economy. Since economic agents form rational expectations, which are assumed to be fulfilled in the medium run, a change in the monetary variables will eventually be fully compensated by a corresponding adjustment of prices. This will have no impact on employment and output. Rather, it will cause inflation.

Due to its lack of realism, we do not want to tackle the question of whether and how monetary policy might affect the real economy within the neo-Classical framework. Rather, we want to contrast the neo-Classical view of monetary neutrality with a post-Keynesian, in particular with a Kaleckian approach, which attaches great importance to describing reality and which offers convenient tools for investigating economic dynamics both theoretically and empirically. In this paper, we want to utilize an extended version of a Kaleckian model of distribution and growth. Including monetary variables in the model, we want to investigate the effects of variations in the interest rates on the economic performance in the long run. We shall also consider the impact on functional income distribution, for both cost and demand factors determine private economic activity in the post-Keynesian framework, as shall be explored in the next chapter. A profound theoretical discussion of the Kaleckian growth and distribution model shall lead the way to an empirical investigation of the impact monetary policy had in the US and in Germany. These countries have been chosen because of their economic weight and because of the difference in their central banks' nature: the Bundesbank and the ECB, respectively, following a strictly conservative, the FED a rather pragmatic approach (cf. Fontana 2006).

Literature on post-Kaleckian growth and distribution models

It took post-Keynesians until the 1980s to start forging a *monetary theory of production*, which Keynes (1973b, xiii, p. 408) set out for already in 1933. The early growth theories of the old Cambridge school, in particular of Kaldor (1956, 1957 and 1961) and Robinson (1962) on the one hand and of Kalecki (1954) and Steindl (1952) on the other, did not

explicitly consider monetary variables in their work.⁹ However, they prepared the ground for subsequent post-Keynesian monetary analysis (Vernengo and Rochon 2001 and Sawyer 2001). Especially, Kalecki's aggregate supply-aggregate demand models turned out to be accessible to contemporary post-Keynesian monetary growth theory.¹⁰

Staying close with his original writings, Rowthorn (1981), Dutt (1984) and Amadeo (1986) formalized Kalecki's work in the 1980s and established so called *underconsumptionist* models in which a strong *accelerator effect* guarantees that increasing wages have expansive effects on the economy. In their seminal paper, Bhaduri and Marglin (1990) enhanced the Kaleckian theory of distribution and growth modifying the traditional investment function in order to allow for both *wage-led* and *profit-led* accumulation regimes. Since the cost-side of wages is also accounted for in their model, an increase in the wage share does not necessarily translate into higher accumulation and growth. Positive demand effects might be overcompensated by negative cost effects on investment.

Post-Kaleckian growth models in Bhaduri and Marglin's (1990) tenor have continually been subject to extensions involving the consideration of the open economy (cf. Blecker 1989 and Bhaduri and Marglin 1990), of technological progress (cf. Dutt 2003) and, of course, of monetary aspects such as the rate of interest and the firms' debt and equity structure.¹¹ The introduction of the interest rate to Kaleckian models rests upon a *horizontalist* view on money supply: The interest rate - steered by the central bank - is given exogenously, while the amount of credit adjusts endogenously according to the need of business.

The interest rate enters post-Kaleckian models in several ways with contradicting impacts on the economy: A rise in the interest rate implies redistribution of income from firms to rentiers: On the one hand, this will have contracting effects on the economy

⁹For an outline of Kaldorian, Robinsonian and Kaleckian growth theory, see Lavoie (1992a, ch. 6) and Hein (2004, ch. 7-8).

¹⁰For the analysis of monetary variables in Kaldorian and Robinsonian growth models, see Lavoie (1995) and Vernengo and Rochon (2001).

¹¹For an overview of the incorporation of interest rates to various post-Keynesian growth models see Lavoie (1995). For monetary extensions of traditional Kaleckian models see Taylor (1985), Dutt (1992) and Dutt and Amadeo (1992). Lavoie (1993), Hein (1998) and Hein and Ochsen (2003) introduced the interest rate to post-Kaleckian models. For Kaleckian models including the debt structure of firms, see Hein (2007). For recent literature analyzing the impacts of the *shareholder value* on accumulation and growth by including the firms' equity structure to the model, see Hein (2008) and Hein and van Treeck (2008) for an overview.

since firms lose funds available to finance investment. On the other, as rentiers consume a part of their income, raising the rate of interest also has expansive effects through an increased consumption demand. Moreover, through an interest elastic mark-up increasing interest rates can have both positive and negative effects on accumulation and growth, respectively, depending on whether the economy is wage-led or profit-led.

Post-Keynesian literature provides several empirical studies of Kaleckian and post-Kaleckian distribution and growth models. This work attempts to figure out the type of accumulation regimes economies are confronted with.¹² However, to the authors' knowledge, there has been only one attempt to analyze the effects of interest rate variations on growth and distribution empirically within a Kaleckian framework which has been endeavored by Hein and Ochsén (2003). Our paper seeks to contribute to the empirical literature by estimating the impacts of interest rate variations on output, accumulation and profits.

Hein and Ochsén (2003) set up a post-Kaleckian growth model including the rate of interest and estimate the model's parameters for some advanced OECD countries using annual data from 1960 to 1995. For the entire period, they find negative impacts of rising interest rates on growth, accumulation and profits in France and in Germany, but not in the UK or in the USA where they observe no significant effects. Looking at sub-periods, they find equivocal results: In France, an increase in the interest rate was associated with a contraction of all three endogenous variables until the early 1980s, whereas no significant relationships could be found afterwards. In Germany, the accumulation regime changed: In the first period, rising interest rates led to a contraction, in the second period to an expansion of growth, accumulation and profits. In the USA, only accumulation did not increase as a response to increasing interest rates in the first sub-period. In the second, expansive effects on all three variables were observed. The authors conclude that their estimations do not offer a good explanation for the economic downturn in the aftermath of the 1980ss recession. Several potential reasons for this can be identified: First, as Hein and Ochsén (2003, p. 426) note, the failure to consider the impacts variations of the interest

¹²Prominent contributions to the empirical analysis of post-Kaleckian models are, amongst others, Marglin and Bhaduri (1990), Bowles and Boyer (1995), Stockhammer and Onaran (2004) and Hein and Vogel (2008).

rate have on the distribution of income between firms and workers is a crucial shortcoming of the empirical model applied. Second, the estimation of the savings function, is based on an unsatisfying calculation of the rentiers' income.¹³ Third, the firms' indebtedness which influences the sensitivity of investment towards interest rate variations is not taken into account. Fourth, for some sub-periods OLS-regressions have been applied to less than 15 observations which does not allow for significant results. Thus, Hein and Ochsens's (2003) results must be kept in perspective.

Overview

In the present paper, we establish a post-Kaleckian growth model and derive the equilibria of output, accumulation and profits as well as the conditions for different economic regimes with respect to interest rate variations. We then confront the model with the data of the USA and Germany from 1960 to 2007, estimate the coefficients by applying a simple ADL approach and determine the demand, accumulation and profit regimes of both countries for the entire period, for two sub-periods and for six business cycles. In doing so, we shall account for the shortcomings of Hein and Ochsens's (2003) contribution: First, we take into account the interest elasticity of the income distribution between firms and workers. Second, data on rentiers' income is derived from national accounts. Third, we also include the debt-capital ratio of firms in our econometric model. Fourth, we abstain from estimating sub-periods due to a lack of observations, but we simply apply our estimated coefficients of the entire period under consideration to the sub-periods.

The paper is organized as follows: In section 2, we will briefly discuss the constitutive concepts of post-Keynesian economics. In section 3, a post-Kaleckian aggregate supply-aggregate demand model including an interest elastic profit share, the net debt-capital ratio and the net equity-capital ratio will be developed. The effects of interest rate variations on capacity utilization, on capital accumulation and on the profit rate will be analyzed and conditions for different accumulation regimes derived. Section 4 confronts the model with data of the US and Germany. The coefficients of the model are estimated

¹³Since appropriate data is not available, Hein and Ochsens simply multiply the interest rate with the nominal capital stock and assume that this amount is distributed to the households.

and accumulation regimes identified. In section 5, some conclusions are drawn.

2 The post-Keynesian economic framework

The work of John Maynard Keynes has been an inspiration of generations of heterodox economists. Not only his well known *General Theory* (1936), but also his *Treatise on Money* (1930) and his *Treatise on Probability* (1921) should turn out to be pathbreaking for a new current of economic thinking.

However, the majority of economists influenced by Keynes grew up within the framework of neoclassical economics and were affiliated to mainstream ideas. Thus Keynes' economics was mainly applied in short run analysis. The main academic challenge within the mainstream was to link the Keynesian possibility of involuntary unemployment with the neo-Classical concept of market clearing. Accordingly, economists such as Hicks (1937) and Samuelson (1947 and 1955), claimed the utilization of *sticky prices* for economic analysis to be the main achievement of Keynes. Sticky prices were blamed to cause unemployment in the short run. In this perspective the Keynesian approach has never been a real attack on the core features of neo-Classical economics.

The interpretation of Keynes' work by economists at Cambridge University, such as Joan Robinson (1956), Richard Kahn (1972) and Nicholas Kaldor (1956 and 1957), were fundamentally different to the mainstream perception. For them, Keynes formed the basis on which the development of a heterodox approach to economics could be continued. These economists rejected the foundations of the neo-Classical framework and formed an economic framework, which should be developed and refined by economists of later generations under the label "post-Keynesian economics" (Lavoie 1992a, p. 1)

Although coming from a totally different context than Keynes, Michal Kalecki (1954, 1969 and 1971) is not less important for the development of the post-Keynesian approach. As a Polish economist he was strongly influenced by Marx. Nevertheless, Kalecki's ideas are at the core of post-Keynesian economics today.

In the following, we want to briefly discuss the core features of the post-Keynesian framework, in particular, the post-Keynesian microeconomic footing, the Keynesian and Kaleckian principles of effective demand, and the post-Keynesian perceptions of money and interest.

2.1 Economic behavior in a world of fundamental uncertainty

Contrary to neo-Classical economics, the primary post-Keynesian objective has always been to “explain the world as observed empirically” (Eichner and Kregel 1975, p. 1309). As we shall see in this section, this is in particular reflected by its microeconomics. Moreover, as we shall argue here, post-Keynesian microeconomics is highly consistent with its macroeconomics.

The post-Keynesian economic agent is taking decisions in a world of *fundamental uncertainty*. Uncertainty implies that households or firms do not have the basis of information that would be required in order to solve their individual intertemporal optimization problem. The probabilities and the values of potential outcomes as well as the set of these outcomes resulting from a choice are simply unknown to the individual (Lavoie 1992a, p. 44). Thus, the neo-Classical perception of uncertainty as calculable probabilistic risk is peremptorily rejected by post-Keynesians. Individuals’ economic decisions are based on expectations about the future formed on exceptionally weak foundations. According to Keynes,

most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as a result of animal spirits - of a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities. (Keynes 1973a, vii, p. 161)

The consequences of uncertainty on the macroeconomic level are extensive. Uncertainty particularly affects the investment behavior of firms. In a world of fundamental uncertainty firms do not know the prospective yield of an investment. According to Keynes (1973a, vii, p. 161) “animal spirits” are the driving force of private entrepreneurship. Thus investment demand is subject to strong exogenous fluctuations. This gives rise to the argument that the random shifts of investment demand do not allow for its proper modeling (cf. Shackle 1992, p. 218). Following this view, post-Keynesian economics would be constrained to short run analysis. Without a theory of investment, no long run conclusions can be drawn. Since we are interested in economic growth, specifically in its

sensitivity in respect of changes in the interest rate, we reject this line of argument. This is where conventions come in.

Uncertainty does not lead to chaotic behavior of economic agents. Quite the contrary: In the face of uncertainty, rational individuals generate norms of behavior which they follow. Agents base their economic decisions on conventions, on rules of thumbs.¹⁴ Individuals' expectations about the future rest upon experiences in the past. If a decision worked out satisfyingly in the past, then there is no reason to deviate from this choice in the future. As Keynes puts it,

in practice we have agreed, as a rule, to fall back on what is, in truth, a *convention*. The essence of this convention - though it does not, of course, work out quite so simply - lies in assuming that the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change. (Keynes 1973a, vii, p. 152)

Conventions are easy to identify on both the consumer and the producer side. Consumption expenditures are strongly influenced by habits. Similarly, investment behavior is not only determined by somewhat arbitrary "animal spirits", but it is also dependent on conventions: Liquidity ratios, leverage ratios and the normal rate of capacity utilization (Lavoie 1992a, p. 55).

The existence of conventions is a blessing for long run analysis: The agents' conventional behavior allows for periods of stability providing a basis for economic models of investment and consumption as long as no fundamental changes occur in the context. Conventions are a source of stability, rather than instability. Individuals do not respond to every single change in the environment, because they do not maximize utility (Lavoie 1992a, p. 60).

¹⁴Conventions are not arbitrary. They are the consequence of rational individuals reacting to a world of fundamental uncertainty (cf. Crotty 1990). Individuals are not rational in the neo-Classical sense, by which they optimize their objective function within a set of perfectly known constraints imposed by the economic environment. In post-Keynesian microeconomics economic behavior is characterized by "procedural rationality" (Simon 1976, p. 130). It requires that individuals base their decisions on "appropriate deliberation" (Simon 1976, p. 130). Agents are rational as long as their behavior relies on adequate reasoning. The post-Keynesian perception of rationality also accounts for subjective constraints in gathering and processing information (Lavoie 1992a, p. 51). For the procedure of decision-making is costly, especially in a world of uncertainty and insufficient capabilities, individuals relying on norms act rationally.

2.2 The role of classes

For post-Keynesians, agents do not optimize some kind of objective function. Macroeconomic outcomes of individual behavior is not the sum of the agents' optimal choices. In short, individuals' preferences are not the only and by far not the most important determinant of economic activity. Thus, there is no point in putting the individual into the heart of economic analysis.

Accordingly, post-Keynesians regard social classes as the subject of analysis.¹⁵ Therefore, post-Keynesian models rest upon the patterns of the behavior of social classes. They raise questions concerning the distribution of income and of social power, concerning the interdependence of macroeconomic variables such as profitability, savings propensities, income distribution, interest rates and economic growth. Considering the individual as a social being allows for *fallacies of composition* in macroeconomics: An option which seems optimal to an individual may bring about a macroeconomic outcome inferior to the previous situation, if the option has been chosen by everyone (Lavoie 1992a, pp. 10-11).

2.3 The post-Keynesian firm

In neo-Classical economics a representative firm's only objective is to maximize profits by producing a certain level of output that equilibrates market price and marginal cost. It is characterized by decreasing returns to scale and operating in an environment of perfect competition. In contrast to the strong assumptions of neo-Classical economics, post-Keynesians follow a more realistic approach.

The firm's objectives

The post-Keynesian firm, which our forthcoming analysis will be based on, operates in a context of oligopolistic competition. Firms face a limited number of rivals who engage in the same market. By the "urge to survive" (Robinson 1962, p. 38) companies are forced

¹⁵This is consistent with the post-Keynesian notion of individuals. For post-Keynesians individuals are social beings, shaped by their context and their culture, their behavior influenced and constrained by socioeconomic classes, social norms and institutions, respectively. Conversely individuals affect their own context, the framework of their economic behavior. This heterodox view accounts for the interdependence between individuals, the social structure and its institutions (cf. Lavoie 1992a, p. 10).

to focus on the long run and to follow strategies which consolidate the future position in the market.¹⁶ An essential means to achieve this objective is the pricing policy of the firm. Prices, set strategically, allow for profits necessary for future investment and can prevent the entry of additional competitors into the market. Prices are set by firms and are generally not the result of market forces (Lavoie 1992a, p. 95).¹⁷

Strategic price setting is an important but not the only objective of post-Keynesian firms. In order to consolidate and improve their market position firms are also eager to get control over their suppliers, to have access to cheap funds for investment and to influence national and international legislation. The power to carry out each of these objectives is dependent on the size of the company (Galbraith 1975, p. 56). Thus, what a post-Keynesian firm is centrally occupied with, is to boost its growth in size and market shares (Robinson 1962, p. 38). As we shall argue now, profits are the source of growth and thus the condition for gaining and sustaining market power.

Expansion implies the growth of the firms' capital stock. Thus, investment is the condition for growth. In order to finance this investment, firms can either use retained earnings or raise funds on the financial markets via bank credits, bonds or stocks. However, firms face financial constraints that limit the possibility to raise funds for investment. The limitations depend on the profitability of the firm. This for two reasons: First, retained earnings and thus the possibilities to utilize own funds increase with realized profits, in specific with the realized profit rate. Second, the access to funds from banks and financial markets is also dependent on retained earnings. According to Kalecki's (1937) *principle of increasing risk*, which characterizes the behavior of lenders and borrowers in the context of fundamental uncertainty, the willingness of lenders to grant loans to a firm depends on the latter's credit-worthiness, which is indicated by its current cash flow compared

¹⁶In recent decades, the rise of the *shareholder value* attenuated the firms' desire to grow. As Lazonić and O'Sullivan (2000) argue, accretive shareholder orientation in corporate governance moved the management's primary objective from "retain and invest" somewhat towards "downsize and redistribute". Under the heading of *financialization*, this phenomenon has been analyzed extensively by, amongst others, Stockhammer (2004a, 2005-06), Hein (2008), Hein and van Treeck (2008) and van Treeck (2008). In our post-Kaleckian macro model, we will take account for the influence of the firms' shareholder value orientation.

¹⁷Not all firms have the ability to set prices - just a few of them. The *price leaders* consist of a minority of companies that are powerful enough to dominate markets and determine the prices. They set the benchmark which *price takers* have to follow, because they do not have the power to influence prices.

to its financial leverage. Given the firm's leverage, the lower the profit rate of the firm, the riskier granted loans are for the bank. A firm not seeming credit-worthy due to low profits and high leverage will face heavy constraints in trying to receive funds from financial institutions. According to Kalecki (1971, p. 106), firms do not want to raise external funds either, given low cash flows and high financial leverage, since they do not want to take the risk to find themselves in an illiquid situation. Taken together, high profitability enables firms to raise cheap funds - internal and external - which allow for investment, growth and economic power.

As we have seen, the growth of the post-Keynesian firm is constrained by its profitability. Inversely, the profit rate feasible to a firm is constrained by the firm's growth rate. Permanent adoption of new technologies and growing capacities to produce enable firms to achieve higher sales, lower costs and thus higher profits. However, firms growing too fast also face problems concerning profitability, due to the so called *Penrose effect* (Penrose 1959): Excessive growth causes extra costs arising from additional marketing expenditures and from the adoption of new technologies. Moreover, managers and employees must get accustomed to the new operational environment (Lavoie 1992a, p. 115).

As we have argued in this section, the post-Keynesian firm's main objective is to guarantee its long run survival. In order to achieve this, it attempts to accumulate power by growth at the operational level, which is restricted by the profits of the firm required to finance the expansion.

Excess capacity and the firm's cost curves

According to Lavoie (2006, p. 41), the shape of the cost curves is the "core" of the post-Keynesian theory of the firm. Whereas the neo-Classical firms face increasing marginal costs and produce at a unique level of output minimizing unit costs, post-Keynesian firms are more flexible in varying production, without sacrificing cost efficiency. Post-Keynesians, following Eichner and Kregel (1975, p. 1305), assume constant returns to scale and constant marginal costs up to full capacity utilization. Provided that firms have spare capacities, they can increase production at constant unit direct costs and, taking also fixed costs into account, at decreasing unit costs. Due to economies of scale, higher

output accompanies lower unit costs. When full capacity is reached, increasing marginal costs begin to apply causing unit costs to rise. According to this line of argument, firms are expected to produce at full capacity utilization where unit costs are minimized (cf. Lavoie 1992a, pp. 118-23).

However, firms generally do not produce at full capacity in the post-Keynesian microeconomic framework. Firms usually do not utilize their entire capital stock. This view is based on Kalecki (1969) who most notably applied constant unit direct costs at excess capacity in his macroeconomic models already in the 1930s (Lavoie 1992a, p. 123) and it was further explored by Steindl (1952). As a matter of fact, firms do not exploit full capacities in reality. They utilize roughly 70 to 85 per cent (Lavoie 2006, p. 41). The reason for this, again, rests upon fundamental uncertainty. Firms cannot predict future demand. If there is an unexpected increase in demand, they want to benefit from higher sales. Moreover, they do not want to lose market shares to domestic and foreign competitors (Sylos-Labini 1971, p. 247). Thus, firms are required to adjust production in time. Their only option is to leave spare capacities which they can utilize in case of unexpected and enduring demand shifts.¹⁸ It is a strategy contributing to the firm's long run survival.

Cost-plus price setting

As we have argued, firms generally change their production volume in case of demand shifts, not prices. This shall be further explored in the subsequent discussion of the role of effective demand in post-Keynesian theory. For now, let us reconsider the price setting policy of firms, which we want to presume later in our post-Kaleckian growth and distribution model.

In general, post-Keynesian macroeconomic models assume firms to engage in cost-plus pricing. It implies that firms set prices equal to their unit costs plus a mark-up (Lavoie 1992a, p. 129). In a simplified Kaleckian version of this pricing policy the mark-up is assumed not to rely on overall unit costs but on unit direct costs instead (Kalecki 1971,

¹⁸Inventories are not eligible, because they will run out if a permanent shift in demand is met. Investment in new plants and machinery takes too much time to be carried out. Hence, firms prefer to rely on excess capacity, which enables them to react swiftly to unexpected fluctuations in demand (Steindl 1952, pp. 9-14).

pp. 44-45). In both approaches the mark-up is supposed to account for desired profits, in the latter also for potential fixed costs. Mark-up prices are always set before the products eventually meet their demand (Lavoie 2006, pp. 44-45). Thus, there is no feedback from actual demand conditions assumed to influence the pricing policy. Unit costs and the mark-up are its only determinants.

Mark-up pricing rests upon the fact that firms operate in an oligopolistic environment, where prices are governed by big corporations. Thus, the cost-plus pricing policy seems to be valid only for market leaders. However, especially long run analysis does not depart too much from reality when assuming that all firms are governed by the cost-plus pricing rule for the following reason: Companies with relatively inefficient cost structures will face severe difficulties raising funds for investment and growth, because they lack profits, the condition for internal and external finance (cf. Steindl 1952, pp. 40-52). Thus, they will drop out of the market in the long run. Only firms with sustainably low unit costs will survive (Lavoie 2006, p. 50).¹⁹

The question arises, how the general mark-up implied by market leader's price setting is determined. Following Kaldor (1985, pp. 50-51) firms set the mark-up within two extrema: On the one hand, the objective to grow requires high mark-ups that allow for high profits needed to finance investment. On the other, the objective to expand in market shares requires low prices in order to be competitive. Thus, depending on the constraints given by finance frontiers and market power, firms have to decide on their optimal mark-up. Kalecki (1971, p. 168) emphasized another constraint to the corporate liberty to set prices, the *degree of monopoly* in a market. The higher the market concentration the higher the market power of the firms in this industry and the higher these firms can set their mark-up without losing market shares. Moreover, the firms' ability to set prices is also constrained by the relative power of the corporate sector or of an industry compared to other social classes. The higher the bargaining power of trade unions the higher are the workers' real wages. Increases in wage costs cannot be passed on easily to higher prices

¹⁹Of course, mark-ups differ between companies. Following Kalecki (1971, p. 44), the price set by a firm does not only rely on unit costs and the profits it wants to achieve, but also on the pricing behavior of competitors. Firms facing temporarily relatively high unit costs have to lower their mark-up in order to provide competitive prices. Especially smaller and foreign firms with low market shares cannot pass on increases in unit costs easily, since they are price takers.

when the power of workers is strong (cf. Kalecki 1971, pp. 49-52).

