International Journal of Economics and Finance; Vol. 16, No. 12; 2024
ISSN 1916-971X E-ISSN 1916-9728
Published by Canadian Center of Science and Education

The Impact of Inflation and a Real Interest Rate Gap on the Capital Market and Economic Development - Evidence from Two Behavioral Experiments

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Received: September 26, 2024 Accepted: October 17, 2024 Online Published: October 25, 2024

doi:10.5539/ijef.v16n12p15 URL: https://doi.org/10.5539/ijef.v16n12p15

Abstract

This paper investigates the impact of central bank interventions in the capital market on savers and corporate investments through two behavioral experiments. The interest lag hypothesis is confirmed. Inflation changes the distribution it favors debtors and disadvantages creditors, such as savers. When expansive monetary policy by central banks results in inflation, the artificial reduction of the real interest rate acts as an economic stimulus. In this context, the positive economic effects of a low interest rate or QE policy are largely due to a redistribution policy at the expense of savers, who subsidize the expansion of corporate capacity. However, our experiments show also the risk of overstimulation, potentially leading to boom and bust cycles. In addition, the expansive monetary policy was ineffective in the long run and unfair in terms of distribution policy.

Keywords: financial markets, inflation, distribution, behavioral economics, monetary policy, interest rate policy, interest lag hypothesis, investments, business cycles, real interest rate gap, Marshall hypothesis

1. Introduction

Several researchers detect a global deviation of monetary policy from the Taylor rule (Hofmann & Bogdanova, 2012; Kahn, 2010; Taylor, 2012, Ahrend, 2010; IMF staff, 2015, p. 32). In this context one of the most significant proposed changes to monetary policy in recent years is a lower real interest rate (difference between nominal interest rate and inflation rate) in the Taylor equation. The members of the Federal Open Market Committee have recently estimated that the average equilibrium real interest rate is now at least one percentage point lower than previously thought. This adjustment has been supported by various studies, including those by Laubach and Williams (2003, 2016) and Holston, Laubach and Williams (2016). On the other hand, Taylor and Wieland (2016) highlight the significant uncertainty surrounding this adjustment, noting that the low interest rates set by central banks can make it challenging to estimate the equilibrium real rate. In fact, historical data from the US shows that the long-term average real interest rate has been 3.69% (ycharts.com, 2024). Does the implementation of Quantitative Easing (QE) by central banks potentially lead to an artificial reduction in the real interest rate, creating a real interest rate gap, thereby serving as an economic stimulus?

Stiglitz (2018) addressed the dominance of Dynamic Stochastic General Equilibrium (DSGE) models in macroeconomics over the last twenty-five years. He asserted that the core issue lies in their inappropriate microfoundations, which overlook essential elements of economic behavior, such as insights from information economics and behavioral economics. Stiglitz pointed out the inadequate modeling of the financial sector, rendering these models incapable of predicting or responding effectively to financial crises. Additionally, he criticized the reliance on representative agent models, arguing that this approach limits the analysis of how distribution affects fluctuations and crises as well as the impact of economic fluctuations on inequality. In this paper, we want to analyze the distribution effects of expansionary interest rate policy.

This paper examines the effects of central bank interventions in the capital market on savers and companies by means of two behavioral experiments. The focus of this paper is the interest lag hypothesis (Verbic, 2001), which claims that the creditor suffers losses from unexpected inflation because of the devaluation of his capital purchasing power and the fixed interest rates. The aim of this paper is to analyse the impact of the decrease of the real interest rate due to inflation on the savers` and companies` interest rate bargaining and the companies`

investments.

Amato (2005, p. 2) gives a definition for the “real rate gap” as the difference between the actual short-term ex ante real interest rate and the natural rate. In his view, the real rate gap is a principal source of aggregate demand-driven imbalances. Amato (2005, p. 5) summarizes the Wicksells` business cycle approach: “real interest rate gaps are at the core of welfare-reducing business cycle fluctuations.”. Therefore the Wicksell distribution hypothesis can be formulated as follows: “The distribution effects of real interest rate gaps are the driver of the economic fluctuations caused by the central banks.” The natural rate of Wicksell is inherently unobservable and challenging to measure in practice (Amato 2015, Deutsche Bundesbank 2017), why this paper takes a different approach. It analyzes as “real interest rate gap” the difference between the historical long-term average interest rate and the current real interest rate. Banks are seen in this paper as intermediaries who demand a margin from savers and borrowers, rather than active negotiating participants. Section 2 reviews literature about the influences of inflation on the bargaining process in the capital market and the impact on economic development. Section 3 delves into the experimental design, while sections 4 and 5 outline the results and conclusions, respectively.