2.4 The principle of effective demand

While neo-Classical economists accept the importance of effective demand in determining the level of output and employment in the short run, they reject it for medium- and long-run analysis. As they argue, production is constrained by the supply-side of the economy in the long run. The economy is expected to converge towards a natural, supply-side determined level of output. Accordingly, economic growth is determined by supply-side factors such as population growth or technological progress (cf. Solow 1956 and Romer 1990). For post-Keynesians, however, the principle of effective demand is still valid in the long run.²⁰

The meaning of effective demand

According to the principle of effective demand, the production of goods adjusts itself to the demand for goods. [...] The economy is therefore demand-determined, and not constrained by supply or given endowments. This means investment is essentially independent of savings; investment and capital accumulation are not tied to the intertemporal consumption decisions of households. (Lavoie 2006, pp. 11-12)

This distinct definition of the core of post-Keynesian economics accounts for several aspects of the principle of effective demand:

First, as Keynes (1973a, vii, pp. 27-28) argues, *Say's Law* - the proposition that supply creates its own demand - is not valid. The economy is not supply constrained, but restricted by the scale of effective demand comprising consumption and investment demand. To outline his argument, Keynes assumes constant nominal wage rates. Given an increase in employment, he argues, the additional income is consumed only partly. Thus, not all of the additional output is consumed. Entrepreneurs are now facing an

²⁰As for the distinction between the short and the long run in the post-Keynesian framework, Lavoie (2006, p. 84) argues that the difference regards to the view on the stock of capital. In the short period the capital stock is assumed to be constant. Thus, investment generates income, but does not alter the capital stock. In the long period however, the capital stock is allowed to vary.

unprofitable situation, where aggregate supply is higher than aggregate demand, unless investment demand increases in order to compensate for the difference. Hence, given the demand for investment and consumption, there is only one level of output and employment consistent with equilibrium in the goods market.

Second, since the consumption behavior of individuals or, using Keynes' notation, the *propensity to consume* is relatively stable (Keynes 1973a, vii, ch. 8-9), investment demand, whether private or public, is the key to high employment (Keynes 1973a, vii, p. 28). Investment is the driving force of the economy. For Kalecki (1971, ch. 10) and in particular for Keynes (1973a, vii, ch. 11-12) investment is a rather independent variable.

Third, in contrast to the neo-Classical view, investment is not constrained by available savings in post-Keynesian economics. Rather, investment is the precondition for savings. In equilibrium an increase in investment will raise the level of aggregate income such that the new stream of income generates savings equal to the initial increase in investment. Thus, the identity between investment and savings holds *ex post* in post-Keynesian economics. The causation is reversed: Investment causes savings to adjust via a corresponding adjustment of income (Gordon 1995). For post-Keynesians prices do not change. Quantities do. Accordingly, investment and savings are equilibrated by income adjustments and not by the interest rate. Another disagreement to neo-Classical economics.

Keynes' and Kalecki's version of the principle of effective demand differ, as they originate from different contexts (Davidson 2000, p. 3).²¹ Recent studies, however, emphasize the complementarity of Keynes' and Kalecki's contributions to economics by arguing that, although coming from different worlds, they basically followed similar theoretical approaches and drew similar conclusions. (Lopez and Mott 1999, Cf., Lopez 2002)

²¹Keynes, on the one hand, was shaped by his neo-Classical environment. In his *General Theory* he failed to escape the neo-Classical framework by accepting mainstream hypothesis such as profit maximizing firms, diminishing returns and exogenous money. Kalecki, on the other hand, was influenced by Marx. His models were utterly free of neo-Classical assumptions and thus coherent (Lavoie 2006, pp. 86-89). This lead Robinson (1972, p. 4) to the conclusion that Kalecki's approach was "in some ways more truly a *general* theory than Keynes".

Investment

Investment is the key element of effective demand. It is the main source of economic fluctuations and business cycles (Kalecki 1971, p. 9). So far, investment was assumed to be an exogenous, rather independent variable. This was especially highlighted by Keynes.

The beginning of Keynes' (1973a, vii, ch. 11) analysis of the "inducement to invest" is clearly neo-Classically inspired. He claims that in equilibrium investment is necessarily such that the marginal efficiency of capital equals the interest rate. However, a closer look on the subsequent analysis reveals that Keynes actually broke with the neo-Classical tradition (Shapiro 1977, p. 542). It turns out that the marginal efficiency of capital is equivalent to the expected profitability of investment, with *expected* being the crucial word. The willingness to invest, thus, is determined by entrepreneurs' long term expectations formed in a world of fundamental uncertainty concerning the future. Investment is conceived as an "autonomous process" (Shapiro 1977, p. 542) driven by the *animal spirits* of entrepreneurs. Following this view, the *fundamentalists* of post-Keynesian theory emphasized the prevalence of uncertainty and, linked to that, the exogeneity of investment (cf. Davidson 1972 and Minsky 1976).

However, a long-run analysis of capital accumulation that we want to pursue in this paper requires an underlying theory of investment which is aimed at identifying its determinants.

While Kalecki's theory of investment also accepts the influence of psychological factors especially in times of a "crisis of confidence" (Kalecki 1990, p. 114), he emphasizes the importance of objective factors in the determination of investment. According to Kalecki (1971, ch. 10), capitalists do not mainly rely on expectations, as Keynes has argued.²² Rather, they base their investment decisions upon current profits.

Profits have several positive effects on investment: Realized profits are the preferred

²²Kalecki disagreed with Keynes on the stability of investment decisions. According to Kalecki (1971, p. 2), investment decisions cannot be revised once they are made. This argument is based on the assumption that investment is carried out over several periods. First the decision to invest has to be taken. Then capital goods have to be ordered, produced and at last delivered. Changes in investment are costly once the production of capital goods has started. Thus, Kalecki assumes investment to be constant and not subject to changes in expectations in the short run. This is the reason why shifts in expectations only play a minor role in Kalecki's theory of investment (Lopez and Mott 1999).

source of funds for investment. As we already know from Kalecki's (1937) *principle of increasing risk*, capitalists have a strong preference for internal funds, since external finance would raise the firms' risk of default. Profits also facilitate the access to financial markets, since profitable firms appear to be credit-worthy. Moreover, realized profits indicate the prospective profitability of investment (cf. Lopez and Mott 1999, p. 297).

Kalecki's theory of investment offers an adequate access point to our investigation of monetary effects on economic growth and income distribution. Later, we will adopt a Kaleckian-type of investment function in our model.

Savings

Post-Keynesians reject the neo-Classical hypothesis that the interest rate equilibrates savings and investment, the former being the precondition for the latter. Rather than that, savings adjust *ex post* to investment via changes in aggregate income. As we have argued above, a given level of investment is associated with a certain amount of income that generates savings equal to the initial investment.

Different types of incomes feature different propensities to consume. Since the wages received by workers are typically lower than the profits earned by capitalists, the former generally consume a higher share of their income than the latter do. This is also consistent with orthodox microeconomic theory. On institutional grounds, Kaldor (1966, p. 310) argues that the distinction is not to be drawn between workers and capitalists, but between households and firms: The latter institutionally save a large fraction of their profits, which they need to finance investment, while nearly all households consume most of their income.

The macroeconomic relation between investment and savings was most clearly expressed by Kalecki (1971, ch. 7). Investigating the determinants of profits, he applies a national accounting approach. Given a closed economy with no government sector, the national product can be looked at from an income and from an expenditure perspective. Thus, the national product can be defined by

$$National\ Product = Wages + Profits = Consumption + Investment.$$

Since consumption can be split in a workers' and a capitalists' share, we get

$$Wages + Profits = Workers' Consumption + Capitalists' Consumption + Investment.$$

Following the *classical savings hypothesis* according to which workers consume all of their income, we obtain

$$Profits = Investment + Capitalists' Consumption.$$

In this simple economy, aggregate profits are equal to private investment plus consumption out of profits. Since capitalists cannot decide on the size of the profits they want to earn, whereas they are in disposal of their investment and consumption behavior, the causation necessarily runs backwards from investment to profits (Kalecki 1971, pp. 78-79). In the aggregate, firms can determine their profits by deciding on their investment and consumption expenditures. This is the crucial point of Kalecki's analysis. Capitalists as a class are able to ascertain their income by controlling their investment and consumption behavior. Now, we can truly comprehend Kaldor's (1956, p. 96) famous claim: "Capitalists earn what they spend, and workers spend what they earn." Rearranging the profit equation to

$$Profits - Capitalists' Consumption = Investment$$

reveals the identity between investment and savings, the latter being the left hand side of the equation. Since capitalists cannot directly decide on the size of their profits, we can identify the macroeconomic content of the equation: An increase in investment implies an increase in aggregate demand. Capitalists will raise their production volume. Aggregate income will rise accordingly. Since workers spend all their income on consumption, an increase in the wage rate directly translates into an increase in demand. Higher sales imply higher profits which are partly saved and partly consumed, the latter again stimulating aggregate demand. Via the mechanism of aggregate demand, investment will thus generate profits such that, given the capitalist's consumption behavior, savings are equal to investment.

The post-Keynesian labor market

Contrary to mainstream economics, post-Keynesians reject the notion of a labor market with well-behaved supply and demand functions and a price which clears the market. This is the case for several reasons:

First, as Keynes (1973a, vii, p. 13) points out, workers and capitalists do not bargain for the real wage which is usually seen as the equilibrating variable in neo-Classical models. In fact, they negotiate the nominal wage. Since firms set prices, it is also firms who - depending on their relative power - eventually determine the real wage and not market forces (Stockhammer 2004b, p. 31). For post-Keynesians, the real wage is determined by conventions, by notions of justice and fairness (Lavoie 1992a, p. 218). Moreover, since the wage is also a source of income, it cannot be seen as an ordinary price.

Second, the supply function of labor is not well-behaved and based on individuals following norms and conventions. Since the income effect empirically dominates the distribution effect, it seems closer to reality to conceive the labor supply curve as a falling function of the real wage (Lavoie 1992a, p. 220).²³

Third, post-Keynesians reject the neo-Classical production function together with its free substitutability between capital and labor. In reality, only a certain amount of labor can be employed given the stock of capital. Nevertheless, production can vary even in the short run, since firms generally do not produce at full capacity. When needed, they employ more labor and utilize a higher fraction of their machinery. The relation between output and employment is represented by a *utilization function* (Lavoie 1992a, p. 225). Since there is no substitution between capital and labor possible in the utilization function, a rise in the real wage will not induce a change in the technological coefficients of production (Lavoie 1992a, 225).

Fourth, since real wages are not determined by the intersection of well-behaved supply and demand functions, they cannot clear markets.

In post-Keynesian economics, market forces do not bring about full employment, nei-

²³According to Lavoie (1992a, p. 222), this is consistent with post-Keynesian microeconomics, according to which individuals try to reduce working loads as long as the following holds: First, they can maintain their position in the consumers' hierarchy. Second, they do not want to climb up in the hierarchy. Third, they have the institutional possibility to decide on the working hours freely.

ther in the short nor in the long run. Rather, employment is determined by the level of effective demand.

2.5 Credit and money in post-Keynesian economics

An essential feature of the post-Keynesian approach to economics is the claim that a sound economic theory has to address a “monetized production economy” (Eichner and Kregel 1975, p. 1309, fn. 39), rather than a simple barter economy where money is seen as a *veil* without any influence on the principles of economic activity.

The post-Keynesian view on money is shaped by several school of thoughts. It originates in the so called *banking school* of the mid-nineteenth century which opposed the classical quantity theory of money (cf. Wray 1990, ch. 4). Post-Keynesian monetary theory is also based on Keynes’ (1930) *Treatise on Money* which inspired the so called *circuitist school* (Schmitt 1966 and Parguez 1975) and several other heterodox economists (Minsky 1957, Kaldor 1970, 1982, Moore 1988 and Lavoie 1984) to forge the framework for a coherent theory of endogenous money. Today, their work is the foundation of the post-Keynesian view on money. (Cf. Lavoie 1992b, Rochon 1999, Wray 1990, ch. 5 and Cottrell 1984)

As this paper investigates the macroeconomic effects of an essential monetary variable, i.e. the rate of interest, an outline of the core features of post-Keynesian monetary theory is required. This shall be pursued in this section.

The endogeneity of money

For post-Keynesians, money is *endogenous* in the sense that it is “[introduced] into the economy through a process which remains largely beyond the control of the central bank” (Rochon 1999, p. 57). In contrast to the Monetarist view of a given stock of money which is basically controlled by the central bank, money is in fact created by the economic process itself. Money is demand determined, in particular by the demand for loans.

In order to understand the mechanism behind the creation of money, we will follow Lavoie (1992a, pp. 152-57) in considering the monetary circuit of an economy illustrated

Table 1: *Simple balance sheet of commercial banks*

<i>Assets</i>	Commercial banks	<i>Liabilities</i>
Loans to firms		Deposits of households
Y		Y

Notes: Y denotes the amount of loans to firms and the deposits of households, respectively.

by the banking sector's balance sheet. For now, we assume a simplified economy consisting only of firms, households and commercial banks. There has not been any economic activity in the past and there is no cash in the economy. As we have argued, firms produce and invest according to their expectations about future marketing opportunities. Assuming that firms do not hold liquid funds, they need to obtain bank loans in order to finance production and investment at the beginning of the period. These funds are distributed to the households via wages and appear as money on their banking deposits. The commercial banks' balance sheet is depicted in table 1 where Y denotes the amount of received loans and earned income, respectively. Credits appear on the asset side, money on the liability side of the balance sheet. Via the economic circuit, credits have been channeled into deposits. This, again, illustrates the causation of the investment and savings relationship: Investment leads to corresponding savings. What is crucial at this point, "a flow of credit money has been created *ex nihilo*, at a simple stroke of the pen. This flow of money is endogenous; it is the result of the credit needs of firms, consequent to their production plans" (Lavoie 1992a, p. 153). By granting loans, banks create money out of nothing, initiating the inevitable, the reflux of funds backing up the initial efflux of credit.

However, this is not the end of our simplified story. Households do not leave their money with the banks. In fact, they mainly consume. They purchase goods offered by the firms assuring the latter's income. Hence, firms receive the funds they need to reimburse their bank loans at the end of the period. In this process, money is destroyed, just as it was created beforehand (Lavoie 1992a, 155).

Households do not spend all of their income. They save a part of it which we want to denote by M . Thus, firms selling goods do not realize the entire amount of money necessary to meet their debt obligations. There remains an amount of M of outstanding

Table 2: *Advanced balance sheet of commercial banks*

<i>Assets</i>	Commercial banks	<i>Liabilities</i>
Loans to firms		Deposits of households
M		M

Notes: M denotes the amount of firms' outstanding debt and of households' savings, respectively.

debt in the end of the period. The balance sheet of the commercial banks is depicted in table 2. Not all the money is destroyed. Accountants will identify M as the stock of money in our simple model. Thus, the variable that is assumed to be exogenously given by orthodox economics is in fact nothing more than a residual, a remainder of the economic process of creating and destroying credit money (Lavoie 1992a, p. 155).

For post-Keynesians money is both a flow and a stock. It enters the economy via production and is determined endogenously by the desire of firms to obtain credit required for production. These loans create deposits. Thus, money is subject to effective demand which is the throttle control of firms' economic activity.²⁴

Central banks

As we have seen in our simple example, the money stock cannot be determined exogenously. This is not caused by the fact that we have excluded a monetary authority from our model, which might have been able to do so. Although the central bank has some influence on the monetary circuit, it cannot change the results achieved above substantially, even if we want to include it to our economy in the following²⁵.

Let us now suppose that households want to hold their money partly as deposits and partly in cash. Coins and notes are produced by the central bank. As we have argued above, the banking sector does not have liquid funds for purchasing money in cash provided by the central bank. Each loan is counterbalanced by a deposit. There are no excess reserves available. Hence, in order to obtain money in cash that is desired by the households, banks have to borrow from the central bank. This was pointed out by Hicks

²⁴For empirical support for these theoretical arguments, see Moore (1988, ch.7), Arestis and Biefang-Frisancho Mariscal (1995) and Shanmugam et al. (2003)

²⁵For a model also considering the government sector, see Lavoie (1992a, pp. 165-69)

(1974, p. 54) whose “overdraft economy” requires firms to borrow from banks who in turn have to borrow from the central bank.²⁶ By the same token, reserve requirements on bank deposits can induce commercial banks to incur debts. Following these requirements, a specific part of the deposits must be backed by liquid funds that again have to be borrowed from the central bank (Lavoie 1992a, pp. 161-65).

For the banking sector is largely dependent on base money provided by the central bank, the monetary authority gains some power to interfere in the monetary circuit, since it can determine the conditions of lending, thus influencing the behavior of firms and banks. However, the possibilities are limited. The central bank cannot control the stock of money generated endogenously in the economy. Moreover, as Kaldor (1970, pp. 8-9) and Lavoie (1992a, pp. 178-86, 1996a) argue, in reality central banks do not determine the stock of high-powered money either since they do not refuse to accommodate the demands of banks.²⁷ As Arestis (1988, p. 5) points out, “they cannot afford to jeopardize the solvency of the banking system.” Nevertheless, monetary authorities are especially powerful in the post-Keynesian view since they determine the rate of interest. As a matter of fact, this is what central banks do in most countries.²⁸

Horizontal money supply

In orthodox textbook macroeconomics the supply of money is assumed to be exogenous. In this view, central banks directly control the stock of base money. Since the *money*

²⁶In an *overdraft economy*, banks are forced to borrow from the central bank if they want to mobilize liquid funds. This is not necessarily the case if we allow for a government sector running budget deficits that are financed by issuing government bonds. Banks buying these bonds are now able to sell them to the central bank whenever they need liquidity, rather than to borrow funds. Done in a grand scale, this system is called *market economy*. However, as Lavoie (1992a, p. 181) points out, the difference between the two regimes “is of a legal rather than an economic nature”. Whatever the system, the chain of causation remains the same.

²⁷This view is not undisputed within the post-Keynesian framework as the controversy between the so-called *horizontalists* and *structuralists*, sketched in the next subsection, shows.

²⁸Also in the *New Monetary Consensus*, the predominant economic theory favored by most central bankers, the monetary authority is assumed to control the interest rates without leering at any monetary aggregate. The heart of this theory is the so-called *Taylor Rule*, a reaction function according to which the central bank has to set the interest rate under consideration of the inflation target, of the output gap and of an assumed *natural* rate of interest (Taylor 1993). The new consensus theory relies on the Wicksellian view that the interest rate equilibrates savings and investment, which is categorically rejected by post-Keynesians. Moreover, new-Keynesians suppose that tight monetary policy does not negatively affect economic growth, a fact to which post-Keynesians are strongly opposed to (Lavoie 2004) and which we want to refute in this paper.

*deposit multiplier*²⁹ is assumed to be stable, the mainstream concludes that central banks are also able to control the stock of broad money. Thus, in mainstream textbooks the money supply curve appears as a vertical line in the interest rate and money space. Money is exogenous, the interest rate determined by market forces equilibrating money supply and demand, the latter being negatively related to the rate of interest resulting from portfolio decisions.

Things are different in the so-called *horizontalist* view (cf. Kaldor 1982 and Moore 1988) that we want to follow here: Given the interest rate which is determined by the central bank, commercial banks will provide funds whatever firms want to borrow as long as they seem credit-worthy (cf. Moore 1988, p. 24 and Robinson 1952, p. 29). They do not systematically increase the interest rate on loans that are associated with higher risks. Rather, they simply provide no further loan (Robinson 1952, p. 83). By granting credits, banks induce the creation of money which was the main conclusion of the previous analysis. Money is determined by credits. In the credit (C) and interest rate (i) space, the credit supply curve (CS) is a horizontal line, infinitely elastic to changes in the interest rate (Kaldor 1982, p. 24). The amount of loans granted by banks is, in fact, only constrained by the credit-worthy needs of firms (CD). Their demand for credit is inversely related to the interest rate since higher rates are associated with a decreasing willingness of firms to run into debts. The stock of credit and thus the stock of money are determined endogenously, as depicted in figure 3. For each level of worthy credit demand, the central bank will then be induced to provide base money, the amount of which depending on the so-called *credit divisor* (Lavoie 1992a, p. 174), the equivalent to the neo-Classical money deposit multiplier.

Not all post-Keynesians agree on the horizontalist view on money supply. For some, the supply of money is better characterized by an upward-sloping curve. Accordingly, some post-Keynesians such as Rousseas (1986) argue that central banks typically do not accommodate the money demand of commercial banks. For them, the resulting shortage of base money will cause the interest rate to rise. Similarly, *structuralists* such as Pollin (1991) and Seccareccia (1988)) argue that central banks refusing to accommodate

²⁹It is defined as the relation between the stock of broad money and the stock of base money.

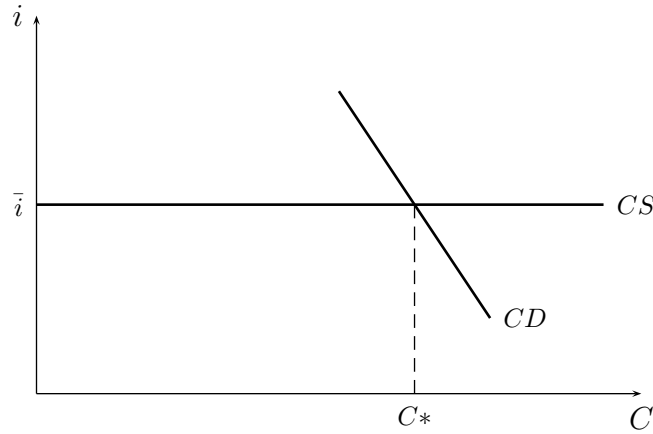


Figure 3: *The horizontalist view on the post-Keynesian money market*

impose inconveniences on banks and financial institutions that eventually call for rising lending rates. According to another current, the *liquidity preference view*, the rate of interest will endogenously rise “if banks refuse to provide more money to satisfy the preference for liquidity” (Wray 1992, p. 1159). In this view, banks are assumed to ask for higher interest rates that compensate for the expansion of their balance sheet which is associated with higher risk since the banks’ liquidity is reduced (Wray 1990, pp. 155-70). Nevertheless, in what follows we want to stick to Lavoie (1996a) and Rochon (1999, ch. 5) who conclude that all asserted counter-arguments can be basically conceived as specific cases of a generally horizontal money supply curve. As Lavoie notes, “disagreements are mainly the result of differences in emphasis” (Lavoie 1996a, p. 296) and not of fundamental nature.³⁰ Thus, in the next section, we want to derive a model of growth and distribution and introduce the interest rate as an exogenous variable which we want to analyze with respect to its effects on the real side of the economy.