2. Related Literature

In experiment A we tested behaviorally the impact of inflation on the savers and the interest rate bargaining process with its distribution effects. Too much central bank money or too low interest rates lead to inflation (Friedman & Schwartz, 1963), that is prevailing opinion, but the research on the impact of inflation on distribution is divided. However there has been also a Neo-Keynesian consensus, that money expansion has nearly no influence on prices (John & Steve, 2022).

Hayek (1932) traces the "forced saving" approach back to Jeremy Bentham. In a credit-financed upswing, inflation forces consumers to buy less because the purchasing power of their money has fallen. More money with the same supply is the cause of this inflation (Laidler, 2009). When it comes to inflation, the most disadvantaged members of society tend to suffer more than they gain. But Bulir and Gulde (1995) found mixed results. Greece, Israel, and Russia stand out as countries where inflation clearly acts as a regressive tax, coincidentally also being among the lowest-income nations with limited financial complexity. On the other hand, in the United States, the United Kingdom, and Italy, inflation seems to function as a progressive tax. Their analysis revealed a noteworthy insight: the nature of inflation as either a progressive or regressive tax hinges on the developmental stage and complexity of the financial system. In less affluent countries with less advanced financial sectors, greater inflation tends to correlate with heightened inequality. Conversely, in wealthier nations with more sophisticated financial systems, the lower-income segment tends to benefit from higher inflation. This might be caused by different shares of capital gains in the income of these countries. Apart from the real wage losses, the direct effect of inflation is the reduction in private net wealth, a distribution between private debtors and creditors (Fischer & Modigliani, 1978). Kim and Lin (2023) came to the same result. In a dataset encompassing both developed and developing nations, the study revealed a positive link between inflation and income inequality. However, it also identified a negative correlation between income inequality and the interplay of inflation and financial development. While inflation tends to elevate income inequality, the presence of financial development mitigates this impact. Boel and Camera (2009) calculated the welfare expense of expected inflation using a calibrated model of the U.S. economy. If money stands as the sole asset, inflation primarily affected the wealthier individuals negatively, potentially benefiting those with lower wealth. If the wealthier can hedge against consumption risks using assets beyond money, the situation reverses. Albanesi (2007) suggests that low-income households tend to allocate a larger portion of their total purchases to cash holdings, making them more vulnerable to the negative effects of inflation. Additionally, inequality, stemming from disparities in labor productivity, exacerbates the weakening of their bargaining power. Lenza and Slacalek (2024) found that Quantitative Easing has a compressive effect on the income distribution as it leads to increased employment among many households with lower incomes. However, the impact of monetary policy on the Gini coefficient for wealth is minimal.

Deopke and Schneider (2006) provided a quantitative analysis of inflation’s impact by examining shifts in the value of nominal assets. They investigated nominal asset holdings in the United States across various sectors and household demographics, estimating the wealth redistribution resulting from a moderate inflationary period. The primary losers of inflation were identified as wealthy, elderly households, who held significant bond assets. Conversely, the main beneficiaries were young, middle-class households burdened with fixed-rate mortgage debt. Doepke, Schneider, and Selezneva (2015, 2019) quantified the redistribution effects of US monetary policy. The impacts of inflation varied significantly across the population, resulting in substantial losses for wealthier, older households with significant investments in long-term nominal assets like bonds, while middle-class homeowners

with substantial outstanding mortgages experienced considerable gains. And Pallotti (2022) analyzed the US inflation surge in 2021, the burden largely fell on foreign bond holders. Moreover, there was a notable aggregation of nominal assets among affluent middle-aged and elderly households, leading to considerable losses for them. Conversely, most other household demographics experienced average gains. Meh and Terajima (2011) measured the redistributional consequences of inflation in Canada resulting from the reassessment of nominal assets and liabilities. Even low inflation had significant impact. The primary beneficiaries were identified as young, middle-class households burdened with mortgage debt. Additionally, the government experiences a substantial increase in its wealth from its long-term debt holdings. Conversely, elderly individuals, affluent individuals, and middle-aged, middle-class households predominantly suffered losses, primarily due to their ownership of bonds and non-indexed defined benefit pension assets.