³⁰For detailed arguments in favor of the horizontalist view, see Lavoie (1992a, pp. 192-212, 1996a) and Rochon (1999, ch. 5).

3 The post-Kaleckian model of distribution and growth

In this section a simple post-Kaleckian growth model in the vein of Bhaduri and Marglin (1990) is presented which has been elaborated extensively by Lavoie (1995), Hein and Ochsen (2003) and Hein (2007). It serves as the basis which the subsequent empirical investigation will rest upon.

3.1 The foundations of the model

We suppose a closed economy without government activity. There is no technological progress and no depreciation of the capital stock. Only one good is produced which can be used for both consumption and investment. We assume the coefficients of production to be constant. Our simplified economy consists of three groups of agents: firms, rentiers, and workers. Both firms and rentiers own the means of production. Firms earn profits which they have to redistribute a certain part of to the rentiers depending on the extent to which rentiers finance production. Workers sell labor to firms which they get compensated for by earning a wage.

As the income distribution between firms and rentiers largely depends on the financial structure of the firm, we want to follow Lavoie (1995) and Hein (2007) by introducing the debt-capital ratio to our post-Kaleckian growth model. Recent work by Hein (2008) and Stockhammer (2004a) also included the equity-capital ratio depicting the influence of the *shareholder value* on profit distribution and on investment decisions. This shall also be considered here. In order to introduce interest and dividend payments to the model, we decompose total profits (Π) into retained profits (Π^r) and distributed profits comprising interest payments (Z) and dividend payments (D), i. e.

$$\Pi = \Pi^r + Z + D \tag{1}$$

Firms have to pay interest (Z) for their outstanding debt according to the current rate of interest (i) and the bonds issued in the past (B). Likewise, dividend (D) has to be paid to shareholders according to the amount of money per stock that was agreed to be

distributed (d) and the amount of stocks sold (E). In formal terms, this implies

$$Z = iB \quad (2)$$

$$D = dE \quad (3)$$

Thus, interest and dividend rate variations can affect firms' financial payments only as far as these firms raised money on financial markets. The fractions of the nominal capital stock (pK) that are financed by bonds (B) and shares (E), i.e. the debt-capital ratio (λ) and the equity-capital ratio (ϕ), respectively, are defined as

$$\lambda = \frac{B}{pK} \quad (4)$$

$$\phi = \frac{E}{pK} \quad (5)$$

We assume the debt-capital and the equity-capital ratios to be given in the short run. In order to keep our model simple, we assume given ratios at every point in time ignoring their long-run behavior.³¹

Contrary to the old post-Keynesian growth models in the tradition of Kaldor (1956, 1957 and 1961) and Robinson (1962) who relied on full employment analysis, we assume our firms to operate at excess capacity. Following Eichner and Kregel (1975, p. 1305), we further assume firms facing constant marginal costs up to full capacity utilization. In order to make things easier, we assume away any fixed costs such as overhead labor.³² Thus, provided that they have spare capacities, firms can increase production at constant unit costs which are equal to unit labor costs.

Following Kalecki (1971), our firms operate in the context of oligopolistic competition. Prices are set by firms who put a mark-up on unit labor costs. Since prices are always set before the products are placed on the market, there is no feedback from actual demand on

³¹For the endogenization of the debt-capital ratio in simple Kaleckian models, see Lavoie (1995), Hein (2006) and Hein (2007).

³²In the post-Keynesian framework, employment usually consists of *overhead labor* and *direct labor* (Kalecki 1971, p. 44). The former covers those workers who are employed whatever positive level of output is produced. They are a fixed factor of production. The latter is variable in the sense that the amount of its employment depends on the actual level of output produced.

the price setting policy (Lavoie 2006, pp. 44-55). As the mark-up determines the profit over labor costs for every unit produced, the distribution of income between firms and workers is determined uniquely by the firms' mark-up. The profit share (h), defined as total profits (Π) over nominal income (pY), is a positive function of the mark-up (m), i.e.

$$h = \frac{\Pi}{pY} = h(m), \quad \frac{\partial h}{\partial m} \geq 0 \quad (6)$$

In Kaleckian growth theory, hence, the distribution of income is given exogenously.³³

Interest and dividend payments are distributed profits of the firm and hence not part of the unit costs which are marked-up in our model. However, it is reasonable to expect firms to increase prices as a response to an increase in interest payments in order to achieve a certain level of retained profits.³⁴ Thus, we assume the mark-up (m) to be an increasing function of the rate of interest payments ($\frac{Z}{pK}$), which, according to equations (2) and (4), is equal to the debt-capital ratio (λ) multiplied by the rate of interest (i).³⁵ We get a non-negative interest elasticity for the mark-up:

$$m = m(\lambda i), \quad \frac{\partial m}{\partial \lambda i} \geq 0 \quad (7)$$

Given equation (6), equation (7) implies that the profit share is also a non-negative function of the rate of interest payments, which we want to define as

$$h = \gamma_0 + \gamma_1(\lambda i), \quad \frac{\partial h}{\partial \lambda i} = \gamma_1 \geq 0 \quad (8)$$

where h , λ and i denote the profit share, the debt-capital ratio and the interest rate,

³³This is the essential difference to Robinsonian and Kaldorian growth theory, according to which the endogenous adjustment of the distribution of income is the mechanism equilibrating aggregate demand and aggregate supply. (Cf. Lavoie 1992a, pp. 284-296 and Hein 2004, pp. 149-168)

³⁴In order to keep our model simple and since we are interested only in the implications of variations in the rate of interest, we ignore the effect a variation in the dividend payments might have on the mark-up.

³⁵The assumption of an interest elastic mark-up is in accordance with Kalecki (1971, pp. 48-50) who argues that the *degree of monopoly* may be influenced by interest costs. In standard post-Kaleckian literature (cf. Hein 2004), the mark-up is usually related to the interest rate and not to interest payments since it is suggested that firms perceive the interest rate as a benchmark for their desired profitability. In our model, however, we want to stick to Kalecki (1971) and the Sraffians (cf. Panico 1985 and Pivetti 1985) by looking at the interest rate from its cost side. Since interest rates affect the firms' profits only forasmuch as they are indebted, we perceive the mark-up as a function of the rate of interest payments and not only of the interest rate.

respectively. γ_0 captures the fraction of the mark-up and thus of the profit share that is not influenced by variations in the rate of interest payments, the effects of the latter being denominated by γ_1 . Given a positive debt-capital ratio, an increase in the rate of interest will induce firms to raise the mark-up on unit labor costs causing the profit share to increase by $\gamma_1\lambda$. Thus, income is redistributed from wage to profit earners.

The Kaleckian growth model is based on two equations: an investment and a savings function that even up in equilibrium. According to the principle of effective demand, aggregate demand induces corresponding aggregate supply. The economy is demand determined with investment being the active part of aggregate demand and the driving force of the economy (cf. Kalecki 1971 and Keynes 1973a). Since the amount of available savings is not a condition for investment, although the identity between savings and investment holds *ex post*, we can model an independent investment function.

For Kalecki (1971, ch. 10), capitalists base their investment decisions mainly upon current profits, which provide access to internal and external funds for investment, according to the *principle of increasing risk*. Moreover, current profits serve as an anchor which the expectation of the future profitability of investment is based on. Bhaduri and Marglin (1990) generalized Kalecki's view by decomposing profits into a cost and a demand factor which enter the investment function separately. In the Bhaduri/Marglin variant of the Kaleckian growth model, the profit rate (r) which is defined as total profits (Π) over the nominal capital stock (pK) is split up into the profit share (h) and the rate of capacity utilization (u) assuming that the capital coefficient is constant over time, i.e.

$$r = \frac{\Pi}{pK} = \frac{\Pi}{pY} \frac{pY}{pK} = hu \quad (9)$$

where $h = \frac{\Pi}{pY}$ and $u = \frac{Y}{K}$.³⁶

Since investment comes prior to savings, it must be financed independently of savings by credit. We assume the banking sector to accommodate any credit demand by credit-worthy business independent of the interest rate. This is in compliance with the

³⁶Since u relates output (Y) to the capital stock (K) it can be interpreted as a measure of capacity utilization as long as the assumption of a constant capital coefficient is valid.

horizontalist view on money supply pioneered by Kaldor (1982) and Moore (1988), according to which the interest rate is determined exogenously by the central bank, while the stock of money adjusts endogenously to credit demand.³⁷ The dynamics of the economy does not systematically influence the rate of interest. Thus, the interest rate enters the investment function as an exogenous variable.

Summing up, we can depict the investment behavior of firms by a simple linear accumulation function. The accumulation rate (g^I), defined as capital formation (I) over the nominal capital stock (pK), depends on the deviation of the rate of capacity utilization (u) from its normal rate (u_n), on the profit share (h), and on financial variables such as the debt-capital ratio (λ), the interest rate (i), the equity-capital ratio (ϕ) and the dividend rate (d).³⁸ In formal terms, this implies

$$g^I = \frac{I}{pK} = \alpha + \beta(u - u_n) + \tau h + \theta_i \lambda i + \theta_d \phi d, \quad \alpha, \beta, \tau \geq 0, \quad \theta_i, \theta_d \leq 0 \quad (10)$$

α represents autonomous investment which is not induced by demand, profits or financial variables. β indicates the impact of variations in the deviation of capacity utilization from its long-run value on the entrepreneurs' investment behavior. Rising aggregate demand pushes the utilization rate above its standard level implying both increasing expectations of future sales and a decreasing flexibility to react on market competitors each of which induces firms to raise their investments.³⁹ τ indicates the direct influence of the distribution of income on investment. The profit share can also be interpreted as

³⁷The central bank determines the prime rate which commercial banks put a mark-up on according to the riskiness, the period of maturity and the liquidity of the loan. The essence of the *horizontalist* view is that commercial banks do not increase interest rates systematically given an increasing amount of credit.

³⁸Considering equation (2) and (4), we know that the debt-capital ratio (λ) multiplied by the rate of interest (i) is equal to the rate of interest payments ($\frac{Z}{pK}$), i. e. $\lambda i = \frac{Z}{pK}$. Equivalently, considering equation (3) and (5), we know that $\phi d = \frac{D}{pK}$. The rate of dividend payments ($\frac{D}{pK}$) consists of the product of the equity-capital ratio (ϕ) and the dividend rate (d).

³⁹Contrary to Bhaduri and Marglin (1990), Lavoie (1995), Hein and Ochsén (2003), and Hein (2007) who assume investment decisions to be dependent on the rate of capacity utilization, we follow Duménil and Lévy (1999), Shaikh (1991), and Lavoie et al. (2004) and model accumulation as a function of the deviation of current capacity utilization from its normal long-term level. This allows for a consistent and sophisticated econometric model due to the following reason: The interpretation of the output-capital ratio as capacity utilization implies the assumption of a constant capital coefficient, which does not hold in reality. Thus, the decreasing trend of the utilization rate over time would bias the estimation of the accumulation function. Since, according to the authors, output growth does not seem to be a satisfying approximation for utilization, we split the output-capital ratio into a permanent and transitory component and put the deviations into the accumulation function.

an indicator of future profits since it determines the profit margin over the costs accruing from the production process. A rising profit share implies increasing current profits and decreasing labor costs per unit of output produced which raises the firms' expectations of the profitability of investments (Marglin and Bhaduri 1990, p. 163). θ_i and θ_d are expected to be negative and quantify the impact of interest payments and of dividend payments, respectively, on the firms' invest decisions.⁴⁰ Increasing financial payments, e.g. through an increase in the rate of interest, reduce the amount of internal finance and, according to Kalecki's (1937) *principle of increasing risk*, the entrepreneurs' incentives to invest.

Figure 4 illustrates the accumulation rate (g^I) as a function of the current rate of capacity utilization (u) in the (u, g^I) -space. The slope of the curve is given by the marginal reaction of accumulation towards a one unit change in current utilization, which is β . The ordinate intercept is determined by the other components of accumulation, which are $\alpha + \beta u_n + \tau h + \theta_i \lambda i + \theta_d \phi d$. As depicted in figure 5, variations in these factors will cause the accumulation curve to shift upwards and downwards, respectively. Given a positive interest elasticity of investment and a positive debt-capital ratio, an increase in the interest rate will have contradicting *primary* and *secondary effects* on the initial position of the accumulation curve, which is given by g_0^I . In a first round, we assume the mark-up on unit labour costs and, hence, also the profit share to be constant. Thus an increased interest rate will transfer income only from the firms to the rentiers. As we have argued, this redistribution of income will reduce retained profits and induce the firms to cut down on investment. The accumulation curve will shift downwards to g_1^I . In a second round, firms react to the increased interest costs by raising the mark-up and, thus, the profit share. This redistribution of income from laborers to firms will increase the profit share and induce firms to enhance their investments. The accumulation curve will move upwards. Depending on whether the secondary effect exceeds the primary effect, the accumulation curve will end up above or below the initial position, i.e. at g_{2a}^I or

⁴⁰There are two reasons why interest and dividend payments have not been summarized in the investment function: First, in the econometric model, we also use them as distinct regressors as taking them together would blur the link to monetary policy. Second, in contrast to interest payments, dividend payments are also driven by the *shareholder value* which has gained relevance in recent years (cf. Stockhammer 2004a).

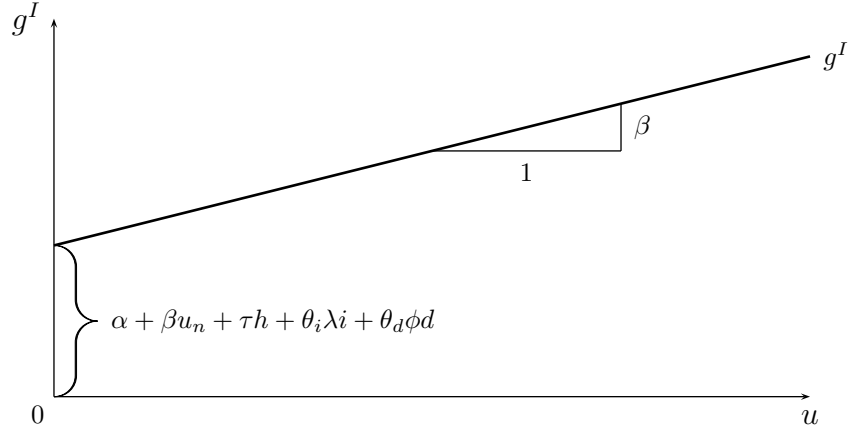


Figure 4: *Accumulation curve*

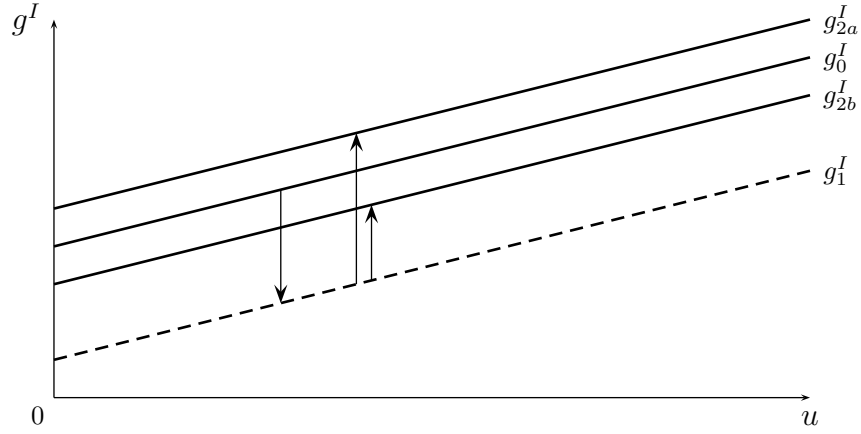


Figure 5: *Response of the accumulation curve to a positive interest rate shock*

g_{2b}^I . The overall impact of a rising interest rate on the accumulation curve may thus be positive or negative. Given a positive interest elasticity of investment the overall effect of an increasing interest rate on savings depends on the weight of the primary and the secondary effect as well as on the initial value of the utilization rate.

Contrary to the traditional Bhaduri and Marglin (1990) type of model, we do not follow the classical saving hypothesis according to which there is no savings out of wages, only out of profits. Since we want to apply our model to empirical data, we assume workers to save a part of their wage income (W), the latter being given by

$$W = w l Y \quad (11)$$

In compliance with Kaldor (1966), we suppose that the propensity to save out of wage

income (s_W) is smaller than the propensity to save out of interest and dividend income (s_Z). Total savings (S) consists of the firms' savings (S^F) and of the households savings (S^H). The former is equal to the firms' retained profits (Π^r) which are saved by definition. The latter comprise the savings out of rentiers' income ($s_Z(Z+D)$) and out of labor income ($s_W W$). Given equations (1), (2), (3), (4), (5) and (11), we can imply for the savings rate (g^S) relating total savings (S) to the nominal capital stock (pK) that

$$\begin{aligned} g^S &= \frac{S}{pK} = \frac{S^F + S^H}{pK} = \frac{\Pi^r + s_Z(Z+D) + s_W W}{pK} = \\ &= hu - (1 - s_Z)(\lambda i + \phi d) + s_W(1 - h)u, \quad 0 \leq s_W < s_Z \leq 1 \end{aligned} \quad (12)$$

where the profit share (h) and the rate of capacity utilization (u) are defined as $h = \frac{\Pi}{pY}$ and $u = \frac{Y}{K}$, respectively.

Figure 6 presents the savings rate (g^S) as an increasing function of the utilization rate (u). The slope of the curve is equal to $h + s_W(1 - h)$. The ordinate intercept is negative and determined by the negative value of consumption out of rentiers' income, which is $-(1 - s_Z)(\lambda i + \phi d)$. An increase in the rate of capacity utilization (u) implies additional income, a part of which will be saved according to the propensities to save out of rentiers' and labor income and according to the distribution of income amongst firms and workers. The effects of changes in the rate of interest on the savings curve are depicted in figure 7. Again, a rise in the interest rate involves primary and secondary effects: Given a constant profit share (h) in the first round, an exogenous increase in the rate of interest (i) will diminish total savings as funds are transferred from firms who save their profit income entirely to rentiers who consume a part of their income. The savings curve will shift downwards. In the second round, firms will increase the mark-up, thus transferring funds from workers to the firms. Since the propensity to save out of wages is positive whereas the propensity to save out of retained earnings is zero, total savings increase. The savings curve will *rotate* counter-clockwise, as the increased profit share implies that for each additional unit of aggregate income a higher fraction is saved.

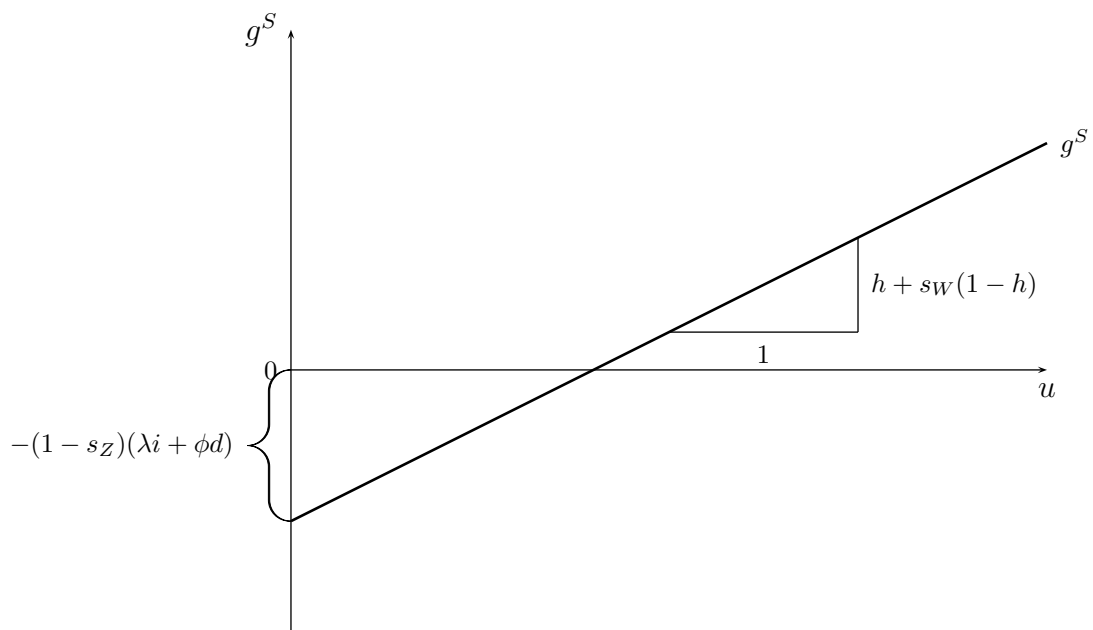


Figure 6: *Savings curve*

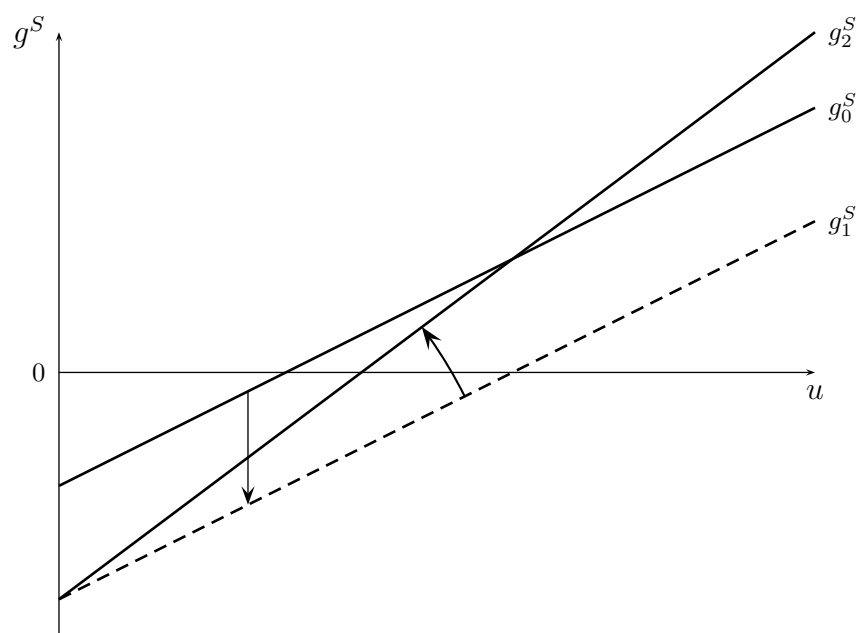


Figure 7: *Response of the savings curve to a positive interest rate shock*

3.2 Equilibrium

The goods market is in equilibrium when aggregate supply (Y) is equal to aggregate demand comprising consumption ($Y - S$) and investment demand (I). Relating supply and demand to the stock of capital, we can imply for the equilibrium in the goods market that

$$g^I = g^S \quad (13)$$

The goods market will equilibrate since any disequilibrium will induce the utilization rate to move towards its equilibrating level. The Keynesian stability condition implies that savings needs to react more sensitively to variations in capacity utilization than accumulation does. Referring to figure 4 and to figure 6, this means that the savings curve must be steeper than the investment curve in order to get positive equilibria. Thus, the following condition must hold:

$$\frac{\partial g^S}{\partial u} - \frac{\partial g^I}{\partial u} = s_W + (1 - s_W)h - \beta > 0 \quad (14)$$

Provided the stability condition is satisfied, we get positive equilibrium values for the rate of capacity utilization (u^*), for the accumulation rate (g^*) and for the profit rate (r^*) by substituting equations (10) and (12) into equation (13) and by solving for the endogenous variables as follows:

$$u^* = \frac{\lambda i(1 - s_Z + \theta_i) + \phi d(1 - s_z + \theta_d) + \alpha + \tau h - \beta u_n}{s_W + (1 - s_W)h - \beta} \quad (15)$$

$$\begin{aligned} g^* = & \frac{\lambda i \left(\beta(1 - s_Z) + \theta_i \left(s_W + (1 - s_W)h \right) \right)}{s_W + (1 - s_W)h - \beta} \\ & + \frac{\phi d \left(\beta(1 - s_Z) + \theta_d \left(s_W + (1 - s_W)h \right) \right)}{s_W + (1 - s_W)h - \beta} \\ & + \frac{\left(s_W + (1 - s_W)h \right) (\alpha + \tau h + \beta u_n)}{s_W + (1 - s_W)h - \beta} \end{aligned} \quad (16)$$

$$r^* = \frac{h \left(\lambda i(1 - s_Z + \theta_i) + \phi d(1 - s_z + \theta_d) + \alpha + \tau h - \beta u_n \right)}{s_W + (1 - s_W)h - \beta} \quad (17)$$

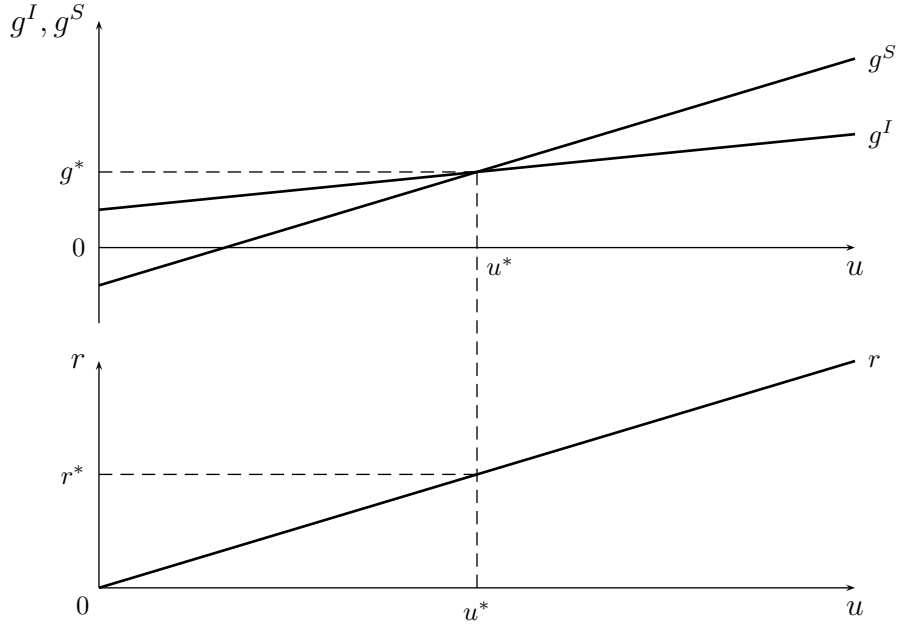


Figure 8: *The equilibrium values of utilization, accumulation and profits*

Figure 8 is the graphical representation of equations (15) to (17). The upper part is the synthesis of figure 4 and figure 6. The lower part illustrates the realized profit rate curve which follows from equation (9). The slope of this curve is equal to the profit share (h).

3.3 Effects of interest rate variations on utilization, accumulation and profits

The effects of a variation in the rate of interest on the equilibrium values of the rate of capacity utilization, of the accumulation rate and of the profit rate can be derived by differentiating the equilibrium positions with respect to the interest rate. The total effects are given by

$$\frac{\partial u^*}{\partial i} = \frac{\lambda(1 - s_Z + \theta_i) + \gamma_1 \lambda \left(\tau - (1 - s_W)u \right)}{s_W + (1 - s_W)h - \beta} \quad (18)$$

$$\frac{\partial g^*}{\partial i} = \frac{\lambda \left(\beta(1 - s_Z) + \theta_i \left(s_W + (1 - s_W)h \right) \right) + \gamma_1 \lambda \left(\tau \left(s_W + (1 - s_W)h \right) - \beta u(1 - s_W) \right)}{s_W + (1 - s_W)h - \beta} \quad (19)$$

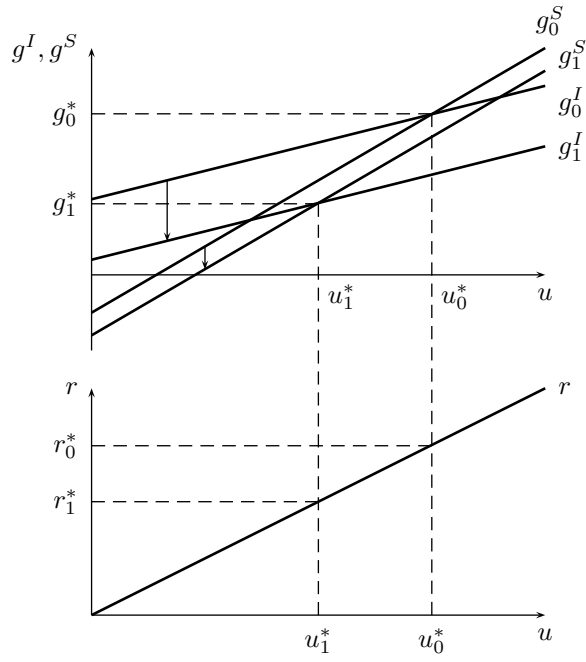
$$\frac{\partial r^*}{\partial i} = \frac{\lambda \left(h(1 - s_Z + \theta_i) \right) + \gamma_1 \lambda \left(\tau h + (s_W - \beta)u \right)}{s_W + (1 - s_W)h - \beta} \quad (20)$$

The reactions of utilization, accumulation and profits to a variation in the interest rate depend on the coefficients of the accumulation and savings function as well as on the

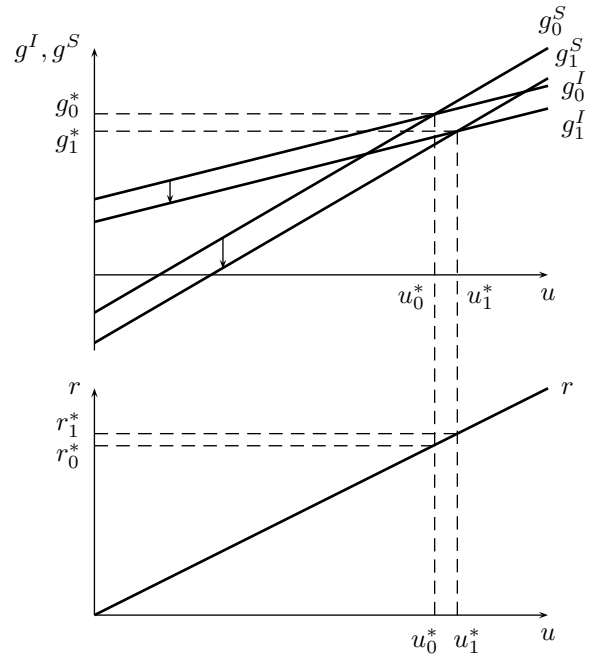
marginal effect of a variation in the rate of interest payments on the profit share. Taking only stable equilibria into account, these effects depend on the sign of the numerators in equations (18) to (20).

Assuming a rigid mark-up in the first round, the interest elasticity of the profit share is zero implying that $\gamma_1 = 0$. Thus, the primary effects of a variation in the interest rate on the equilibrium values of utilization, accumulation and profits depend basically on the savings rate out of interest and dividend income and on the marginal response of investment towards changes in the rate of interest payments.⁴¹ Different accumulation regimes can be distinguished, which are represented in figure 9: The *normal* post-Keynesian case is illustrated in panel a. An increase in the rate of interest has negative effects on demand, accumulation and profits (cf. Hein 2006 and 2007). This regime is characterized by rentiers who save a big fraction of their income implying that increasing interest rates translate only into a merely weak expansion of consumption demand. Hence, the savings curve shifts downwards only moderately. Entrepreneurs heavily rely on the current burden of interest payments in forming their investment decisions. Thus, the investment curve shifts downwards significantly. What Lavoie (1995) and Hein (2007) call the *puzzling* case is a regime in which an increase in the interest rate has expansive impacts on the equilibrium values of the endogenous variables, which is depicted in panel c of figure 9. As Hein (2007) points out, this is the case when rentiers stimulate demand by a small propensity to save and entrepreneurs do not care a lot about interest payments in their investment behavior. Hence, given an increase in the interest rate, the savings curve shifts significantly downwards whereas the investment curve does so only a little. Savings and investment functions which are sensitive towards changes in the rate of utilization are also favorable to this regime, as they imply a strong accelerator effect. An *intermediate* case, depicted in panel b of figure 9, is also possible. In this case, utilization and the profit share increase whereas accumulation decreases as a response to rising interest rates. In general, the debt-capital ratio cannot reverse, but only mitigate or amplify the effects variations in the interest rate have on the equilibrium values.

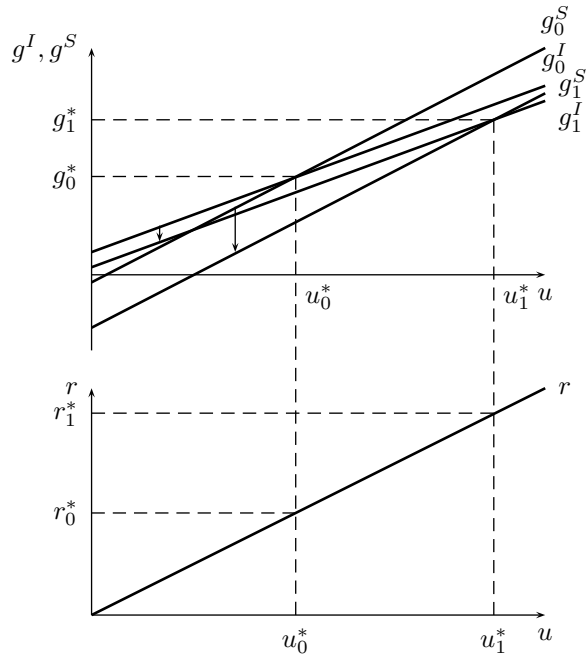
⁴¹Furthermore, the effect on accumulation depends on the workers' propensity to save, on the sensitivity of investment towards changes in demand, and on the profit share.



Panel a: *Normal case*



Panel b: *Intermediate case*



Panel c: *Puzzling case*

Figure 9: *Different demand, accumulation and profit regimes*

Assuming an interest elastic mark-up in the second round, the sensitivity of the profit share towards variations in the rate of interest payments is positive, i.e. $\gamma_1 > 0$. Now, things get more complicated because the indirect secondary effects through the redistribution of income from workers to firms have to be considered, too. These secondary effects of a change in the interest rate may reverse, dampen or amplify the primary impacts discussed in the case of a rigid mark-up. Given a low responsiveness of investment towards the profit share, a high one towards capacity utilization, and a high current rate of capacity utilization, a rising mark-up induced by an increase in the interest rate will most likely have a negative impact on utilization, accumulation and profits.⁴² In this case, the positive effect on investment due to an increasing profit share does not compensate for the negative effect on consumption which is induced by lower wage income. The economy can be characterized by a wage-led demand, accumulation and profit regime since an increasing profit share reduces the equilibrium positions of all endogenous variables. Again, the debt-capital ratio can only influence the dimensions of the total effects of interest rate variations on the equilibrium values, but it does not account for the relative weights of the partial effects.⁴³

Figure 10 depicts a selected *normal* post-Keynesian case. Considering only the first-round effects, we observe an *intermediate* case. A high responsiveness of investment towards higher interest costs causes a significant downward move of the investment curve. A low propensity to save out of rentiers' income implies the same with the savings curve. The new first-round equilibrium implies lower accumulation as well as unchanged utilization and profits. After the second round, things have changed. Due to a weak influence of an increased profit share on investment the investment curve shifts upwards only moderately whereas the savings curve turns counter-clockwise the extent of which depending on the increase of the profit share. The new and final equilibrium is characterized by lower accumulation and lower utilization. Due to the increase in the profit share, the profit

⁴²A high propensity to save out of labor income may reverse the negative indirect effect of an increase in the mark-up on accumulation into a positive one.

⁴³This is a contradiction to Lavoie (1995) and Hein (2007) who assume the profit share to be elastic towards changes in the rate of interest (i) and not in the rate of interest payments (λi). Thus, the debt-capital ratio does not show up in the secondary effect. As it has an impact on the significance of the primary effect, it also determines the relative weights of the two partial effects.

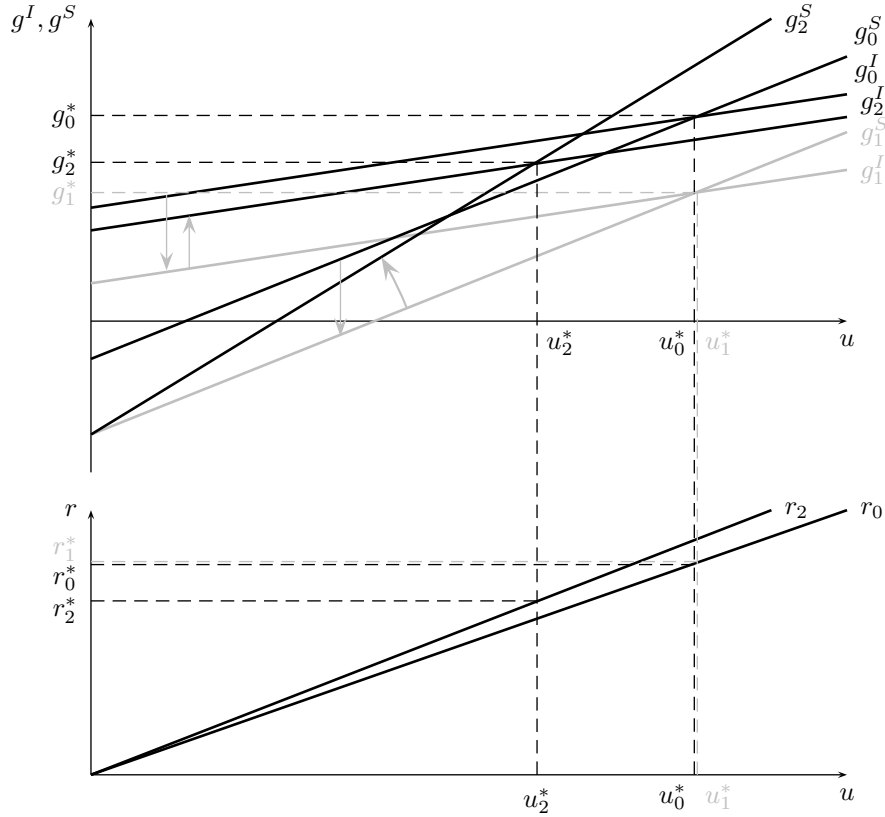


Figure 10: *Responses of the endogenous variables to a positive interest shock in a normal case*

rate function will turn counter-clockwise. Depending on the extent the profit share has increased and depending on the final position of the utilization rate, the new equilibrium of the profit rate will be either above or below the initial one. In the case depicted in figure 10, the profit rate decreases. All endogenous variables decrease as a response to an increase in the interest rate. Since the rise of the profit share has a negative impact on utilization and a positive one on accumulation, we can speak of a *wage-led* demand regime and of a *profit-led* accumulation regime, respectively.

Figure 11 depicts a *puzzling* case. Again, we observe an *intermediate* case, after the first-round effects have been completed. Given the profit share induced rotation of the savings curve, a sufficiently high sensitivity of investment with respect to changes in the profit share shifts the investment curve upwards and accounts for new second-round equilibria of accumulation and of utilization which are higher than the initial ones. The impact on the profit rate is also positive, as utilization increased given the increase in the profit share. Thus, the overall effects of an increasing interest rate on the endogenous

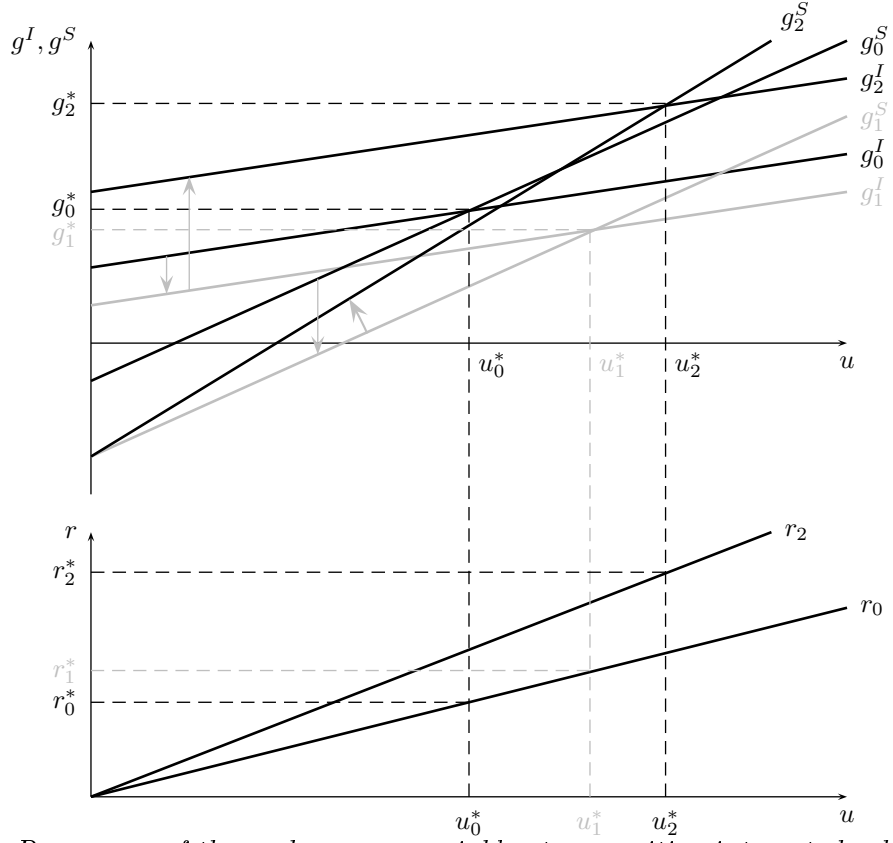


Figure 11: *Responses of the endogenous variables to a positive interest shock in a puzzling case*

variables are positive. Since utilization, accumulation and profits expand moving from the first- to the second-round equilibria, figure 11 displays *profit-led* demand, accumulation, and profit regimes.

4 Interest rates, output, accumulation and profits in the US and Germany

This section applies the post-Kaleckian growth model which we have developed above to data of the US and (West-)Germany.⁴⁴ For both countries, we want to identify their respective economic regimes, theoretically outlined in the previous section, for the period from 1960 to 2007. We want to find answers to the question of how demand, accumulation and profits have responded to variations in the interest rate and in how far monetary policy can explain the economic performance of both countries since the 1960s.

In the present paper, we want to address the plausibility of the post-Kaleckian growth model in capturing reality. Thus, we want to stick to our theoretical model as far as possible, when setting out for empirical analysis. A few issues that might put our results into perspective have to be clarified: First, both the US and Germany are open economies. However, we do not consider foreign trade or payments in our analysis. Second, equivalently to our theoretical model, our econometric model builds on the assumption that all net interest and dividend payments of firms are exclusively transferred to rentiers who receive exclusively these funds as net interest and dividend income. Third, although it does not hold exactly in reality, we do not drop the implication of the post-Kaleckian model that the rate of net interest payments of firms is equal to the product of the net debt-capital ratio and some interest rate. In reality, financial assets do not fully compensate liabilities since the former do not yield as much interest as interest has to be paid for the latter. Thus, netting out financial assets might be a source of distortion. Therefore, we stick to the rate of net interest payments in our estimations and do not rely on the product of interest rates and the debt-equity ratio.

4.1 The data

Estimating the growth model discussed in the previous section requires a broad set of data: For the investment function, we need data on accumulation, on capacity utilization, on

⁴⁴In the following, *Germany* will refer to West Germany until 1990 and, thereafter, to unified Germany.

the profit share as well as on interest and dividend payments. For the savings function, data on private savings and on different types of income, particularly on wage income and interest and dividend income are used. The estimation of the marginal reaction of the profit share to changes in the rate of interest payments requires data on the profit share, on the interest rate and on several control variables such as unemployment, inflation and aggregate demand. Since these data on the US and on Germany were not available from one institution, several sources have been utilized, in particular the OECD, European Commission, US Bureau of Economic Analysis, the Federal Reserve, the Statistisches Bundesamt Deutschland and the German Bundesbank.⁴⁵

Accumulation is represented by the growth rate of the net capital stock of the private business sector. Since there is no reliable data on capacity utilization we relate real net domestic income to the real net capital stock as a proxy for demand. This is not fully consistent with recent empirical literature where capacity utilization is usually approximated by the growth rate of real GDP (cf. Hein and Ochsén 2003, van Treeck 2008, Stockhammer 2004a). However, our approximation is consistent with our theoretical definition of the rate of capacity utilization presented in the previous section. The rate of normal capacity utilization is assumed to be equal to the trend of actual capacity utilization which has been derived by applying the Hodrick-Prescott filter ($\lambda = 100$). For the profit share, the net operating surplus of the total economy adjusted for the labor income of the self-employed is related to the net value added. In contrast to Stockhammer (2004a) where interest/dividend payments and income enter the investment function separately, we follow the approach by van Treeck (2008) by employing net interest and net dividend payments of non-financial businesses. Since both financial payments and financial income are highly correlated, using net values promises more robust results than can be expected from considering gross values. Equivalently, we construct the debt-capital ratio as the difference between liabilities and financial assets over tangible assets. Both, net interest and net dividend payments enter the accumulation function related to the nominal net capital stock.

The savings equation is estimated only for private households since firms' retained

⁴⁵For a detailed description of the data set and its sources, see table A1.

earnings are saved by definition in the Kaleckian growth model. Wage income is indicated by the compensation of employees. Rentiers' income has been derived from the net interest and dividend income of private households. In addition to these essential variables, several control variables have been employed: proprietors' income for the US and Germany as well as rental income, transfer income, and transfer payments only for the US. Similarly to the accumulation function, all types of income have entered the savings function related to the net stock of capital.