Kim and Lind (2023) analyzed developing and developed countries over the period 1970-2019. As inflation surprises occur, income distribution becomes increasingly unequal, with income shifting away from wage earners and savers towards profits. Through lowering the real interest rate, unexpected inflation allows entrepreneurs to repay their debts with devalued currency. This widens wealth inequality, as entrepreneurs—often comprising a significant portion of the affluent—benefit from unexpected inflation while low and medium-income households, primarily savers, bear the cost.

In experiment B it should be tested behaviorally how the real interest rate deductions influenced the investment reactions of the companies, thus also growth and economic development. Inflation hampers economic growth by diminishing investment and productivity growth, while budget deficits also impair both capital accumulation and productivity growth. Marshall (1887) argued that as prices rise, nominal interest rates adjust slowly, leading to a decline in real interest rates, which creates profitable borrowing opportunities from the banking system. This expansion of bank lending increases the money supply, boosting expenditure and further driving up prices in a potentially continuous process (Marshall hypothesis).

López-Villavicencio and Mignon (2011) analyzed the impact of inflation on economic growth across various countries. Their findings indicate that inflation starts to have a detrimental effect at 17.5% in emerging economies, while in developed economies, this effect begins at just 2.7%. Additionally, in developed nations, inflation can promote growth if it remains below 2.7%. Similarly, Sarel (1996) explored the nonlinear impacts of inflation and identified a significant structural break at an 8% inflation rate. Below this threshold, inflation either has no discernible effect on growth or may even have a slightly positive impact. However, once the inflation rate exceeds 8%, its effect on growth becomes significant, robust, and highly influential. This indicates that inflation does not have a linear effect on economic growth. High growth over extended periods and sustained growth is incompatible with high inflation (Fischer, 1993, Barro, 1995).

How interest rates influence the economy was always a decisive question for scientists. Following early contributions by Harrod (1936). Kaldor (1940) introduced a mechanism based on the disjunction between ex-ante saving and investment to internally elucidate shifts in economic activity levels. His model posits that investment is contingent on profit levels, which, in turn, are determined by economic activity levels. Nonlinear investment and savings functions, coupled with their temporal shifts, give rise to business cycles. Kalecki (1935) further enriched this concept by incorporating the notion of time lags in capital accumulation (Krawiec & Szydlowski, 1999; Szydłowski & Krawiec, 2001; Szydłowski & Krawiec, 2005). Finally, Hicks (1950) successfully elucidated fluctuations in the utilization of a perpetually expanding production potential observed in reality by considering induced and autonomous investments. Based on Hicks' model, numerous advancements have emerged. Chenery (1952) devised an investment function reliant on both demand and capacity utilization, incorporating the capacity effects of prior investments. The lack of endogenization of the money market was provided by Phillips (1961). These aspects are combined in a further developed business cycle model that relies on investment as an endogenous trigger for the business cycle.

In summary, the effects of inflation on distribution and growth are controversial among researchers, which is why we conducted two alternative behavioral experiments. Behavioral modeling endeavors to delineate the economic framework guiding behavior across various contexts, recognizing its departure from an exact portrayal of reality. In contrast to traditional economic modeling, which relies on mathematical frameworks and assumes rational behavior, behavioral modeling employs experiments to explore behavior, aiming for a more realistic approximation of real-world dynamics. These models concentrate on the pertinent factors influencing decision-making and scrutinize the sociological interactions among multiple actors. Within these models, behavioral hypotheses are formulated and tested using human subjects, with careful attention given to experimental design to facilitate replication by other researchers. Consistent with Popper's (1958) scientific approach, these hypotheses maintain validity until challenged by experiments yielding divergent outcomes. The

identified behavioral tendencies can then serve as foundational principles for the formulation of new economic theories and policy approaches (De Grauwe, 2019, Conrad, 2015, 2024).