For estimating the interest sensitivity of the adjusted net profit share, the rate of net interest payments has been used, in addition to the following control variables: the unemployment rate indicating the relative power of firms in the distribution struggle with laborers; inflation indicating exogenous price shocks; the growth rate of real net domestic income as an indicator for demand.⁴⁶

The following two challenges which the author faced in refining the data are worth being noted: First, our econometric model applies to non-financial non-residential private businesses. However, the data set used is not fully consistently based on this sector. Data on the adjusted net profit share is only available for the total economy, net capital stock data only for the entire business sector. Since the systems of national accounting changed several times in the time period considered, for Germany a fully consistent sectoral demarcation is not possible. However, since time series based on different accounting standards overlap, deviations between accounting regimes have been corrected for. Second, data on the net stock of capital is used in our analysis which recently ceased to be published by the OECD. Its quality might be low. However, this is certainly not true for the US, where OECD data has been taken from national accounts. For Germany, the OECD used to estimate a gross capital stock. Comparing this data with AMECO data provided by the European Commission and with data from the Statistisches Bundesamt Deutschland offers a surprising result: The capital stock data seems to be net, not gross as is indicated

⁴⁶Marterbauer and Walterskirchen (2002) used GDP growth, the unemployment rate, inflation and the real long-term interest rate as regressors for the estimation of the determinants of the adjusted wage share in Austria, Germany and several other European countries. Argitis and Pitelis (2001) estimated an *industrial profit share* and used the nominal lending interest rate, money wages, the unemployment rate and a measure of strike intensity as regressors.

by the OECD (Schreyer and Webb 2006).⁴⁷

4.2 Stylized facts

In order to facilitate the interpretation of our estimation results it is useful to identify general trends of some basic indicators of the US-American and the German economy. For the period from 1960 to 2007, table 3 displays the development of the growth rate of the net capital stock, of the growth rate of net domestic income, of the rate of capacity utilization defined as net domestic income related to the net capital stock, of the adjusted net profit share, of the debt-capital ratio, of the short- and long-term real interest rate, and of the interest payments related to the net capital stock from 1960 to 2007. All variables have been averaged over the total period under consideration, over each sub-period, and over each business cycle.⁴⁸

In the USA and in Germany, accumulation displays a decreasing trend since the 1960s. In the second sub-period accumulation was significantly lower than in the first one in both countries. The recessions in the early 1980s sustainably impeded subsequent accumulation. While the USA managed to increase accumulation during the 1990s, Germany faced a dramatic decline in accumulation rates throughout the 1990s and early 2000s.

Economic growth shows a similar pattern. In Germany, high growth rates persisted until the mid 1970s and were followed by an economic downturn and stagnating economic growth. This is also true for the rate of capacity utilization relating output to the capital stock, which shows a falling trend throughout the entire time period. In the US, growth rates decreased enormously in the late 1970s/early 1980s, recovered during the 1980s and 1990s and decreased again in the current business cycle. The boom in the 1980s and 1990s has been pronounced and accounts for the high average level of economic growth

⁴⁷Comparing the growth rate of the OECD's capital stock with net investment including dwellings (AMECO) over the OECD's capital stock yields an almost identical curve. This does not hold, if we compare the growth rate of the OECD's capital stock with gross investment including dwellings (AMECO) over the OECD's capital stock, nor if we compare it with private non-residential capital formation (OECD EOL 78) over the OECD's capital stock. However, comparing the growth rate of the OECD's capital stock to the growth rate of the net capital stock measured by the Statistisches Bundesamt Deutschland, again, yields a similar curve. In short, there is strong evidence suggesting that the OECD's estimations of the German capital stock should be interpreted as net values, rather than as gross values.

⁴⁸A local minimum of the growth rate of net domestic income designates the end of a business cycle.

Table 3: *Averages of accumulation, growth, distribution, debts, interest rates, and interest payments over the total period, sub-periods, and business cycles (in percent)*

USA	Total period	Sub-periods		Business cycles					
	1960-2007	1960-1982	1983-2007	1960-1970	1971-1974	1975-1982	1983-1991	1992-2001	2002-2007 ^(vi)
$g^{(i)}$	3.41	4.14	2.77	4.43	4.33	3.68	2.88	3.01	2.23
$\dot{y}^{(i)}$	3.27	3.26	3.29	4.22	3.33	2.03	3.63	3.31	2.74
u	83.30	86.57	80.28	91.31	86.31	80.19	78.02	81.27	82.04
h	22.14	21.47	22.75	22.55	20.74	20.61	21.96	23.03	23.47
$\lambda^{(iv)}$	14.85	13.88	15.79	11.64	14.09	17.27	21.03	16.02	5.89
$i_s^{(i)}$	2.92	2.75	3.07	2.96	2.20	2.76	4.86	3.04	0.45
$i^{(i)}$	3.18	1.96	4.26	2.26	0.70	2.22	5.97	4.18	1.81
$\frac{Z^p}{pK}^{(iv)}$	3.23	2.65	3.79	2.15	3.01	3.16	4.13	3.68	3.38
Germany	Total period	Sub-periods		Business cycles					
	1960-2007	1960-82	1983-2007	1960-1967	1968-1975	1976-1982	1983-1993	1994-2003	2004-2007 ^(vi)
$g^{(i)}$	4.08	6.15	2.25	8.95	5.84	3.71	3.17	1.71	1.09
$\dot{y}^{(i)(v)}$	2.55	3.08	2.09	3.36	3.60	2.19	2.63	1.54	2.01
u	53.12	61.65	45.28	74.61	58.22	50.75	46.17	44.58	44.59
h	20.58	20.75	20.42	23.48	20.52	17.87	20.43	19.71	22.20
$\lambda^{(ii)(iii)}$	32.75	43.55	24.30	41.63	44.68	43.08	33.07	19.77	-1.31
$i_s^{(i)(v)}$	2.52	1.91	3.06	1.10	1.65	3.01	3.72	2.83	1.85
$i^{(i)(v)}$	3.79	3.28	4.24	3.20	2.69	4.03	4.58	4.45	2.78
$\frac{Z^p}{pK}$	0.88	0.97	0.80	0.83	1.04	1.06	0.87	0.80	0.60

Notes: g , growth rate of the real net capital stock; $\dot{y}$, growth rate of real net domestic income; u , rate of capacity utilization; h , adjusted net profit share; λ , debt-capital ratio; i_s , real short-term interest rate; i , real long-term interest rate on government bonds; $\frac{Z^p}{pK}$, net interest payments of non-financial private businesses related to the nominal net capital stock; For a description of the data set and its sources, see table A1.

⁽ⁱ⁾ beginning from 1961

⁽ⁱⁱ⁾ beginning from 1965

⁽ⁱⁱⁱ⁾ until 2005

^(iv) until 2006

^(v) German unification in 1992

^(vi) not an entire business cycle

which we observe in the US for the second sub-period. On average, capacity utilization decreased significantly from the first to the second sub-period.⁴⁹

Until the early 1980s, both the US and Germany faced a redistribution of income from profits to wages, i.e. decreasing profit shares. Since the 1980s, profit shares display an increasing trend, which is especially pronounced in the US. Thus the US profit share was higher in the first half of the time period than in the second. For Germany, this does not hold as the profit share in the 1960s was extraordinarily high.

In the US-economy, net interest payments as a share of the capital stock increased permanently until the early 1990s and decreased thereafter. In Germany, the development of interest payments takes a similar course, with the peak in the 1976 to 1982 cycle.⁵⁰ Although the trend is similar in both countries, the US rate of net interest payments increased from the first to the second sub-period, whereas the German rate decreased. Two causes for the specific pattern of the rate of net interest payments can be identified: the development of the interest rates and of the debt-capital ratios, which, taken together, constitutes the rate of interest payments.

In Germany, both the short and the long-term real interest rates show an increasing trend until the early 1990s followed by decreasing interest rates thereafter. In the US, interest rates were stagnating until the early 1980s, when they increased tremendously. After that, interest rates decreased slowly. In the current business cycle the US-monetary authority decreased interest rates enormously. In the US and in Germany, both short- and long-term real interest rates are significantly lower in the first sub-period than in the second one. For both the US and Germany, we observe increasing debt-capital ratios in the first half of the time period considered and tremendously decreasing ratios in the second half. Taking a closer look on the data, it can be seen that the latter is caused by an enormous boost in financial accumulation beginning in the 1990s, which reduces the net indebtedness of non-financial firms.⁵¹ The development of the interest rates and of

⁴⁹The difference between the US-American and the German rate of capacity utilization is partly caused by the OECD's inconsistent methods of measuring the capital stocks of the respective countries.

⁵⁰The difference between the US-American and the German rate of interest payments partly originates from the utilization of different databases. For a detailed description of the data used, see table A1.

⁵¹As has been noted earlier, the decline in firms' net indebtedness has to be interpreted with caution as it does not depict the firms' debt burden adequately. Financial assets do not fully compensate for liabilities since they usually do not yield as much interest as has to be paid on debt.

the debt-capital ratio can explain a big part of the concave form of the trend of the rate of interest payments.

From the analysis of the economic indicators, several preliminary results can be extracted: First, an increasing profit share in the aftermath of the recession in the early 1980s is accompanied by declining economic dynamics. This is especially true for Germany, where both accumulation and economic growth show falling trends. In the US this relationship is perceptible, but weak. Second, in the US we observe a diametrically opposed development of the rate of net interest payments and of the accumulation rate. While accumulation gradually declines until the early 1990s, interest payments rise. A slight reduction of these payments in the 1990s is accompanied by an increase in accumulation. In Germany such a negative relationship can be observed until the early 1980s. Afterwards, both interest payments and accumulation decline on average. Third, the increases in the interest rates come along with decreasing accumulation and growth in both countries in the 1980s and 1990s. However, declining interest rates in the current business cycle have not been able to boost the economic performance in any of the two countries. Fourth, no clear relationship between the profit share and the rate of net interest payments can be observed. Fifth, from the development of the interest rates, of the debt-capital ratio and of the rate of interest payments we can infer the following: The influence of monetary policy on the investment behavior of firms increased until the 1980s (Germany) and 1990s (USA), respectively, and decreased thereafter. This is indicated by the debt-capital ratio. In the first half of the period analyzed, it gradually increased implying rising net indebtedness of firms which made them increasingly vulnerable to rising interest rates. Decreasing net debts of firms which characterized the second part of the period indicate a lower sensitivity of investment to variations in the interest rates.

Our findings confirm a conventional classification in literature (cf. Boyer 2000a, Stockhammer 2005-06 and van Treeck 2008), which distinguishes three historical regimes of accumulation: first, the *Fordist accumulation regime* from the 1960s to the mid 1970s characterized by high accumulation and growth, by an anxious redistribution of income in favor of labor and low real interest rates; second, the *period of crisis* from the mid 1970s to the mid 1980s with a sharp downturn in capital stock and output growth and

high inflation; third, the *finance-led accumulation regime* prevailing since the mid 1980s and characterized by a stabilization of capital stock and output growth, by a redistribution of income in favor of capitalists and rentiers and by an increasing engagement of non-financial business in financial accumulation.

4.3 Estimation results

This section presents our results of estimating the coefficients of the accumulation function, savings function and profit share function, which put together enables us to draw conclusions about the type of demand, accumulation and profit regimes the US and Germany have been confronted with on average from 1960 to 2007.

At this point, a few remarks on the econometric methods applied are required. It is common knowledge in modern time series analysis that the OLS estimator will be biased if the regressors exhibit a unit root (cf. Granger and Newbold 1974). By differentiation of non-stationary variables, the consistency of the OLS estimations can be reestablished. By this modification of the time series, however, some information regarding the long-run relationship between variables will get lost. The modern error correction approach allows to consistently model the long-run relationship of economic variables as well as the short-run dynamics of these variables as long as two conditions are fulfilled: First, a cointegrated relationship between the variables of interest has to exist. That is, a linear combination of these variables must be stationary. Second, traditional cointegration literature requires that all variables considered must be integrated of the same order. This condition has been softened by new bound testing approaches by, amongst others, Pesaran et al. (2001). (Cf. Hamilton 1994 and Charemza and Deadman 1997)

Since the Johansen test (cf. Johansen 1988 and Johansen and Juselius 1990) indicates the existence of up to three cointegration vectors for each function we want to model, we tried to estimate error correction models for accumulation, savings and the profit share both for the US and for Germany.⁵² We followed the bounds testing approach by Pesaran et al. (2001), according to which level relationships between variables can be consistently

⁵²The results of the Johansen tests are presented in Tables A2, A3 and A4.

modeled, although the respective variables are not integrated of the same order. However, due to several reasons, we did not pursue the error correction approach any further in this paper: First, the results derived from the error correction models were insignificant and not satisfying, especially not for Germany. Second, the Engle and Granger (1987) test procedure falsifies the hypothesis of a cointegrated relationship including all relevant variables for all functions analyzed.⁵³ Third, in each behavioral equation, there exist essential variables which do not exhibit a unit root. Thus a precondition for error correction modeling is not fulfilled according to traditional cointegration literature (cf. Hamilton 1994, pp. 635-640). Fourth, the Johansen tests most likely have indicated cointegration only for subsets of the variables considered, as the Engle and Granger test did not confirm the results in the majority of cases. Fifth, our sample with less than 50 observations is not big enough for doing reliable error correction analysis.

Simple autoregressive distributed lag (ADL) modeling with OLS-regressions in first differences was chosen as the main estimation strategy.⁵⁴ Following the general to specific approach (Charemza and Deadman 1997), we started from a general model including a bulk of variables and lags and gradually reduced its size by dropping the most insignificant ones until only significant regressors remained.

If not noted otherwise, all regression results presented in this section passed the White (1980) test for heteroscedasticity, the Ramsey (1969) RESET specification test, the CUSUM parameter stability test, the Doornik and Hansen (2008) test for normality of the residuals and the Breusch (1978)-Godfrey (1978) LM tests for autocorrelation up to order 1, 2 and 3, each at least at the 10% significance level. For reference, these tests are presented in table A7. Since the time period under consideration covers more than 45 years, tests for structural breaks in the regressions were also required. As presented in table A8, Chow (1960) breakpoint tests do not provide any significant evidence for structural breaks in 1982.⁵⁵ All estimations and tests have been performed with *Gretl*.

⁵³Table A6 illustrates the test statistics of the ADF test on the residuals of the cointegrating regressions. They fail to reject the null of a unit root in the residuals for any behavioral equation considered at least at the 5% significance level, which provides some statistical evidence that, in most instances, there are no cointegrated relationships in the functions including all relevant variables.

⁵⁴Almost all variables in levels exhibit a unit root, as is suggested by Augmented Dicky-Fuller tests illustrated in table A5.

⁵⁵1982 has been chosen as the potential break in the sample due to three reasons: First, it is close

Contrary to Hein and Ochsens (2003), we estimated the model parameters only for the entire time period under consideration and not for sub-periods, since a lack of observations would question the explanatory power of these results. Nevertheless, we can also draw some conclusions on the development of the accumulation regimes through time by applying the estimated model parameters to sub-periods and business cycles.

Investment function

For the US and for Germany, we estimated the investment function given in equation (10) in first differences and including three lags of each variable,

$$\begin{aligned}\Delta g_t = & \beta_0 + \sum_{j=0}^3 \beta_{1j}(u - u_n)_{t-j} + \sum_{j=0}^3 \beta_{2j}\Delta h_{t-j} + \sum_{j=0}^3 \beta_{3j}\Delta\left(\frac{Z^p}{pK}\right)_{t-j} \\ & + \sum_{j=0}^3 \beta_{4j}\Delta\left(\frac{D^p}{pK}\right)_{t-j} + \sum_{j=1}^3 \beta_{5j}\Delta g_{t-j} + e_t\end{aligned}\quad (21)$$

Accumulation (g_t) is measured by the growth rate of the net capital stock and it is explained by autonomous accumulation (α), by the deviation of capacity utilization from its normal rate ($(u - u_n)_t$), by the adjusted net profit share (h_t), by net interest ($(\frac{D^p}{pK})_t$) and dividend payments ($(\frac{D^p}{pK})_t$) and by an error term (e_t). Aside from the profit share, all variables are normalized by the capital stock. As may be noticed, the rate of interest is not explicitly considered in the investment function. It is part of the rate of interest payments that also takes into account the indebtedness of firms. Assuming that the rate of interest multiplied by the net debt-capital ratio (λ_t) does not deviate too much from the rate of net interest payments ($(\frac{Z^p}{pK})_t$), we can interpret $\theta_i \lambda_t$ as the marginal effect of variations in the interest rate on investment. As we are not interested in the impacts of the shareholder value orientation on investment decisions, the rate of net dividend payments ($(\frac{D^p}{pK})_t$) is only considered a control variable.⁵⁶

to the middle of the period considered. Second, in 1982, both countries faced recessions designating the transition from one business cycle to another. Third, as has been argued by, amongst others, Lipietz (1997) and Boyer (2000b), Keynesianism has been replaced by Monetarism as the leading paradigm in economic policy in the late 1970s/early 1980s. Beginning in that time, the German and the US-American monetary policy has been perceptibly imprinted by Monetarist ideology (cf. Bernanke and Mishkin 1992 and Arestis and Chortareas 2006, pp. 380-4)

⁵⁶Dummies have been included for years in which the residuals displayed significant spikes.

Table 4: *OLS-regression results for equation (21): investment function*

	USA		Germany	
Constant	0.00	(-0.81)	0.00*** ⁽ⁱ⁾	(-5.82)
$(u - u_n)_t$	0.30***	(8.70)	0.40***	(9.90)
$(u - u_n)_{t-1}$	-0.18***	(-3.01)		
$(u - u_n)_{t-2}$	-0.14**	(-2.29)	-0.25***	(-5.15)
$(u - u_n)_{t-3}$	0.13***	(3.23)		
Δh_t			0.14***	(3.51)
Δh_{t-1}			0.08*	(1.71)
Δh_{t-3}	0.10*	(1.90)	0.12***	(3.38)
$\Delta(\frac{Z^p}{pK})_t$			-1.03**	(-2.53)
$\Delta(\frac{Z^p}{pK})_{t-3}$	-0.52**	(-2.41)		
$\Delta(\frac{D^p}{pK})_t$			-0.27***	(2.76)
$\Delta(\frac{D^p}{pK})_{t-2}$			0.27**	(2.52)
$\Delta(\frac{D^p}{pK})_{t-3}$			0.25**	(2.47)
Δg_{t-1}	0.53***	(3.94)		
Δg_{t-2}	-0.25*	(2.89)		
<i>dum75</i>	—		0.01***	(3.18)
<i>dum81</i>	0.01***	(2.89)	—	
<i>dum93</i>	—		0.01***	(3.95)
<i>dum07</i>	—		-0.01**	(-2.33)
Dependent variable	Δg_t		Δg_t	
Period	1965-2006		1965-2007	
Observations	42		43	
R-squared	0.88		0.87	
Adj. R-squared	0.84		0.81	

Notes: g , $u - u_n$, h , $\frac{Z^p}{pK}$, and $\frac{D^p}{pK}$ denote the rate of accumulation, the deviation of the rate of capacity utilization from its normal value, the adjusted net profit share, the rate of net interest payments and the rate of net dividend payments, respectively. *dum75*, *dum81*, *dum93*, and *dum07* are dummies for the years 1975, 1981, 1993, and 2007, respectively. Numbers in parenthesis are t-values. *, **, and *** denote the significance level at 10%, 5%, and 1%, respectively. For a description of the data set and its sources, see table A1.

⁽ⁱ⁾ Coefficient has been rounded off to 0, although it is significantly different from 0.

Table 5: *The long-run determinants of the accumulation rate*

Investment function:		
$g^I = \alpha + \beta(u - u_n) + \tau h + \theta_i \frac{Z^p}{pK} + \theta_d \frac{D^p}{pK}$		
	USA	Germany
<i>Constant</i>	0.00	0.00
$(u - u_n)$	0.14	0.15
h	0.14	0.33
$\frac{Z^p}{pK}$	-0.72	-1.03
$\frac{D^p}{pK}$	0.00	0.00 ⁽ⁱ⁾

Notes: g , $u - u_n$, h , $\frac{Z^p}{pK}$, and $\frac{D^p}{pK}$ are the rate of accumulation, the deviation of the rate of capacity utilization from its normal value, the adjusted net profit share, the rate of net interest payments, and the rate of net dividend payments, respectively. α represents autonomous investment and β , τ , θ_i , and θ_d denote the long-run coefficients of the explanatory variables. All values have been derived from the coefficients of the estimated accumulation function presented in table 4. For a further discussion of the data set and its sources, see table A1.

⁽ⁱ⁾ The Wald (1943) test does not allow to reject the null hypothesis that the sum of the coefficients of the significant lags is different from 0 at the 10% significance level.

The OLS-regression results of the investment function are summarized in table 4. Following the general to specific method, we started with regressions of the comprehensive model and gradually reduced the regressors by dropping the most insignificant one and re-estimating the model. This was repeated until all remaining regressors were significant within the 10% level. Although being insignificant, the constant was not dropped in order to prevent other regressors from picking up its influence on the endogenous variable. To the author, it seemed reasonable to include three lags of each exogenous variable, since investments might take some years to be carried out. Because of autocorrelation problems, we also included lags one to three of the endogenous variable to our initial model.

In order to allow for an interpretation of the estimation results, the long-run influences of capacity utilization, of the profit share, of net interest and of net dividend payments on accumulation have to be calculated. The long-run relationships between the endogenous and the various explanatory variables are presented in table 5.⁵⁷ Except from the rate

⁵⁷The long-run effect of an explanatory variable x with N lags and significant coefficients $\beta_1, \beta_2, \dots, \beta_N$ on an endogenous variable y with M lags and significant coefficients $\gamma_1, \gamma_2, \dots, \gamma_M$ is given by $\frac{\sum_{i=1}^N \beta_i}{1 - \sum_{i=1}^M \gamma_i}$.

of net dividend payments, which does not offer significant coefficients in any of the two countries, all variables show the expected signs. At the sample mean, we find a marginal reaction of accumulation to a 1%-point change in capacity utilization of 0.14 for the US and of 0.15 for Germany. The profit share has also positive impacts on accumulation in both countries. In the US, a 1%-point increase of the profit share raises the rate of accumulation by 0.14%-points, which is equal to the marginal effect of the utilization rate. In Germany, the marginal effect of the profit share is 0.33 on average, which is considerably higher than the marginal effect of the utilization rate. Both in the US and in Germany, the rate of net interest payments has a considerable impact on the rate of accumulation with marginal effects of -0.72 and -1.03, respectively. Net dividend payments do not play a significant role on average.

Our findings are basically in line with recent literature. Hein and Ochsén (2003) estimate the coefficients of capacity utilization approximated by the growth rate of real GDP and of the adjusted net profit share in a simple partial adjustment model of accumulation including an AR(1) process. For the US and for Germany from the early 1960s to the early 1990s, they find coefficients of 0.11 and 0.10, respectively, for the influence of utilization on investment, which is very similar to our findings. However, they do not find a significant role of the profit share in any of the two countries, which contradicts our results.

For several OECD countries, Hein and Vogel (2008) estimate logarithmized investment as a function of, amongst others, logarithmized real GDP and of the adjusted profit share in first differences. For the period from 1960 to 2005, they get extraordinarily large elasticities for the accelerator term (US: 2.42 and Germany: 1.61) and *negative* but insignificant ones for the profit share. However, there are severe endogeneity problems in the specification of the investment function, as current investment is an immediate component of current GDP, which has been used as a regressor. Thus, the accelerator effect is likely to be overstated.

Naastepad and Storm (2006-07) estimate the logarithmized investment share as a

This long-run effect is significantly different from 0, if the Wald (1943) test allows to reject the null hypothesis of $\sum_{i=1}^N \beta_i = 0$ at least at the 10% significance level.

function of the profit share and of real GDP, both variables entering the model in lagged logs. Regressions were run in levels for some OECD countries from 1960 to 2000. AR processes have been included. For the US and for Germany, they find marginal GDP-effects on investment of 0.12 and 0.27, respectively. This is highly consistent with our results. The influence of the profit share, which they have quantified with 0.48 and 0.56, respectively, is slightly higher than in our estimations.

Savings function

In our post-Kaleckian growth model, savings consist of two parts: firms' and households' savings. Retained earnings are saved by definition. Hence, we focus on the determinants of private households' savings. In order to quantify the effects of income redistribution on consumption demand, the propensities to save out of wage and net interest and dividend income have to be determined. Savings accrue from different types of income. According to post-Keynesian theory, labor income is associated with a lower savings rate than capital income (cf. Kaldor 1966). This assumption shall be verified and quantified empirically.

For both the US and Germany, the savings functions have been estimated for the period from 1961 to 2007. For the US, we estimated the following model in first differences applying the general to specific estimation strategy:

$$\begin{aligned}
\Delta\left(\frac{S^H}{pK}\right)_t &= \beta_0 + \sum_{j=0}^2 \beta_{1j} \Delta\left(\frac{W}{pK}\right)_{t-j} + \sum_{j=0}^2 \beta_{2j} \Delta\left(\frac{Z^i + D^i}{pK}\right)_{t-j} + \sum_{j=0}^2 \beta_{3j} \Delta\left(\frac{P}{pK}\right)_{t-j} \\
&+ \sum_{j=0}^2 \beta_{4j} \Delta\left(\frac{R}{pK}\right)_{t-j} + \sum_{j=0}^2 \beta_{5j} \Delta\left(\frac{T^i}{pK}\right)_{t-j} + \sum_{j=0}^2 \beta_{6j} \Delta\left(\frac{T^p}{pK}\right)_{t-j} \\
&+ \sum_{j=1}^2 \beta_{7j} \Delta\left(\frac{S^H}{pK}\right)_{t-j} + \beta_8 \psi_t + e_t
\end{aligned} \tag{22}$$

Total savings of private households $((\frac{S^H}{pK})_t)$ are mainly generated by savings out of compensation of employees $((\frac{W}{pK})_t)$, out of net interest and dividend income $((\frac{Z^i + D^i}{pK})_t)$, out of proprietors' income $((\frac{P}{pK})_t)$, out of personal rental income $((\frac{R}{pK})_t)$ and out of transfer income $((\frac{T^p}{pK})_t)$. Since all of these types of income are gross values, the amount of tax

and transfer payments $((\frac{T^i}{pK})_t)$ may also influence households' savings.⁵⁸ We are only interested in the marginal effect of variations in the wage and rentiers' income, captured by β_{1j} and β_{2j} ($j = 1, 2$), respectively. All other variables are perceived as control variables. In order to estimate coefficients that are consistent with our theoretical model, we normalized all variables to the capital stock. A deterministic time trend ($\beta_8\psi_t$) has been added to the model in order to account for a linear, non-stochastic change in the savings behavior of private households. The regression results are to be found in table 6.

For Germany, the regression analysis in first differences did not offer significant results. Hence, we followed the partial adjustment modeling approach by Hein and Ochsén (2003) who estimated their savings function in levels, included a deterministic time trend as well as a first-order autoregressive process to their OLS-regressions and applied Newey and West (1987) t-statistics that are ascribed to cope with remaining autocorrelation and heteroscedasticity problems (Davidson and MacKinnon 1993).⁵⁹ We estimated the following savings function, eliminated insignificant variables and reestimated the function until merely significant regressors were left:

$$\left(\frac{S^H}{pK}\right)_t = \beta_1\left(\frac{W}{pK}\right)_t + \beta_2\left(\frac{Z^i + D^i}{pK}\right)_t + \beta_3\left(\frac{P}{pK}\right)_t + \beta_4\psi_t + \beta_5e_{t-1} + \epsilon_t \quad (23)$$

The savings of private households related to the capital stock $((\frac{S^H}{pK})_t)$ are explained by the compensation of employees $((\frac{W}{pK})_t)$, by the net interest and dividend income $((\frac{Z^i + D^i}{pK})_t)$, and by the proprietors' income $((\frac{P}{pK})_t)$, each related to the capital stock. β_1 , β_2 , and β_3 measure the propensity to save out of labor, out of rentiers', and out of proprietors' income, respectively. $\beta_4\psi_t$ and $\beta_5e_{t-1} + \epsilon_t$ capture the deterministic time trend and the stochastic first-order autoregressive process, respectively.⁶⁰ The regression results for Germany are also presented in table 6.

From the short-run coefficients of the households' savings function, we can again derive

⁵⁸For a detailed description of the underlying data set and its sources, see table A1.

⁵⁹After the deterministic time trend and the first-order autoregressive process have been added to the model, non-stationarity of the error terms was not a problem anymore. This is confirmed by the Augmented Dickey-Fuller test on a unit root in the error term which yields a test-statistic of -7.06, allowing to reject the null of a unit root within the 1% significance level.

⁶⁰The first-order autoregressive process is implied by the condition that $e_t = \beta_5e_{t-1} + \epsilon_t$.

Table 6: *OLS-regression results for equations (22) and (23): households' savings function*

USA		Germany	
Constant	0.00*** ⁽ⁱ⁾ (-0.15)		
		$\left(\frac{W}{pK}\right)_t$	0.13*** (19.11)
$\Delta\left(\frac{W}{pK}\right)_{t-1}$	0.11** (2.08)		
$\Delta\left(\frac{Z^i+D^i}{pK}\right)_t$	0.99*** (5.31)	$\left(\frac{Z^i+D^i}{pK}\right)_t$	0.60*** (3.95)
$\Delta\left(\frac{P}{pK}\right)_t$	0.47** (2.26)		
$\Delta\left(\frac{R}{pK}\right)_t$	0.85* (1.93)		
$\Delta\left(\frac{R}{pK}\right)_{t-1}$	-0.94** (-2.18)		
$\Delta\left(\frac{T^i}{pK}\right)_t$	0.79*** (3.03)		
$\Delta\left(\frac{T^p}{pK}\right)_t$	-0.48*** (-4.18)		
$\Delta\left(\frac{S^H}{pK}\right)_{t-1}$	-0.31*** (-2.91)		
ψ_t	0.00*** ⁽ⁱ⁾ (-3.34)	ψ_t	0.00*** ⁽ⁱ⁾ (-6.14)
		e_{t-1}	0.77*** (9.54)
Dependent variable	$\Delta\left(\frac{S^H}{pK}\right)_t$	Dependent variable	$\left(\frac{S^H}{pK}\right)_t$
Period	1963-2007	Period	1961-2007
Observations	45	Observations	47
R-squared	0.66	R-squared	0.996
Adj. R-squared	0.57	Adj. R-squared	0.996
		DW	1.94
		White	28.89***
		CUSUM	-1.85**

Notes: $\frac{S^H}{pK}$, $\frac{W}{pK}$, $\frac{Z^i+D^i}{pK}$, $\frac{P}{pK}$, $\frac{R}{pK}$, $\frac{T^i}{pK}$, $\frac{T^p}{pK}$, ψ , and e denote the rate of households' savings, the rate of households' wage income, the rate of households' net interest and dividend income, the rate of proprietors' income, the rate of rental income, the rate of households' transfer income, the rate of households' transfer payments, the time factor, and the residuals, respectively. Numbers in parenthesis are t-values. For Germany, Newey and West (1987) t-statistics have been applied. *, **, and *** denote the significance level at 10%, 5%, and 1%, respectively. *DW* is the Durbin-Watson statistic. *White* is the White (1980) test for heteroscedasticity with the null of no heteroscedasticity. *CUSUM* is the CUSUM test for parameter stability with the null of no changes in parameters. For a description of the data set and its sources, see table A1.

⁽ⁱ⁾ Coefficient has been rounded off to 0, although it is significantly different from 0.

Table 7: *The long-run determinants of the households' savings rate*

Households' savings function:		
$\frac{S^H}{pK} = s_0 + s_W \frac{W}{pK} + s_Z \frac{Z^i + D^i}{pK} + s_P \frac{P}{pK} + s_R \frac{R}{pK} + s_{T^i} \frac{T^i}{pK} + s_{T^p} \frac{T^p}{pK}$		
	USA	Germany
<i>Constant</i>	0.00	—
$\frac{W}{pK}$	0.09	0.13
$\frac{Z^i + D^i}{pK}$	0.76	0.60
$\frac{P}{pK}$	0.36	0.00
$\frac{R}{pK}$	0.00 ⁽ⁱ⁾	—
$\frac{T^i}{pK}$	0.60	—
$\frac{T^p}{pK}$	-0.37	—

Notes: $\frac{S^H}{pK}$, $\frac{W}{pK}$, $\frac{Z^i + D^i}{pK}$, $\frac{P}{pK}$, $\frac{R}{pK}$, $\frac{T^i}{pK}$, and $\frac{T^p}{pK}$ are the households' savings rate, the rate of households' wage income, the rate of households' net interest and dividend income, the rate of households' proprietors' income, the rate of households' rental income, the rate of households' transfer income, and the rate of households' transfer payments, respectively. s_W , s_Z , s_P , s_R , and s_{T^i} denote the marginal propensities to save out of wage, rentiers', proprietors', rental, and transfer income, respectively. s_{T^p} denotes the marginal reaction of the savings rate to a one unit change in the rate of transfer payments. All values have been derived from the coefficients of the estimated savings function presented in table 6. For a further discussion of the data set and its sources, see table A1.

⁽ⁱ⁾ The Wald (1943) test does not allow to reject the null hypothesis that the sum of the coefficients of the significant lags is different from 0 at the 10% significance level.

the long-run determinants. The marginal effects of the various types of income on savings are reported in table 7. Regarding the influence of the rate of labor and rentiers' income, we get univocal results for both the US and Germany. At the sample mean, the marginal propensity to save out of wage income is 0.09 in the US and 0.13 in Germany, whereas the marginal propensities to save out of rentiers' income are 0.76 and 0.60, respectively. As expected, the savings rate out of rentiers' income is considerably higher than out of labor income. Hence, Kaldor's (1966) proposition of a lower savings rate out of labor income than out of profit income and one essential assumption of our Kaleckian growth model can be confirmed empirically. While the rate of proprietors' income does not contribute to explaining households' savings in Germany, the marginal propensity to save out of proprietors' income is 0.36 in the US. The rate of rental income is not significant in either country. The marginal effect of transfer income (0.60) is surprisingly high in the US. The long-term coefficient of transfer payments exhibits the expected sign: A 1%-point increase in the rate of transfer payments implies a reduction of the rate of savings of 0.37%-points. For Germany, the quality of the estimation may be low, as the CUSUM test suggests low parameter stability.⁶¹ However, the result of a low savings propensity associated with labor income and of a high one associated with rentiers' income seems to be robust.

Comparing our coefficients of the savings function with recent literature, our propensities to save out of wage income are confirmed by most of the other estimations, whereas our propensities to save out of rentiers' income are higher than the conventional propensities to save out of profit income, which are usually estimated in the literature.

Hein and Ochsen (2003) estimate the savings rate of private households as a function of the rate of wage income and of the rate of an artificially constructed rentiers' income. An AR(1) process has been added to the model. They do not find significant propensities to save out of wage income, neither for the US nor for Germany. Moreover, their propensities to save out of rentiers' income exceed unity with values of 1.11 and 1.39, respectively. These unrealistic coefficients are certainly due to their somewhat adventurous construction of the rentiers' income. They simply multiply the nominal net capital stock with the

⁶¹Heteroscedasticity does not bother us since this is corrected for by Newey and West (1987) t-statistics applied in the regression.

nominal long-term interest rate.

Hein and Vogel (2008) estimate logarithmized consumption of the total economy as a function of, amongst others, logarithmized wages and profits. For the US, they derive coefficients which are equivalent to the following elasticities of total savings: 0.58 with respect to wage income and 0.83 with respect to profit income. The respective values for Germany were 0.47 and 0.88. These elasticities are not comparable to our marginal effects.⁶² Nevertheless, Hein and Vogel's (2008) savings differentials are significantly lower than they are in our estimations. This may have various reasons: First, it could be founded in our assumption of no consumption out of retained earnings. Although we explicitly take into account savings out of proprietors' and rental income, there may be consumption out of other parts of retained profits which we do not account for. Second, a low propensity to save out of proprietors' income, which is confirmed by our estimation of the US savings function, given a high share of this type of income in total profits, could be a reason for the low propensity to save out of total profits identified by Hein and Vogel (2008). Third, they use the adjusted *gross* profit share which does not account for the depreciation of tangible assets. Thus, the data basis which we applied is more accurate.

Naastepad and Storm (2006-07) estimate the savings share as a function of the profit share for some OECD countries from 1960 to 2000. For the US and for Germany, they find an average marginal propensity to save out of wage income of 0.12 and 0.09, respectively, which is very similar to our results. The coefficients describing the savings differentials, however, imply marginal propensities to save out of profit income of 0.34 and 0.48, respectively, which is significantly lower than our propensities to save out of net rentiers' income. Again, the smaller savings differential may be due to the different specification of the savings function. Besides retained earnings and rentiers' income, profits may include other types of income which are associated with high consumption and reduce the average propensity to save out of profit income.

⁶²Since we have calculated the long-run coefficients of the savings function, we cannot convert our marginal effect into meaningful elasticities either.

Profit share function

In order to find the marginal effect of a change in the rate of interest payments on the profit share, we had to estimate the latter's determinants. Functional income distribution is hard to explain theoretically, since political and institutional settings that may change over time play an important role. Several factors potentially influencing the profit share can be identified: As we have argued in the theoretical model, firms' will increase the mark-up and, hence, the profit share, if they are urged to remit higher *interest payments* to the rentiers. Moreover, a rise in *unemployment* will strengthen the bargaining power of firms against laborers. As Kalecki's (1971) degree of monopoly will increase, firms can raise the mark-up on unit labour costs more easily. Two more parameters have to be considered, which are relevant for reality, but go beyond the scope of our simple theoretical model: Exogenous *price shocks* on consumer goods may have ambiguous effects on the profit share. They will increase the profit share as long as wages do not rise accordingly. Since trade unions seek to compensate for losses in the real wage, the profit share might decline, the extent of which depending on the relative power of the unions. *Aggregate demand* may also have positive impacts on the profit share since firms may answer higher demand not only with an increase in output, but also with an increase in prices.⁶³ Moreover, firms might want to accrue higher realized profits in order to finance desired investments internally. Thus, they might increase the mark-up, when capacity utilization and thus the desire to invest is high (cf. Eichner 1973).

In the style of Marterbauer and Walterskirchen (2002) who estimated the wage share for Austria, Germany, and several other European countries including, amongst others, GDP-growth, the unemployment rate, and inflation to the OLS-regressions, we estimated the adjusted net profit share (h_t) as a linear function of the rate of net interest payments ($(\frac{Z^p}{pK})_t$), the rate of unemployment (ur_t), the rate of inflation ($\dot{p}_t$) and eventually of the growth rate of net domestic income ($\dot{y}_t$) representing demand. For both countries, OLS-

⁶³In Kaldor's (1956, 1957 and 1961) growth theory, the profit share increases as a response to a positive demand shock: Provided that the economy operates at full capacity utilization in the long run, an increase in autonomous investment, will raise prices. Given sticky nominal wages, the real wages and the wage share will decline. Hence, the profit share will rise. As the propensity to save out of wage income is lower than out of profit income, total savings will adjust to the initial rise in investment. The adjustment of the functional income distribution thus equilibrates aggregate demand and aggregate supply.

regressions were run for the entire time period considered starting from the following linear model:

$$\begin{aligned}\Delta h_t = & \beta_0 + \sum_{j=1}^2 \beta_{1j} \Delta \left(\frac{Z^p}{pK} \right)_{t-j} + \sum_{j=0}^2 \beta_{2j} \Delta ur_{t-j} + \sum_{j=0}^2 \beta_{2j} \dot{p}_{t-j} \\ & + \sum_{j=0}^2 \beta_{4j} \dot{y}_{t-j} + \sum_{j=1}^2 \beta_{5j} \Delta h_{t-j} + e_t\end{aligned}\quad (24)$$

Apart from one exception, only variables with a unit root entered the model in first differences.⁶⁴ The current lag of the rate of net interest payments was dropped in the model, as we wanted to remove negative first-round effects, which a contractive monetary policy aimed at cooling off the economy might have on the profit share. Again, we followed the general to specific estimation strategy. We started with estimating a comprehensive model with up to two lags for each variable, removed the most insignificant one and re-estimated the model until only significant variables remained. Table 8 reports our regression results.⁶⁵

Table 9 displays the long-run determinants of the profit share which we have found in our estimations. Apart from unemployment in Germany, all exogenous variables contribute significantly to the explanation of the profit shares in both countries. Since we want to put it into our post-Kaleckian growth model, we are particularly interested in the coefficient capturing the marginal responsiveness of the profit share towards variations in the rate of net interest payments, denoted by γ_1 . For both countries, we find a high sensitivity of the profit share with respect to changes in the firms' net interest costs. In the US, a 1%-point increase in the rate of net interest payments raised the profit share by 2.44%-points at the sample mean. In Germany the corresponding effect was 2.16. Thus, the average firm's price setting policy seems to be extraordinarily sensitive towards changes in the firm's debt burden. While, on average, the rate of unemployment did not affect the profit share significantly in Germany, unemployment played a significant role in the

⁶⁴US-inflation has been used in levels although it exhibits a unit root because it is theoretically implausible why growth rates such as the rate of inflation should have a unit root. Moreover, the power of unit root tests is weak, as stochastic processes can be approximated by trend-stationary processes quite well (cf. Christiano and Eichenbaum 1990). Augmented Dickey-Fuller unit root tests on the variables of the profit share function can be found in table A5.

⁶⁵Due to spikes in the residuals, dummies were included in the model.

Table 8: *OLS-regression results for equation (24): profit share function*

	USA		Germany	
Constant	0.01**	(2.35)	0.01***	(6.29)
$\Delta(\frac{Z^p}{pK})_{t-1}$	0.96*	(1.89)	2.16*	(1.77)
Δur_t			-0.53***	(-3.29)
Δur_{t-2}	0.34**	(2.61)	0.39**	(2.29)
$\dot{p}_t$			-0.09*	(-1.70)
$\dot{p}_{t-2}$	-0.10**	(-2.25)		
$\dot{y}_t$	0.24***	(5.80)	0.18***	(3.69)
$\dot{y}_{t-1}$	-0.38***	(-6.30)	-0.39***	(-7.74)
Δh_{t-1}	0.24*	(1.93)	0.27***	(3.10)
Δh_{t-2}	0.37***	(3.66)		
<i>dum89</i>	0.02***	(2.90)	0.02***	3.19
<i>dum91</i>	—		0.01***	(-4.22)
<i>dum98</i>	-0.02***	(-3.18)	—	
<i>dum99</i>	—		-0.02***	(-2.95)
<i>dum00</i>	—		-0.02***	(-3.10)
Dependent variable	Δh_t		Δh_t	
Period	1963-2007		1965-2007	
Observations	45		43	
R-squared	0.74		0.83	
Adj. R-squared	0.67		0.78	

Notes: h , $\frac{Z^p}{pK}$, ur , $\dot{p}$, and $\dot{y}$ denote the adjusted net profit share, the rate of net interest payments, the unemployment rate, the inflation rate, and the growth rate of real net domestic income, respectively. *dum89*, *dum91*, *dum98*, *dum99*, and *dum00* are dummies for the years 1989, 1991, 1998, 1999, and 2000, respectively. Numbers in parenthesis are t-values. *, **, and *** denote the significance level at 10%, 5%, and 1%, respectively. For a description of the data set and its sources, see table A1.

Table 9: *The long-run determinants of the profit share*

Profit share function:		
$h = \gamma_0 + \gamma_1 \frac{Z^p}{pK} + \gamma_2 ur + \gamma_3 \dot{p} + \gamma_4 \dot{y}$		
	USA	Germany
<i>Constant</i>	0.02	0.01
$\frac{Z^p}{pK}$	2.44	2.16
<i>ur</i>	0.86	0.00 ⁽ⁱ⁾
$\dot{p}$	-0.26	-0.09
$\dot{y}$	-0.35	-0.39

Notes: h , $\frac{Z^p}{pK}$, ur , $\dot{p}$, and $\dot{y}$, denote the adjusted net profit share, the rate of net interest payments, the unemployment rate, the inflation rate, and the growth rate of real net domestic income, respectively. β_0 represents the part of the profit share that cannot be explained by the explanatory variables. γ_1 , γ_2 , γ_3 , and γ_4 denote the long-run coefficients of the explanatory variables. All values have been derived from the coefficients of the estimated accumulation function presented in table 8. For a further discussion of the data set and its sources, see table A1.

⁽ⁱ⁾ The Wald (1943) test does not allow to reject the null hypothesis that the sum of the coefficients of the significant lags is different from 0 at the 10% significance level.

US: At the sample mean, the marginal effect of a 1%-point increase in the unemployment rate on the profit share was 0.86 in the US. Inflation affected the profit share negatively in both countries, with average marginal effects of -0.26 in the US and -0.09 in Germany. Hence, on average, trade unions were strong enough to compensate for inflation induced losses in the real wage position of laborers. Surprisingly, demand had negative long-run impacts on the profit share in both countries. The marginal effects were -0.35 in the US and -0.39 in Germany. This puzzling result can be explained by looking at the short-run effects reported in table 8: In compliance with the Kaldor-effect, the profit share increases with current economic growth, as sticky wages do not immediately respond to the rise in prices. In the succeeding year, however, labor unions enforce the adjustment of nominal wages, which reduces the profit share. Since labor unions also attempt to include productivity increases in their wage claims, the overall effect of demand on the profit share can be negative if unions are sufficiently powerful.

Our findings are partly consistent with Marterbauer and Walterskirchen (2002). In

their estimation of the determinants of the German *adjusted wage share* from 1970 to 2000, they find the wage share to be negatively affected by demand and by unemployment with marginal effects of -0.25 and -1.11, respectively, which is not in line with our findings at first sight. However, Marterbauer and Walterskirchen (2002) *only* consider the effects of current demand and of the first lag of unemployment on the wage share. A closer look at table 8 reveals that our short-run coefficient of current demand is 0.18, which is in accordance with Marterbauer and Walterskirchen. Moreover, we find also a significant negative impact of unemployment on the profit share in the second lag, which neutralizes the positive impact of current unemployment and which has not been considered by Marterbauer and Walterskirchen. In compliance with our results, Marterbauer and Walterskirchen (2002) find inflation having a positive impact on the wage share with a coefficient of 0.26. The real long-term interest rate was not significant. The results Marterbauer and Walterskirchen derived for Germany seem to hold for most other countries, they have analyzed.