3. Experimental Design

Experiments A was conducted across the winter semesters of 2021/22 and 2023/24, as well as the summer semesters of 2022 and 2023, and B in the winter semesters of 2022/23 and summer semester 2023. MS Teams and Excel were used as primary tools. The study A enlisted a cohort of 159 (game AA 83 and game AB 76) different participants, divided into ten groups, drawn from diverse Business Bachelor programs such as macroeconomics and political economy at the University of Applied Sciences HTW in Saarbrücken, Germany. 137 students – divided into eight groups - participated in experiment B. Prior to commencing the experiment, participants were provided with comprehensive explanations regarding the experiment's regulations.

3.1 Experiment A: Interest Rate Formation on the Capital Market with Inflation

The interest lag hypothesis had to be tested, why we phrase our test hypothesis as follows:

"The creditor suffers losses from unexpected inflation because of the devaluation of his capital purchasing power and the fixed interest rates".

The players were divided into two groups: Capital providers and capital demanders. The capital providers (savers) had to invest 10,000 euros per round and the capital demanders had to borrow 10,000 euros and had an interest budget of 1,000 euros per round. Whoever had the most money in each group after 10 rounds received 10 euros. In each round, the capital demanders (companies) and the capital providers (savers) had to enter their interest bids. They could increase or decrease their bids by a maximum of 10% per round. We started with 0% inflation and an interest rate of 2%. The companies had to borrow 10,000 euros per round with their interest budget of 1,000 euros and the savers had to invest 10,000 euros. The companies whose interest rate bid was higher than the average interest rate offered by all companies received 100% of the requested capital, while those whose interest rate was lower received only 20%. The capital missing in each round was automatically added to the companies at the expensive average interest rate offered by savers. The savers whose interest rate bid was higher than the average interest rate offered could lend 20%, while those whose interest rate was lower could invest 100%. The missing 80% was then calculated using the average interest rate offered by the companies seeking capital.

This corresponds to the market mechanism: those who demand a product above the average price will get directly the product and those who offer less that the average must subsequently accept the price demands of the suppliers. Anyone offering below the average price sells immediately; the other suppliers who are above the average price do not get a chance and must subsequently accept the price bids of the demanders.

Inflation was communicated to the players by the game master at the end of the round and then retroactively reduced the result (of the same round Experiment AA, i.e. with a comparable time lag of one year or the previous round i.e. a comparable time lag of two years, Experiment AB) by reducing the interest rate by the inflation rate, i.e. the amount that the companies as demanders had paid and what the providers of capital, i.e. the savers, had received. This therefore corresponded to the effect of inflation on the purchasing power.

3.2 Experiment B: Real Interest Rate Gap and Economic Development

The aim was to demonstrate the impact of real interest rate decreases due to inflation and a passive central bank interest rate changes on the investments of the enterprises. As a consequence, the real interest rate gap as the difference between the historical long-term average interest rate and the current real interest rate increases. Marshall (1887) contends that when prices increase, nominal interest rates tend to adjust gradually. This slow adjustment results in a decrease in real interest rates, creating advantageous borrowing conditions within the banking system. Consequently, the rise in bank lending expands the money supply, stimulates spending, and further drives up prices in a potentially ongoing cycle. In summary, the Marshall hypothesis states:

"The implementation of expansive monetary policy (low interst rate or QE policy) by central banks lead to an artificial reduction of the real interest rate, thereby serving as an economic stimulus."

We started a game with unlimited money supply in a positive economic environment which led to investments and led the interest rate constant.

Students played the role of managers in a simplified company model were asked to maximize profits by investments. Interest rates were a key factor affecting the company's profit and loss (P&L), as investments are made with borrowed capital. The interest payments reduced the company's equity, while profits (PR) increased it. The investment decisions made by all players impacted demand, with a 50% change in demand percentage terms. The price of products was determined by the ratio of demand to capacity, considering both demand and production

capacity (PC). The price for the current period (P_t) was calculated by multiplying the previous period's price (P_{t-1}) by the ratio of demand to capacity (D/PC). The game began with a balanced demand and supply, and production capacities were reduced by 40% each round due to depreciation.

Each company must make profit-maximizing decisions about its investments, which will likely be influenced by profits, as suggested by Kaldor's theory (1940). However, in reality, there are delays in expanding production capacities, as Kalecki's model (1935) also assumed. Managers are responsible for procuring production equipment and integrating it into the manufacturing process. In our simulation, investments totaling 2.5 million euros over two game rounds resulted in a 50,000-unit increase in production capacity (PC) over two rounds (years). This increase led to an additional 1 million euros in sales revenue at a price of 20 euros per unit, representing a 40% increase in the price of 50 euros per unit of production capacity (calculated as $PC_{t+2} = PC_t + I_t/50$). Once production facilities were installed, they became permanent fixtures, making the capacity increase irreversible.