4.4 Interpretation of the estimation results

In the previous section, we have estimated the coefficients of the investment, savings and profit share functions. Now, we can put them into our Kaleckian growth model in order to determine the US and the German average demand, accumulation, and profit regimes with respect to changes in the interest rate. To achieve this, we have to add not only the estimated coefficients, but also several variables to the model such as the debt-capital ratio, the profit share and the utilization rate. As we are interested both in the entire period under consideration and in sub-periods as well as business cycles, we averaged these variables over the relevant time periods before we included them in the model. This allows us to grasp potential changes in the economic regimes which are based on the intertemporal development of the firm's indebtedness, the profit share or utilization. We may get different regimes for each time period considered. We assume implicitly, that the estimated coefficients are also valid for each sub-period and business cycle. We can identify demand, accumulation and profit regimes for the US and Germany in different

time periods by considering the conditions derived in equations (18) to (20). The stability condition for the goods market equilibrium is fulfilled for both countries and for each of the periods considered in the following, as can be confirmed in table A9.

Total period

As a first step, we derive the demand, accumulation, and profit regimes with respect to variations in the rate of interest for the US and for Germany for the entire time period under consideration, which is from 1960 to 2007. Table 10 reports the overall marginal responses of the equilibrium positions of the rate of capacity utilization, of the accumulation rate, and of the profit rate to a 1%-point increase in the rate of interest, which have been derived theoretically in equations (18) to (20). The primary and secondary effects which constitute the overall effects on the equilibrium positions are also presented in table 10.

Averaging over the entire period from the early 1960s to the mid 2000s, we find that both in the US and in Germany the parameter constellation of the investment, savings and profit share functions was such that increasing interest rates, i.e. contractive monetary policy, had negative impacts on capacity utilization, on capital accumulation and on the profit rate. At the sample mean, a 1%-point increase in the US-interest rate induced marginal long-run reductions of the rate of capacity utilization by 0.69%-points, of the accumulation rate by 0.20%-points, and of the profit rate by 0.11%-points. In Germany, the equilibrium positions of the utilization, accumulation, and profit rates decreased by 1.46, 0.48, and 0.18%-points, respectively, as a marginal long-run reaction to a 1%-point rise of the interest rate. Sticking to the classification of Lavoie (1995) and Hein (2007), these demand, accumulation and profit regimes correspond to the *normal* post-Keynesian case. These results partly confirm the findings of Hein and Ochsen (2003) who also identify a *normal* accumulation regime in Germany from the 1960s to the mid 1990s. For the US, however, they find the endogenous variables not to be sensitive towards interest rate variations.

The contractive effects of restrictive monetary policy on utilization, accumulation and profits in the US as well as in Germany can be explained by primary and secondary

Table 10: *Partial and total effects of interest rate variations on capacity utilization, accumulation, and profits in the US and Germany from 1960 to 2007*

	USA	Germany
$\frac{\partial u^*}{\partial i}$	$-0.47 - 0.22 = -0.69$	$-1.27 - 0.18 = -1.46$
$\frac{\partial g^*}{\partial i}$	$-0.17 - 0.02 = -0.20$	$-0.53 + 0.05 = -0.48$
$\frac{\partial r^*}{\partial i}$	$-0.10 - 0.00 = -0.11$	$-0.26 + 0.09 = -0.18$
where		
$\lambda^{(i)}$	0.15	0.33
h	0.22	0.21
u	0.83	0.53
β	0.14	0.15
τ	0.14	0.33
θ_i	-0.72	-1.03
s_W	0.09	0.13
s_Z	0.76	0.60
γ_1	2.44	2.16

Notes: The conditions for the effects of an increase in the interest rate on capacity utilization, accumulation and profits are derived from equations (18) to (20). All values have been rounded off to two decimal places. λ , h , and u are variables averaged over the entire time period considered and denote the debt-capital ratio, the profit share, and the rate of capacity utilization, respectively. β , τ , θ_i , s_W , s_Z , and γ_1 are the relevant coefficients of the investment, savings, and profit share function, respectively.
⁽ⁱ⁾ Time series from 1965 to 2005 for Germany and from 1960 to 2006 for the US.

effects: High sensitivities of investment towards interest payments (-0.72 and -1.03) and high propensities to save out of rentiers' income (0.76 and 0.60) imply that increasing interest payments induce firms to restrain investment significantly. The funds transferred to the rentiers via increased interest payments are mainly saved and not consumed. Thus, via this primary channel, an increase in the rate of interest mitigates utilization and accumulation in both countries with marginal long-run effects of -0.47 and -0.17 for the US and of -1.27 and -0.53 for Germany. Since capacity utilization decreases in the first round while the profit share is still unchanged, the profit rate has to fall as well. The marginal effects are -0.10 and -0.26 for the US and for Germany, respectively.

As soon as prices adjust to the higher interest costs of firms, the secondary channel via redistribution of income from laborers to firms can be isolated: At the sample mean, US-American and German firms which faced higher interest costs tended to increase prices and thus the profit share enormously (with marginal reactions of 2.44 and 2.16). As the propensities to save out of wage income (0.09 and 0.13) and the responsiveness of investment to profit share variations (0.14 and 0.33) are relatively low in both countries, the redistribution of income from workers to firms transfers means that have mostly been used for consumption to firms who do not sufficiently translate lower unit costs which are implied by a higher profit share into higher investment that would compensate for the lower consumption of workers. Thus, a negative impact of an increasing profit share on utilization can be observed in both countries. The rise of the profit share, induced by a 1%-point increase in the interest rate, causes the equilibrium position of utilization to decrease by 0.22%-points in the US and by 0.18%-points in Germany. Due to its negative impact on demand and its moderate positive direct impact on investment, a rising profit share has also a negative effect on accumulation and on the profit rate in the US. The marginal long-run reactions of accumulation and of the profit rate to an interest induced rise in the profit share are -0.02 and something slightly below -0.00, respectively. This is not true for Germany, where a rising profit share has positive implications for accumulation and for the profit rate. A 1%-point rise of the interest rate implies the increasing profit share to cause a rise of the accumulation and profit rate by 0.05 and 0.09%-points, respectively. This is the case because the responsiveness of investment

towards the profit share is significantly higher in Germany than in the US. Hence, an increase in the profit share stimulates private investment to a greater extent than it is inhibited by the attenuation of demand. As for the positive effect on the profit rate, the increased profit share reduces demand to a less extent than it directly boosts the profit rate. To sum up the secondary effect of an increasing profit share on the endogenous variables, we can refer a wage-led demand, a wage-led accumulation and a wage-led profit regime to the US and a wage-led demand, a profit-led accumulation and a profit-led profit regime to Germany.

In the US, the interest induced pro-capital redistribution of income, thus, aggravates the contraction in demand, accumulation, and profits which has been triggered by contractive monetary policy and the redistribution of income from firms to rentiers. In Germany, however, the adjustment of the profit share contributes only to the contraction of demand, but counteracts, although insufficiently, the slowdown of accumulation and the decline in the profit rate.

Sub-periods

As a second step, we combine the model parameters estimated over the entire period with the model variables averaged over sub-periods in order to identify the accumulation regimes of the US and Germany from 1960 to 1982, on the one hand, and from 1983 to 2007, on the other. As can be confirmed by looking at the trends of the economic indicators summarized in table 3, the first sub-period is associated with high averages in utilization and accumulation and low interest rates, while in the second a decline of utilization and a slowdown of accumulation as well as high averages of real interest rates can be observed. Equivalent to the examination of the total period, the average marginal responses of the equilibria of the endogenous variables towards interest rate increases during each of the two sub-periods are summarized in table 11.

As in the total period analysis, we identify *normal* regimes for the US and for Germany in both sub-periods. Again, contractive monetary policy has been found to reduce demand, accumulation and profits. We do not find a shift in the regimes in any of the two countries considered. Our results contradict the findings of Hein and Ochsén (2003):

Table 11: *The effects of interest rate variations on capacity utilization, accumulation, and profits in the US and Germany in two sub-periods*

	USA		Germany	
	1960-82	1983-07	1960-82	1983-07
$\frac{\partial u^*}{\partial i}$	$-0.46 - 0.23 = -0.69$	$-0.48 - 0.22 = -0.70$	$-1.68 - 0.38 = -2.06$	$-0.95 - 0.06 = -1.02$
$\frac{\partial g^*}{\partial i}$	$-0.16 - 0.02 = -0.19$	$-0.18 - 0.02 = -0.20$	$-0.70 + 0.05 = -0.65$	$-0.39 + 0.05 = -0.34$
$\frac{\partial r^*}{\partial i}$	$-0.10 - 0.00 = -0.10$	$-0.11 - 0.00 = -0.11$	$-0.35 + 0.11 = -0.24$	$-0.19 + 0.07 = -0.13$
where				
$\lambda^{(i)}$	0.14	0.16	0.44	0.24
h	0.21	0.23	0.21	0.20
u	0.87	0.80	0.62	0.45
and β , τ , θ_i , s_W , s_Z , and γ_1 as in table 10				

Notes: The conditions for the effects of an increase in the interest rate on capacity utilization, accumulations and profits are derived from equations (18) to (20). All values have been rounded off to two decimal places. λ , h , and u are variables averaged over the respective sub-period considered and denote the debt-capital ratio, the profit share, and the rate of capacity utilization, respectively. β , τ , θ_i , s_W , s_Z , and γ_1 are the relevant coefficients of the investment, savings and profit share function, respectively.

⁽ⁱ⁾ Time series from 1965 to 2005 for Germany and from 1960 to 2006 for the US.

First, they find a *puzzling* case for the US economy in the periods from 1961 to 1982 and from 1983 to 1995. Second, for Germany, they identify a shift in the accumulation regime from a *normal* case in the first period to the *puzzling* case in the second.

Looking at partial effects, the following holds not only for the entire period but also for both sub-periods: In both countries, interest rate induced redistribution of income from firms to rentiers contributes to decreasing equilibrium positions of demand, accumulation and profits. Redistribution of income from workers to firms further attenuates demand in both countries and the other economic indicators only in the US. In Germany, a rising profit share has positive implications for accumulation and growth in both periods, which is, however, not sufficient to overcompensate the negative first-round effects. As we have derived previously for the economies averaged over the entire period, demand, accumulation and profits are wage-led in the US, whereas, apart from demand, all indicators are profit-led in Germany.

Business cycles

As a third step, we now consider the six business cycles equivalently to the two sub-periods. Since this classification allows us to track the development of the model variables, we can gain insights into the development of the mechanism through which interest rate variations have affected output, accumulation and profits in the US and in Germany since the 1960s. Table 12 and table 13 present the responses of the rates of capacity utilization, capital accumulation and profits towards interest rate variations in each business cycle for the US and Germany.

For the six business cycles under consideration, we basically derive the same results as for the periods we analyzed previously. On the basis of our estimations, output, capital accumulation and profits have been negatively affected by interest rate hikes during every single business cycle in both countries until the mid 2000s. In the current business cycle, interest rates do not seem to influence the endogenous variables in Germany. Considering the behavior of the impacts of monetary policy over time, no shifts in the regime of accumulation based on the development of the model variables such as indebtedness, the profit share and capacity utilization can be observed, neither in the USA nor in Germany.

Table 12: *The effects of interest rate variations on capacity utilization, accumulation, and profits in six business cycles: USA*

	1960-70	1971-74	1975-82	1983-91	1992-01	2002-07
$\frac{\partial u^*}{\partial i}$	$-0.36 - 0.19 = -0.54$	$-0.49 - 0.24 = -0.73$	$-0.60 - 0.27 = -0.88$	$-0.68 - 0.29 = -0.97$	$-0.48 - 0.22 = -0.70$	$-0.17 - 0.08 = -0.25$
$\frac{\partial q^*}{\partial i}$	$-0.13 - 0.02 = -0.15$	$-0.17 - 0.03 = -0.20$	$-0.21 - 0.03 = -0.24$	$-0.25 - 0.03 = -0.28$	$-0.18 - 0.02 = -0.20$	$-0.07 - 0.01 = -0.07$
$\frac{\partial r^*}{\partial i}$	$-0.08 - 0.00 = -0.08$	$-0.10 - 0.01 = -0.11$	$-0.12 - 0.01 = -0.13$	$-0.15 - 0.00 = -0.15$	$-0.11 - 0.00 = -0.11$	$-0.04 - 0.00 = -0.04$
where						
$\lambda^{(i)}$	0.11	0.14	0.17	0.21	0.16	0.06
h	0.22	0.21	0.21	0.22	0.23	0.23
u	0.91	0.86	0.80	0.78	0.81	0.82
and β , τ , θ_i , s_W , s_Z , and γ_1 as in table 10						

Notes: The conditions for the effects of an increase in the interest rate on capacity utilization, accumulations and profits are derived from equations (18) to (20). All values have been rounded off to two decimal places. λ , h , and u are variables averaged over the respective business cycle considered and denote the debt-capital ratio, the profit share, and the rate of capacity utilization, respectively. β , τ , θ_i , s_W , s_Z , and γ_1 are the coefficients of the investment, savings, and profit share function, respectively.

⁽ⁱ⁾ Time series from 1960 to 2006.

Table 13: *The effects of interest rate variations on capacity utilization, accumulation, and profits in six business cycles: Germany*

	1960-67	1968-75	1976-82	1983-93	1994-03	2004-07
$\frac{\partial u^*}{\partial i}$	$-1.40 - 0.49 = -1.89$	$-1.74 - 0.33 = -2.08$	$-1.96 - 0.23 = -2.19$	$-1.30 - 0.10 = -1.39$	$-0.81 - 0.05 = -0.85$	$0.00 + 0.00 = 0.00$
$\frac{\partial q^*}{\partial i}$	$-0.64 + 0.03 = -0.61$	$-0.72 + 0.06 = -0.66$	$-0.73 + 0.07 = -0.67$	$-0.53 + 0.06 = -0.47$	$-0.32 + 0.04 = -0.28$	$0.00 + 0.00 = 0.00$
$\frac{\partial r^*}{\partial i}$	$-0.33 + 0.11 = -0.23$	$-0.36 + 0.12 = -0.24$	$-0.35 + 0.11 = -0.24$	$-0.27 + 0.09 = -0.18$	$-0.16 + 0.05 = -0.11$	$0.00 + 0.00 = 0.00$
where						
$\lambda^{(i)}$	0.42	0.45	0.43	0.33	0.20	$-0.01^{(ii)}$
h	0.23	0.21	0.18	0.20	0.20	0.22
u	0.75	0.58	0.51	0.46	0.45	0.45
and $\beta, \tau, \theta_i, s_W, s_Z$, and γ_1 as in table 10						

Notes: The conditions for the effects of an increase in the interest rate on capacity utilization, accumulations and profits are derived from equations (18) to (20). All values have been rounded off to two decimal places. λ , h , and u are variables averaged over the respective business cycle considered and denote the debt-capital ratio, the profit share, and the rate of capacity utilization, respectively. β , τ , θ_i , s_W , s_Z , and γ_1 are the coefficients of the investment, savings, and profit share function, respectively.

⁽ⁱ⁾ Time series from 1965 to 2005.

⁽ⁱⁱ⁾ Has been set to 0

As we have also concluded for the other periods analyzed, the negative reaction of output, accumulation and profits to interest rate variations during the six US-American business cycles observed builds on both negative primary and secondary effects: The negative direct impacts of increasing interest rates on utilization and investment have been aggravated by an increasing profit share. This supports the proposition that the US-economy has been wage-led in every business cycle throughout the time period considered. In Germany, demand is attenuated by increasing interest rates due to negative primary and secondary effects in every cycle, aside from the last one in which both effects have been zero. In total, both the accumulation and profit rates react negatively to interest rate increases, although an interest rate induced rise of the profit share countervails and mitigates this negative effect. As also concluded for the total period and for the sub-periods, demand in Germany has been wage-led while accumulation and profits have been profit-led in every business cycle apart from the last one.

Looking at the development of the debt-capital ratio, further insights can be gained. The numbers presented in table 12 and table 13 indicate the sensitivity to which the endogenous variables react to interest rate variations. The responsiveness of the equilibria positions of the Kaleckian model towards monetary policy largely depends on the net debt-capital ratio. The less firms are net indebted, the less they care about increasing interest rates in their investment or price setting behavior. Consequentially, as can be seen in table 12 and table 13, until the peak levels of indebtedness - for the US in the 1980s and for Germany in the early 1970s - the primary and secondary effects increased in absolute terms and decreased thereafter. In the US, the overall responsiveness of utilization, accumulation and profits towards interest rate shocks started with -0.54, -0.15, and -0.08, respectively, in the 1960s, increased to -0.97, -0.28, and -0.15, respectively, in the late 1980s and gradually declined until the current business cycle to -0.25, -0.07, and -0.04, respectively. In Germany, the sensitivities of the endogenous variables started from -1.89, -0.61, and -0.23, respectively, in the early 1960s, rose to the vertex of -2.19, -0.67, and -0.24, respectively, and slumped gradually to zero until the current business cycle. There has been no net indebtedness of the non-financial business sector on average in the current business cycle from 2004 to 2007. Since increasing interest rates do not

imply higher interest costs for the average German firm, it does not reduce investment nor does it increase prices. According to our model, the German economy is not affected by interest rate variations anymore. Increasing financial accumulation, resulting in the decline of net indebtedness of the business sector which began in the 1980s and 1970s, respectively, significantly decreased the sensitivity of output and investment to variations in the interest rate.

What can be explained?

How can our results contribute to the explanation of growth and accumulation in the US and Germany between 1960 and 2007? For the US we identify a *normal* case finding negative effects of interest rate variations on output and accumulation over the entire time period. High rates of growth and accumulation throughout the 1960s until the mid 1970s associated with low interest rates are consistent with our story.

The economic slump in the late 1970s/early 1980s cycle cannot be explained by high interest payments, since real interest rates were low. Moreover, the profit share slightly declined which is also not consistent to our story of a wage-led US-American demand and accumulation regime. This business cycle is beyond the scope of our model. A potential explanation could be that in this period of crisis powerful labor unions dominating the distribution struggle decreased the firms' *degree of monopoly* and thus their power to hand increasing costs over to prices. This might have turned the economy into a profit-led regime in the short term, not captured by our estimations. The surge of inflation might have reduced the profit share, which is consistent to the negative coefficient of inflation in our profit share function. As Marglin and Bhaduri (1990) argue, a *profit-squeeze* in this period, which is also indicated in table 3 displaying the trends of some economic indicators, could have contributed to the economic downturn, overcompensating the positive effects of low interest rates.

The interest rate hikes in the early 1980s seem to have contributed tremendously to the slowdown of capital accumulation, because of two reasons: First, the net indebtedness of firms was high implying a high sensitivity of investment decisions to interest rate variations. Second, partly as a reaction to the rise in interest rates, the profit share

slightly increased which cooled off the economy further, given a wage-led accumulation regime in the US.

In the 1990s, the US managed to stabilize the economy at a moderate growth and accumulation rate, although the real interest rates were still high and the profit share increased significantly. This phenomenon might be explained by the following reasons: First, non-financial businesses started to engage seriously in financial accumulation, thus reducing net financial leverage and the sensitivity of investment to interest rate variations. Second, partly due to increasing financial and property wealth of private households and partly due to a change in the social norms, the US-households' propensity to consume increased enormously, which is not captured in our savings function. The economic boom in the 1990s was mainly conveyed by private consumption expenditures (cf. Maki and Palumbo 2001, Catte et al. 2004, and Cynamon and Fazzari 2008). Third, the bubble in the IT-market and attended wealth effects could be responsible for a big part of accumulation and growth observed in the 1990s (cf. Brenner 2003).

In the current business cycle, accumulation and growth have been slow, although real interest rates have also been low. An exogenous explanation for this contradiction might be that in the age of the *shareholder value*, US-firms tremendously increased dividend payments (cf. Lazonick and O'Sullivan 2000 and OECD 2007, ch. 3), reduced internal funds and abstained from costly investments. Moreover, the private household's propensity to consume has almost grown up to unity, thus contributing to high aggregate demand. Endogenously, it might be explained by a low net debt-capital ratio. The net indebtedness of firms today is marginal. Thus, interest variations do not carry much weight in firms' investment decisions. This could also explain why the low real interest rates today do not seem to reduce the profit share which even increased. As the average firm is not net indebted anymore, it does not really benefit from low interest rates. Hence, there is no reason why it should reduce the mark-up. The increasing profit share could probably also be explained by an increasingly asymmetric power relationship between firms and trade unions in the context of globalization. However, a high profit share perfectly fits into our explanation of the moderate growth and accumulation rates in the USA today. The US-economy, identified as a wage-led accumulation regime, suffers from low internal

demand due to a low real wages.

For Germany, we identify a *normal* accumulation regime. Thus, a similar story can be told. In the first business cycle from the early to the mid 1960s, low interest rates are associated with high accumulation and growth which corresponds to our predictions.

From the late 1960s to the mid 1990s, rising real interest rates are associated with a mitigating economic performance, which can be explained by our model. As the profit share decreases at the same time, in particular until the early 1980s, also Marglin and Bhaduri's (1990) *profit-squeeze* explanation for the economic stagnation in the 1970s sounds reasonable, especially as we find a profit-led accumulation regime for Germany. The *profit-squeeze* in this period of crisis might have dominated the expansive effect of an increasing wage share on output growth, which can be inferred from the wage-led growth regime we identified for Germany. Why a falling profit share is coming along with rising interest rates is beyond the cope of our simple model. Other factors such as powerful trade unions and inflationary tendencies might work as superior explanations for a decreasing profit share than increasing interest rates.

The interest rate hikes in the early 1980s and the high level of interest rates in the succeeding years seem to have contributed to the slowdown of accumulation and growth, which is consistent to our story for Germany. Moreover, from the mid 1970s to the early 2000s, increasing interest rates are associated with a slightly increasing profit share, which also confirms our predictions. Contrary to the US, Germany did not manage to stabilize its economy in the 1990s. In consideration of our post-Kaleckian growth model, this is not surprising given the conservative nature of the German Bundesbank and the high long-term interest rate in this period.

Similar to the US, the responsiveness of the German economy to interest rate variations decreased tremendously from the 1980s because firms increasingly engaged in financial accumulation, thus reducing their net indebtedness (cf. OECD 2007, ch. 3). This might be one reason why the German economy did not boost in the last business cycle when interest rates decreased.

5 Conclusions

We have analyzed the effects of interest rate variations on capacity utilization, on capital accumulation and on the profit rate in a simple post-Kaleckian aggregate supply-aggregate demand model based on the work of Bhaduri and Marglin (1990), Lavoie (1995) and Hein (2007). This model featured an investment function proposed by Bhaduri and Marglin (1990) to which the rate of interest and the debt-capital ratio as well as the dividend rate and the equity-capital ratio have been added. The model also included an interest elastic profit share. Considering only stable short-run equilibria, we have found that the impact of the interest rate on the equilibrium positions of the endogenous variables is not unique, but depends primarily on the coefficients of the investment and savings function and on the interest elasticity of the profit share.

Similar to the work of Hein and Ochsén (2003), we confronted our simple model with data of the USA and Germany from 1960 to 2007. As the main differences to Hein and Ochsén's (2003) approach are concerned, our empirical analysis stays close to the theoretical model, includes the debt-capital ratio, uses data on rentiers' net income and on firms' net interest and dividend payments from national accounts, takes into account the interest elasticity of the profit share, utilizes a longer data set and applies a different estimation strategy. For the USA and for Germany, we estimated three equations, i.e. the investment function, the households' savings function and the profit share function, applying a general ADL approach on each one and on the entire period under consideration. For both countries, we find a high sensitivity of investment to changes in the interest rate, a low propensity to save out of labor income and a high propensity to save out of rentiers' income. Moreover, we find a high interest elasticity of the profit share in both countries.