Initially, the test subjects had a turnover of 10 million euros (sales) and an equity of 10 million euros. At a price of €20 per unit and production costs of €15 per unit, they sold 500,000 units of production capacity, resulting in a profit of €1.9 million (profit = sales - production costs - capital costs, PR = S - PC - CC). The capital cots were the borrowing costs of €600,000 at an interest rate of 3%. The interest rate was kept constant during the 10 rounds by the passive central bank. The maximum profit in the group resulted in 10 euros in real money as variable manager remuneration for the students.

3.3 Experiments A and B Together: Distribution Effects Are the Central Trigger of Business Cycles

If hypothesis A and B are confirmed the Wicksell distribution hypothesis is also confirmed: "The distribution effects of real interest rate gaps are the driver of the economic fluctuations caused by the central banks."

4. Results

4.1 Experiment A: Interest Rate Formation on the Capital Market with Inflation

Inflation rose from 0% to 16% in round 5 and then fell back to 0% (see Fig. 1). Savers were initially surprised by the rising inflation, but then pushed through ever higher interest rates (see Fig. 2), so that the distributional advantages diminished (Fig. 3 and 4). When inflation fell, the distributional effects were reversed, as interest rates fell more slowly than inflation, putting companies at a disadvantage. In the end, inflation was the same as at the beginning, but interest rates were significantly higher.

Real interest rates (the difference between the nominal interest rate and the inflation rate) fell as long as inflation rose (Fig. 2). When the trend reversed from round 5 onwards and inflation fell, real interest rates rose disproportionately due to the now higher inflation expectations of savers. As a result, the real interest rate gap also increased. Seen in this way, inflation led to savers being able to push through a risk buffer in interest rates, as the rise in interest rates over the 10 rounds is higher than inflation. Inflation led to a higher real interest rate in the game. Inflation initially favored companies in the distribution and disadvantaged savers. However, this was later reversed (Fig 3 and 4). The same result was obtained when savers were informed about inflation with a delay of two rounds (years), i.e. with a greater time lag. However, the reaction was even stronger.

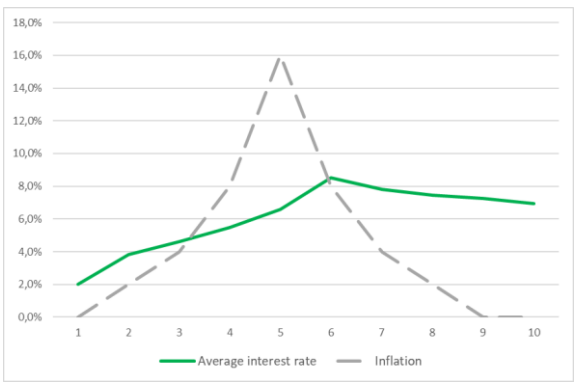

Figure 1a. Average Interest rate and inflation (one round)

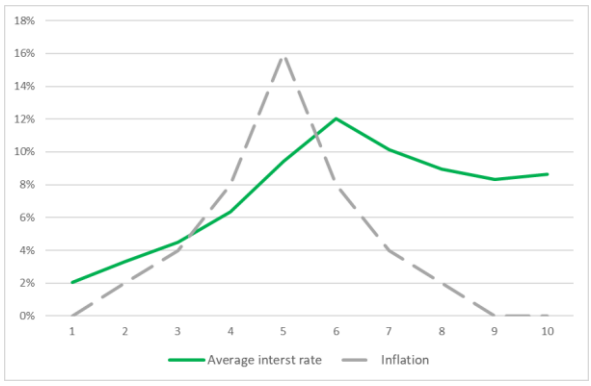

Figure 1b. Average Interest rate and inflation (two rounds)

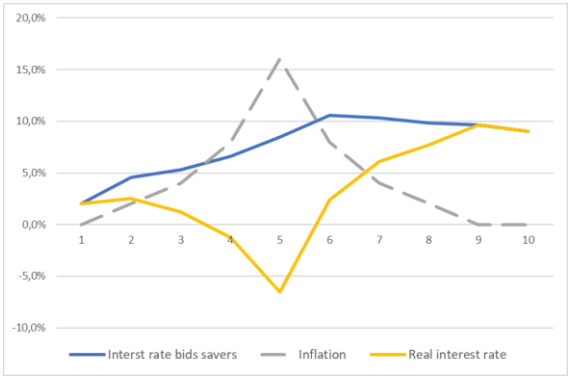

Figure 2a. Interest rate bids savers, inflation and real interest rate (one round)

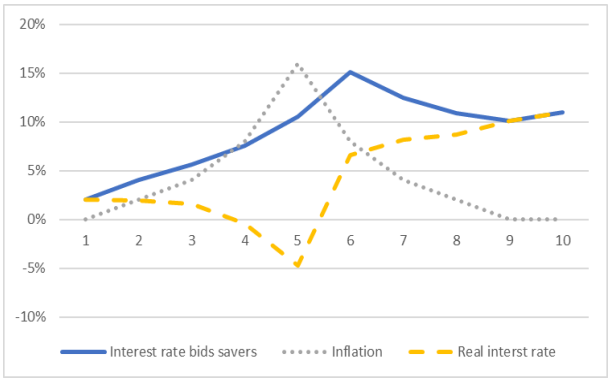

Figure 2b. Interest rate bids savers, inflation and real interest rate (two rounds)

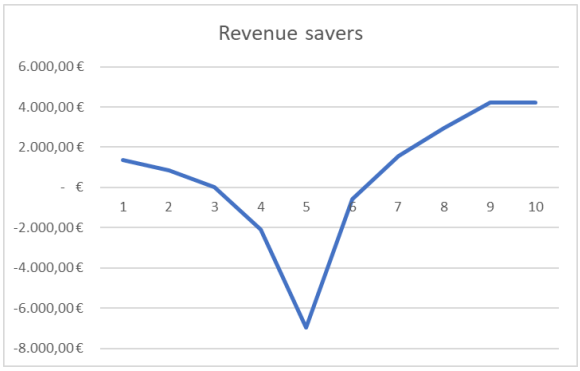

Figure 3a. Revenue savers (one round)

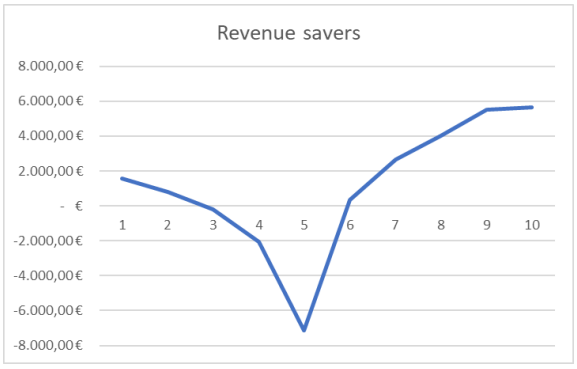

Figure 3b. Revenue savers (two rounds)

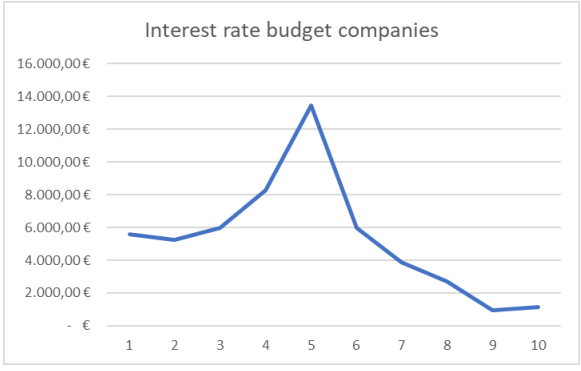

Figure 4a. Interest rate budget companies (one round)

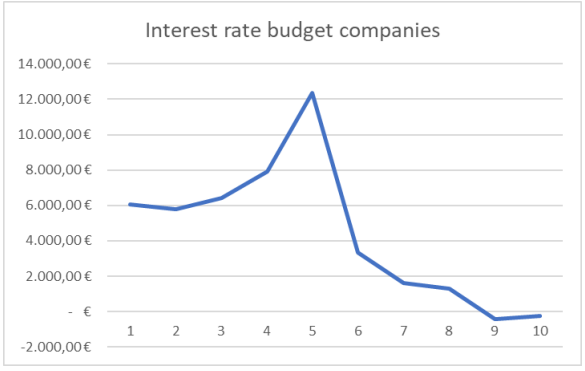

Figure 4b. Interest rate budget companies (two rounds)