We apply our coefficients to three different sets of periods: to the whole period, to two sub-periods and to six business cycles. Both for the US and for Germany, every single period reveals *normal* post-Keynesian demand, accumulation and profit regimes in which increasing interest rates are associated with decreasing utilization, accumulation and profits. By separating primary effects (through the interest elasticity of investment and the redistribution of income from firms to rentiers) and secondary effects (through

the interest elasticity of the profit share), we find that in the US, the negative total effects on the equilibrium values of the endogenous variables are the sum of negative primary and negative secondary effects, the latter implying a wage-led demand, accumulation, and profit regime for the US. The German economy exhibits a wage-led demand regime and a profit-led accumulation and profit regime as the redistribution of income from workers to firms (secondary effect) has negative impacts on output and positive impacts on accumulation and profits, respectively. No shifts in the demand, accumulation, or profit regimes have been found in any of the two countries analyzed.

The *normal* post-Keynesian regimes we have identified for the US and Germany fit the data, in general, well. In the golden age of capitalism, the *Fordist era*, low interest rates were associated with high accumulation and growth. In the US and Germany, high net indebtedness of firms implied a high responsiveness of the economy towards interest rate fluctuations. A slightly increasing wage share enhanced output growth in both countries. In the *period of crisis* covering the inflationary pressures of the 1970s and the interest rate hikes of the early 1980s, high net indebtedness of firms on the one hand and rising interest rates on the other contributed to the economic downturn in these years. However, according to our model, increasing interest rates should have been translated into rising profit shares, which cannot be confirmed by the data. This contradiction might be explained by the influence of powerful labor unions, which prevented firms that faced high interest payments to raise the mark-up. In the succeeding era of *finance-led accumulation*, the US managed to stabilize accumulation and growth on a moderate level (by the aid of financial market bubbles and strong wealth effects on private consumption demand), although the profit share increased and the interest rate decreased. One reason for the insensitivity of the economy towards interest rate fluctuations is the tremendously decreasing net indebtedness of US-American firms which is caused by increasing financial accumulation. This is also the case in Germany where decreasing interest rates have not boosted the economy. A net indebtedness of zero implies the economy being perfectly inelastic with respect to interest rate variations, according to our simple model.

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A Appendix

Table A1: *Description of the data set and of the sources*

Capital stock (K)	Real net capital stock of the business sector (OECD EOL 75, 78; o.c.)
Accumulation (g)	Growth rate of K
Capacity utilization (u)	Net domestic income at current market prices of the total economy (AMECO) deflated by the price deflator of gross domestic product at market prices (AMECO) over K
Normal capacity utilization (u_n)	Trend of u extracted using the Hodrick-Prescott filter ($\lambda = 100$)
Profit share (h)	Net operating surplus of the total economy adjusted for imputed compensation of self-employed (AMECO) over domestic income at current factor cost of the total economy (AMECO)
Rate of net interest payments ($\frac{Z^p}{pK}$)	Interest payments net of interest income of the non-financial business sector (BEA NIPA Tab.7.11; o.c.) over K with K inflated by the price index of gross capital formation of the total economy (AMECO)
Rate of net dividend payments ($\frac{D^p}{pK}$)	Dividend payments net of dividend income of the non-financial business sector (BEA NIPA Tab.7.10; o.c.) over K with K inflated by the price index of gross capital formation of the total economy (AMECO)
Debt-capital ratio (λ)	Liabilities net of financial assets over tangible assets of the non-financial business sector (FED FOF Tab.B.102, Tab.B.103; BuBa; o.c.)
Savings rate of private households ($\frac{S^H}{pK}$)	Savings of private households (BEA NIPA Tab.2.1; DESTATIS; o.c.) over K with K inflated by the price index of gross capital formation of the total economy (AMECO)
Rate of households' wage income ($\frac{W}{pK}$)	Compensation of employees (BEA NIPA Tab.2.1; DESTATIS; o.c.) over K with K inflated by the price index of gross capital formation of the total economy (AMECO)
Rate of households' net interest and dividend income ($\frac{Z^i + D^i}{pK}$)	Interest and dividend income net of interest and dividend payments of private households (BEA NIPA Tab.2.1; DESTATIS; o.c.) over K with K inflated by the price index of gross capital formation of the total economy (AMECO)
Rate of households' proprietors' income ($\frac{P}{pK}$)	USA: Proprietors' income with inventory valuation and capital consumption adjustments (BEA NIPA Tab.2.1) over K with K inflated by the price index of gross capital formation of the total economy (AMECO); Germany: Income of self-employed and transfers from reserves (DESTATIS, o.c.) over inflated K
Rate of households' rental income ($\frac{R}{pK}$)	Rental income of persons with capital consumption adjustment (BEA NIPA Tab.2.1) over K with K inflated by the price index of gross capital formation of the total economy (AMECO)

(cont'd)

Table A1 (cont'd): *Description of the data set and of the sources*

Rate of households' transfer income ($\frac{T^i}{pK}$)	Personal current transfer income (BEA NIPA Tab.2.1; o.c.) over K with K inflated by the price index of gross capital formation of the total economy (AMECO)
Rate of households' transfer payments ($\frac{T^p}{pK}$)	Personal current transfer payments (BEA NIPA Tab.2.1; o.c.) over K with K inflated by the price index of gross capital formation of the total economy (AMECO)
Unemployment rate (ur)	Unemployment rate (OECD EOL 82)
Rate of inflation ($\dot{p}$) ⁽ⁱ⁾	Growth rate of deflator of private final consumption expenditure (OECD EOL 82; o.c.)
Real output growth ($\dot{y}$) ⁽ⁱ⁾	Growth rate of the net domestic income at current market prices (AMECO) deflated by the price deflator of gross domestic product at market prices (AMECO)
Real short-term interest rate (i_s) ⁽ⁱ⁾	Short-term interest rate (OECD EOL 82) minus the growth rate of the gross domestic product deflator (OECD EOL 82; o.c.)
Real long-term interest rate (i) ⁽ⁱ⁾	Long-term interest rate on government bonds (OECD EOL 82) minus the growth rate of the gross domestic product deflator (OECD EOL 82; o.c.)

Notes: OECD EOL stands for OECD Economic Outlook; BEA NIPA for Bureau of Economic Analysis, National Income and Product Accounts; FED FOF for Federal Reserve, Flow of Funds; DESTATIS for Statistisches Bundesamt Deutschland;

⁽ⁱ⁾ German unification in 1992

Table A2: *Johansen test for cointegration: accumulation function*

USA			
Estimation period: 1962-2006			
Variables: g , h , $\frac{Z^p}{pK}$, $\frac{D^p}{pK}$			
Rank r	Eigenvalue	Trace test	λ -max test
0	0.62	81.18***	43.71***
1	0.42	37.47**	24.74**
2	0.15	12.73	7.50
3	0.11	5.23**	5.23**
Germany			
Estimation period: 1962-2007			
Variables: g , h , $\frac{Z^p}{pK}$, $\frac{D^p}{pK}$			
Rank r	Eigenvalue	Trace test	λ -max test
0	0.57	59.06***	38.97***
1	0.24	20.08	12.70
2	0.14	7.38	6.82
3	0.01	0.56	0.56

Notes: g , h , $\frac{Z^p}{pK}$, and $\frac{D^p}{pK}$ denote the rate of accumulation, the adjusted net profit share, the rate of net interest payments and the rate of net dividend payments, respectively. r is the rank of the matrix of the cointegration vectors and indicates the number of cointegration relationships between the variables considered. All Johansen tests have been performed including unrestricted constants and with lag order 1. The trace test tests the null hypothesis of $r \leq h$ (for $h = 0, 1, \dots, m - 1$ and m is the number of variables) against the alternative that $r = h + 1$. The λ -max test tests the null hypothesis of $r \leq h$ against the alternative that $r \geq h + 1$. *, **, and *** denote the significance level at 10%, 5%, and 1%, respectively. Only variables for which the ADF test indicates a unit root have been included to the test. ADF tests are presented in table A5. A description of the data and the sources can be found in table A1.

Table A3: *Johansen test for cointegration: savings function*

USA			
Estimation period: 1961-2006			
Variables: $\frac{S^H}{pK}$, $\frac{W}{pK}$, $\frac{Z^i+D^i}{pK}$, $\frac{P}{pK}$, $\frac{R}{pK}$, $\frac{T^i}{pK}$, $\frac{T^p}{pK}$			
Rank r	Eigenvalue	Trace test	Lmax test
0	0.67	149.00***	51.92***
1	0.53	97.08**	35.08*
2	0.42	62.00	25.87
3	0.37	36.13	21.78
4	0.18	14.36	9.20
5	0.10	5.16	5.16
6	0.00	0.00	0.00
Germany			
Estimation period: 1962-2007			
Variables: $\frac{S^H}{pK}$, $\frac{W}{pK}$, $\frac{Z^i+D^i}{pK}$, $\frac{P}{pK}$			
Rank r	Eigenvalue	Trace test	Lmax test
0	0.70	77.62***	56.45***
1	0.25	21.17	13.01
2	0.09	7.87	4.35
3	0.07	3.52*	3.52*

Notes: $\frac{S^H}{pK}$, $\frac{W}{pK}$, $\frac{Z^i+D^i}{pK}$, $\frac{P}{pK}$, $\frac{R}{pK}$, $\frac{T^i}{pK}$, and $\frac{T^p}{pK}$ denote the rate of households' savings, the rate of households' wage income, the rate of households' net interest and dividend income, the rate of proprietors' income, the rate of rental income, the rate of households' transfer income and the rate of households' transfer payments, respectively. r is the rank of the matrix of the cointegration vectors and indicates the number of cointegration relationships between the variables considered. All Johansen tests have been performed including unrestricted constants and with lag order 1. The trace test tests the null hypothesis of $r \leq h$ (for $h = 0, 1, \dots, m-1$ and m is the number of variables) against the alternative that $r = h+1$. The λ -max test tests the null hypothesis of $r \leq h$ against the alternative that $r \geq h+1$. *, **, and *** denote the significance level at 10%, 5%, and 1%, respectively. Only variables for which the ADF test indicates a unit root have been included to the test. ADF tests are presented in table A5. A description of the data and the sources can be found in table A1.

Table A4: *Johansen test for cointegration: profit share function*

USA			
Estimation period: 1962-2006			
Variables: h , $\frac{Z^p}{pK}$, ur , $\dot{p}$			
Rank r	Eigenvalue	Trace test	Lmax test
0	0.73	88.85***	58.70***
1	0.31	30.15**	16.81
2	0.17	13.34	8.35
3	0.10	4.99**	4.99**
Germany			
Estimation period: 1961-2007			
Variables: h , $\frac{Z^p}{pK}$, ur			
Rank r	Eigenvalue	Trace test	Lmax test
0	0.43	53.44***	26.32***
1	0.31	27.12***	17.46**
2	0.19	9.66***	9.66***

Notes: h , $\frac{Z^p}{pK}$, ur , and $\dot{p}$ denote the adjusted net profit share, the rate of net interest payments, the unemployment rate, and the inflation rate, respectively. r is the rank of the matrix of the cointegration vectors and indicates the number of cointegration relationships between the variables considered. All Johansen tests have been performed including unrestricted constants and with lag order 1. The trace test tests the null hypothesis of $r \leq h$ (for $h = 0, 1, \dots, m - 1$ and m is the number of variables) against the alternative that $r = h + 1$. The λ -max test tests the null hypothesis of $r \leq h$ against the alternative that $r \geq h + 1$. *, **, and *** denote the significance level at 10%, 5%, and 1%, respectively. Only variables for which the ADF test indicates a unit root have been included to the test. ADF tests are presented in table A5. A description of the data and the sources can be found in table A1.

Table A5: *Augmented Dickey-Fuller unit root tests*

	USA		Germany	
	in levels ⁽ⁱⁱ⁾	in first differences ⁽ⁱ⁾	in levels ⁽ⁱⁱ⁾	in first differences ⁽ⁱ⁾
g	-1.94	-6.02***	-2.31	-4.02***
$u - u_n$	-5.55*** ⁽ⁱ⁾		-5.37*** ⁽ⁱ⁾	
h	-2.31	-6.46***	-2.07	-5.33***
$\frac{Z^p}{pK}$	-2.26	-4.47***	-1.50	-6.14***
$\frac{D^p}{pK}$	-0.29	-13.24***	-0.59	-6.34***
λ	-0.50	-3.04**	1.35	-5.13***
$\frac{S^H}{pK}$	0.55	-8.74***	-0.84	-6.51***
$\frac{W}{pK}$	-1.00	-2.20**	-1.85	-4.03***
$\frac{Z^i+D^i}{pK}$	-0.92	-4.52***	-0.89	-3.24***
$\frac{P}{pK}$	-1.72	-4.78***	-2.45	-3.89***
$\frac{R}{pK}$	-2.47	-2.73***		
$\frac{T^i}{pK}$	-0.21	-3.79***		
$\frac{T^p}{pK}$	-0.65	-5.07***		
ur	-2.80 ⁽ⁱⁱⁱ⁾	-5.47***	-1.24	-4.27***
$\dot{p}$	-1.70	-6.55***	-3.03**	
$\dot{y}$	-5.40***		-4.86***	

Notes: The variables in order of appearance denote the accumulation rate, the deviation of capacity utilization from its normal rate, the adjusted net profit share, the rate of net interest payments, the rate of net dividend payments, the debt-capital ratio, savings over the capital stock, compensation of employees over the capital stock, net interest and dividend income over the capital stock, transfer income over the capital stock, transfer payments over the capital stock, the unemployment rate, inflation, and the growth rate of net domestic income, respectively. We tested down from the maximum lag order 3. The null hypothesis of the Augmented Dickey-Fuller (ADF) test is no unit root. *, **, and *** denote the significance level of 10%, 5%, and 1%, respectively. The critical values are taken from MacKinnon (1996). For a discussion of the data set and its sources, see table A1.

⁽ⁱ⁾ ADF test without constant

⁽ⁱⁱ⁾ ADF test with constant

⁽ⁱⁱⁱ⁾ ADF test with constant and trend

Table A6: *Engle-Granger test on cointegration*

	USA	Germany
Cointegrating regression of investment function $g_t = \beta_0 + \beta_1 h_t + \beta_2 \left(\frac{Z^p}{pK}\right)_t + \beta_3 \left(\frac{D^p}{pK}\right)_t + e_t$	-3.43	4.02*
Cointegrating regression of savings function $\left(\frac{S^H}{pK}\right)_t = \beta_0 + \beta_1 \left(\frac{W}{pK}\right)_t + \beta_2 \left(\frac{Z^i + D^i}{pK}\right)_t + e_t$	-3.62*	-2.64
Cointegrating regression of profit share function $h_t = \beta_0 + \beta_1 \left(\frac{Z^p}{pK}\right)_t + e_t$	-2.27	-2.16

Notes: g , h_t , $\frac{Z^p}{pK}$, $\frac{D^p}{pK}$, $\frac{S^H}{pK}$, $\frac{W}{pK}$, and $\frac{Z^i + D^i}{pK}$ denote the rate of accumulation, the adjusted net profit share, the rate of firms' net interest payments, the rate of firm's net dividend payments, the rate of households' savings, the rate of households' wage income, and the rate of households' net interest and dividend income, respectively. * denotes the significance level at 10%. Given that each variable exhibits a unit root, the Engle-Granger test implies no cointegration if the ADF test on the residuals of the cointegrating regression fails to reject the null hypothesis of a unit root. We tested down from the maximum lag order 3. ADF tests have been performed including a constant. The critical values are taken from MacKinnon (1996). Only variables for which the ADF test indicates a unit root have been included to the Engle-Granger test. ADF tests are presented in table A5. For a discussion of the data set and its sources, see table A1.

Table A7: *Various econometric standard tests*

	USA	Germany
Investment function (equation (21)): Specifications of table 4		
<i>White</i>	5.87	20.97
<i>RESET</i>	-2.51	1.04
<i>CUSUM</i>	-0.19	1.38
<i>Normality</i>	1.65	0.32
<i>Breusch-Godfrey L(1)</i>	1.41	0.00
<i>Breusch-Godfrey L(2)</i>	1.97	0.09
<i>Breusch-Godfrey L(3)</i>	1.38	0.97
Savings function (equation (22) and (23), respectively): Specifications of table 6		
<i>White</i>	9.48	28.89***
<i>RESET</i>	0.68	0.67
<i>CUSUM</i>	0.65	-1.85*
<i>Normality</i>	3.99	0.08
<i>Breusch-Godfrey L(1)</i>	0.03	0.02
<i>Breusch-Godfrey L(2)</i>	0.37	2.81*
<i>Breusch-Godfrey L(3)</i>	0.25	1.85
Profit share function (equation (24)): Specifications of table 8		
<i>White</i>	9.51	19.24
<i>RESET</i>	0.40	0.53
<i>CUSUM</i>	0.18	-1.06
<i>Normality</i>	0.28	4.84*
<i>Breusch-Godfrey L(1)</i>	0.00	0.42
<i>Breusch-Godfrey L(2)</i>	0.68	0.25
<i>Breusch-Godfrey L(3)</i>	0.84	0.82

Notes: Apart from the constant, only significant variables are considered in the tests, as all insignificant variables have been omitted according to the general to specific approach. *, **, and *** denote the significance level of the test statistics at 10%, 5%, and 1%, respectively. *White* is the White (1980) test for heteroscedasticity with the null of no heteroscedasticity. *RESET* is the Ramsey (1969) Regression Equation Specification Error Test (RESET) with the null of a correct specification of the model. *CUSUM* is the CUSUM test for parameter stability with the null of stable parameters. *Normality* is the Doornik and Hansen (2008) test for normality applied on the residuals with the null of no normality. *Breusch-Godfrey L(i)* ($i=1,2,3$) is the Breusch (1978)-Godfrey (1978) serial correlation LM test with the null of no autocorrelation of any order up to i in the residuals.

Table A8: *Chow breakpoint tests*

	USA	Germany
Investment function (equation (21)): Specifications of table 4		
Year	1982	1982
Test statistic	1.07	0.62
P-value	0.41	0.78
Savings function (equation (22) and (23), respectively): Specifications of table 6		
Year	1982	1982
Test statistic ⁽ⁱ⁾	0.79	3.69
P-value	0.64	0.45
Profit share function (equation (24)): Specifications of table 8		
Year	1982	1982
Test statistic	0.76	1.54
P-value	0.64	0.19

Notes: The Chow tests have been applied for 1982. Apart from the constant, only significant variables are considered in the tests, as all insignificant variables have been omitted according to the general to specific approach.

⁽ⁱ⁾ As we estimated the savings function for Germany applying Newey and West (1987) t-statistics, the test statistic of the Chow test is chi-squared distributed.

Table A9: *Stability condition fulfilled if $s_W + (1 - s_W)h - \beta > 0$*

Entire period		
USA	1960-2007	$0.09 + (1 - 0.09) * 0.22 - 0.14 > 0$
Germany	1960-2007	$0.13 + (1 - 0.13) * 0.21 - 0.15 > 0$
Sub-periods		
USA	1960-1982	$0.09 + (1 - 0.09) * 0.22 - 0.14 > 0$
	1983-2007	$0.09 + (1 - 0.09) * 0.23 - 0.14 > 0$
Germany	1960-1982	$0.13 + (1 - 0.13) * 0.21 - 0.15 > 0$
	1983-2007	$0.13 + (1 - 0.13) * 0.20 - 0.15 > 0$
Business cycles		
USA	1960-1970	$0.09 + (1 - 0.09) * 0.22 - 0.14 > 0$
	1971-1974	$0.09 + (1 - 0.09) * 0.21 - 0.14 > 0$
	1975-1982	$0.09 + (1 - 0.09) * 0.21 - 0.14 > 0$
	1983-1991	$0.09 + (1 - 0.09) * 0.22 - 0.14 > 0$
	1992-2001	$0.09 + (1 - 0.09) * 0.23 - 0.14 > 0$
	2002-2007	$0.09 + (1 - 0.09) * 0.23 - 0.14 > 0$
Germany	1960-1967	$0.13 + (1 - 0.13) * 0.23 - 0.15 > 0$
	1968-1975	$0.13 + (1 - 0.13) * 0.21 - 0.15 > 0$
	1976-1982	$0.13 + (1 - 0.13) * 0.18 - 0.15 > 0$
	1983-1993	$0.13 + (1 - 0.13) * 0.20 - 0.15 > 0$
	1994-2003	$0.13 + (1 - 0.13) * 0.20 - 0.15 > 0$
	2004-2007	$0.13 + (1 - 0.13) * 0.22 - 0.15 > 0$

Notes: s_W , h and β denote the propensity to save out of wage income, the adjusted net profit share and the elasticity of investment with respect to capacity utilization, respectively. Values are taken from tables 5, 6, 10, 11, 12 and 13, respectively. For a discussion of the data set and its sources, see table A1.

B Zusammenfassung (German Abstract)

Erst kürzlich wurden kaleckianische Wachstums- und Verteilungsmodelle um monetäre Variablen erweitert. Der Zinssatz, der Verschuldungsgrad und die Eigenkapitalquote von Unternehmen sowie ein zinselastischer Preisaufschlag wurden in das Modell inkludiert. Empirische Bewertungen der Frage, in wie fern diese Modelle in der Lage sind, die Wirklichkeit zu beschreiben, sind nach wie vor selten. Diese Arbeit versucht, einen Beitrag zu dieser empirischen Forschung zu leisten. Im ersten Teil werden die Auswirkungen einer exogenen Veränderung des monetären Zinssatzes auf die Gleichgewichtswerte des Auslastungsgrades, der Kapitalakkumulation und der Profitrate im Rahmen eines erweiterten postkaleckianischen Wachstumsmodells im Geiste von Bhaduri und Marglin (1990) theoretisch diskutiert. Im zweiten Teil konfrontieren wir das Modell mit Jahresdaten aus den USA und aus Deutschland von 1960 bis 2007. Mit Hilfe eines einfachen ADL Ansatzes werden die Parameter des postkaleckianischen Wachstumsmodells geschätzt und auf verschiedene Zeiträume angewendet, nämlich auf die Gesamtperiode, auf zwei Subperioden und auf sechs Konjunkturzyklen. In beiden Ländern identifizieren wir normale postkeynesianische Regime, in denen die Nachfrage, die Akkumulation und die Profitrate negativ auf steigende Zinssätze reagieren. Außerdem erhalten wir lohngetriebene Nachfrage-, Akkumulations- und Profitregime für die USA, während die deutsche Ökonomie ein lohngetriebenes Nachfrageregime, aber ein profitgetriebenes Akkumulations- und Profitregime war. Unser Ergebnis bestätigt, dass konservative Geldpolitik zum wirtschaftlichen Abschwung in den USA und in Deutschland speziell in den 1980er bzw. 1990er Jahren beigetragen hat.

C Curriculum Vitae

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