4.2 Experiment B: Real Interest Rate Gap and Economic Development

In game B, savers had no influence on their interest rates, as the central bank sets interest rates through its interest rate policy. The central bank did not react to inflation and did not raise interest rates as part of a low interest rate policy or QE policy. Investment was positive from the outset. The positive demand trend led to price increased. The price increased (Fig. 5) and caused real interest rates to fall. Until round 6, there was a negative real interest rate and thus a real interest rate gap, why unit profits to rose. The increased unit profits triggered investment (Fig. 6 and 7). There was an upswing. Growth was generated (Fig. 8). As capacities did not increase at first, prices continued to rise and so did profits. The managers only saw their P&L. The increase in demand led to price increases with initially constant capacities until round 6. The companies' profits increase. In microeconomic terms, the manager consistently decides to increase capacity in order to increase sales and thus profits. Investments increase and demand continues to rise. The investment gestation period is the time required from raising capital to implementing the new equipment in production. Capacity therefore increased two rounds later in order to adjust

supply to demand. This is why the price and therefore the profit continue to rise at first and the managers invested even more. Then, after two rounds, the capacity expansions come onto the market as additional supply. Prices fell from round 7 and real interest rates rose, which is why unit profits also fell. Companies invested less beginning in round 7, leading to a downturn (Fig. 9). This led to bankruptcies, resulting in negative equity (see Fig. 8). Consequently, the market equilibrium would be restored as the reduced supply adjusted with the exit of these companies.

Figure 5. Price

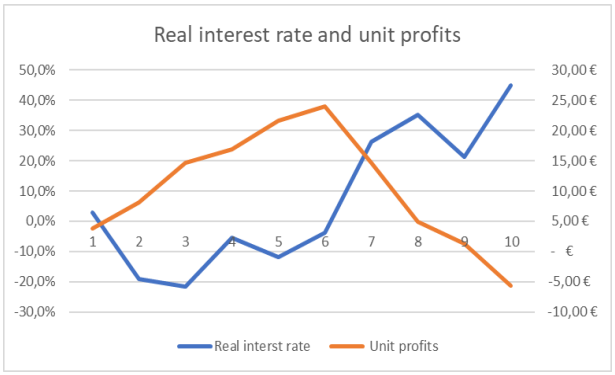

Figure 6. Real interest rate and unit profits

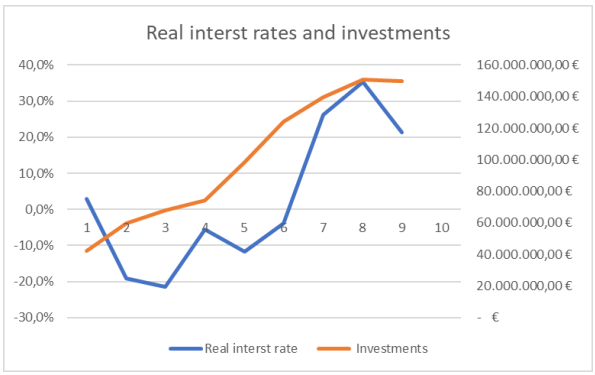

Figure 7. Real interest rate and investments (without round 10)

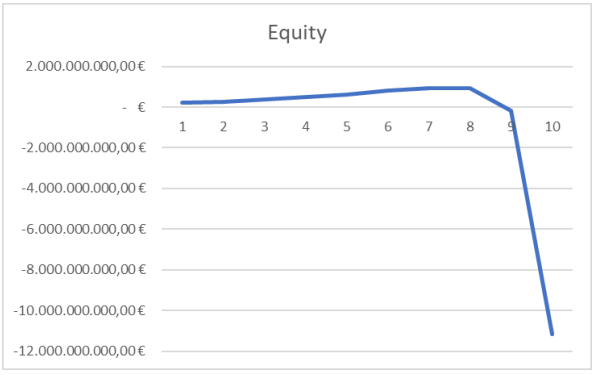

Figure 8. Equity

Figure 9. Sales or GDP

6. Conclusion

The task of this paper was to test the interest lag hypothesis, which claims that the creditor suffers losses from unexpected inflation because of the devaluation of his capital purchasing power and the fixed interest rates. This was confirmed by the behavioral experiment A. In addition, we tested in game B if inflation caused by an expansive monetary policy potentially leads to an artificial reduction of the real interest rate, thereby serving as an economic stimulus. The Marshall hypothesis was also confirmed: the expansion of bank lending increased the

money supply, boosting expenditure and further driving up prices in a potentially continuous process. Therefore, the implementation of expansive monetary policy (low interst rate or QE policy) by central banks led to an artificial reduction of the real interest rate, thereby serving as an economic stimulus. Experiment A and B together confirmed the Wicksell distribution hypothesis: the distribution effects of real interest rate gaps were the driver of the economic fluctuations caused by the central banks.

In game A, inflation in the distribution initially favored companies and disadvantaged savers. However, this was reversed. Savers were initially surprised by the rising inflation. As a result, the real interest rate gap (the difference between the long-term average interest rate and the current real interest rate - also increased. The interest rate bids of the savers remained below the inflation rate for a long time. However, savers then pushed through ever higher interest rates, so that the distributional advantages diminished. The real interest rates fell as long as inflation rose. When the trend reversed from round 7 onwards and inflation fell, real interest rates rose disproportionately due to the now higher inflation expectations of savers. When inflation fell, the distribution effects were reversed, as interest rates fell more slowly than inflation, putting companies at a disadvantage.

As a result, the real interest rate gap also fell. In the end, inflation was the same as at the beginning, but interest rates were significantly higher. Inflation led to savers imposing a risk buffer on interest rates, as the rise in interest rates over the 10 rounds was higher than inflation. Inflation led to a higher real interest rate. Inflation is therefore in the long run detrimental to growth. In economic terms, inflation therefore initially had a positive stimulus effect but then a negative one as savers pushed through higher interest rates. This result is in line with the empirical findings of other researchers (presented in section 2) that low inflation supports positive economic development in the short term.

The same result was obtained when savers were informed about inflation with a two-round (year) delay, i.e. a longer time lag. However, the reaction was even stronger. How could this be explained? The longer it takes for inflation expectations to be corrected, the longer it takes for them to adjust their interest claims upwards and the greater the disadvantage for savers in terms of the distribution effect. They therefore try to correct the disadvantage all the more later. In economic terms, inflation initially had a positive but then a negative effect because savers later pushed through higher interest rates.

In game B, savers no longer had any influence on interest rates, as the central bank sets interest rates through its interest rate policy and provided unlimited money at this interest rate. The central bank did not react to inflation and did not raise interest rates as part of an expansionary monetary policy. Thus, the savers were forced to accept their loss of purchasing power, which increased profits and thus financed the upswing. Due to inflation, there was a negative real interest rate and thus a real interest rate gap, why unit profits rose. The increased unit profits triggered the investment. There was an upswing. Growth was generated. Therefore, the central bank was able to reinforce the reduction in real interest rates and, in the longer term, a real interest rate gap by setting the interest rate. By this strategy, the central bank stimulated the economy at the expense of savers. Seen in this light, the positive economic effect of a low interest rate policy or a QE policy is essentially due to a redistribution policy at the expense of savers. Savers subsidize the expansion of corporate capacity. However, the outcome of Game B also points to the danger of overstimulation. Boom and bust cycles can arise. And, due to rising prices, several companies (players) invested too much and later went bankrupt.

In addition, saving is created by renunciation of consumption. Savers will have to compensate for the decreased purchasing power of their interest income if they save for future expenses (e.g. pensions). This would then lead to a fall in demand, thus a negative economic stimulus. And if savers stop saving in response to the fall in real interest rates, there would be too little supply for the increased demand for investment, which would lead to excess demand on the goods market and thus to further inflationary pressure. To sum it up, our experiments show, that low interest rate policy or QE policy is ineffective in the long run and unfair in terms of distribution policy.

Authors Contributions

Christian A. Conrad was responsible for all phases of manuscript production and also read and approved the final manuscript.

Funding

There are no grants or financial support to declare.

Competing Interests

The author declares that he is not aware of any competing financial interests or personal relationships that could influence the work in this paper.

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