

Wage Bargaining and Inflation: Perception Thresholds in the Labor Market and the Impact on Distribution and Economic Development – Evidence From Two Behavioral Experiments

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Abstract

This paper examines the effects of inflation on both worker and employers wage bargaining on the labor market and the impact on distribution and economic development through two behavioral experiments. The findings of experiment A support the wage lag hypothesis, indicating that inflation alters the distribution, favoring companies while disadvantaging workers. Later workers then enforced higher wages, which overcompensated the expansionary effect, why expansive monetary policy which result in inflation is likely to be ineffective over the long term, detrimental and unfair. Experiment B explored how workers respond to inflation in wage demands and found that they do not act rationally. Instead, there were perception thresholds, showing that wage adjustments happen first disproportionately in reaction to inflation and then abrupt. This challenges the rationality assumption in DSGE-models.

Keywords: labor markets, inflation, distribution, behavioral economics, monetary policy, wage lag hypothesis, DSGE-models, Phillips curve, business cycles

1. Introduction

The New Keynesian macroeconomics has been key in developing dynamic stochastic general equilibrium models (DSGE), which assume rational behavior and are utilized by central banks and policy-making institutions globally (Gali 2018). Stiglitz (2018) criticizes the DSGE-models for their inadequate microfoundation, which overlooks essential elements of economic behavior. The focus of the behavioral approach of this paper is the wage lag hypothesis (Verbic, 2001). The wage-lag theory posits that nominal wages, representing a relatively fixed portion of income, trail behind changes in prices. In times of inflation, wage adjustments lag behind price increases, granting entrepreneurs greater excess profits. Consequently, unexpected inflation distributes purchasing power from workers to entrepreneurs, exacerbating income and wealth inequality (Kessel, 1956; Kim & Lin, 2023). Due to the lower real wage and thus the higher profit, entrepreneurs demand more labor and invest in production, which leads to higher employment and an upturn in the economy, which is the topic of the Phillips curve. This paper examines the effects of wage bargaining on the labor market and the impact on distribution and economic development by means of two behavioral experiments. Do workers react rational and what are the effects for distribution? Section 2 reviews the literature. Section 3 delves into the experimental design, while sections 4 and 5 outline the results and conclusions, respectively.

2. Related Literature

The neoclassical-monetarist perspective posits that price increases are solely driven by monetary factors. In this view, excessive central bank money supply or unusually low interest rates directly result in inflation, with no consideration for the concept of money illusion (Friedman & Schwartz, 1963). On the other hand, there is the Keynesian approach, which is based on the 'Phillips curve', the negative relationship between unemployment and inflation, where monetary policy can combat unemployment and create growth. The original 1958 Phillips curve, derived from UK data spanning 1861 to 1957, depicted the correlation between average nominal wage increases and the unemployment rate. Samuelson and Solow (1960) altered the relationship between inflation and unemployment. Subsequently, Friedman (1968) and Phelps (1968) demonstrated that over the long term, the link between inflation

and unemployment dissipates, rendering the Phillips curve vertical. It is now widely accepted that the central bank can solely influence non-structural unemployment. Monetary interventions beyond this with structural unemployment only result in inflation without a corresponding reduction in unemployment (Zanetti, 1998). Behavioral science (Conrad, 2023) confirmed the Phillips hypothesis, demonstrating through experiments that inflation temporarily reduces unemployment, especially when wages are assumed to be inflexible in the short term. Consequently, a central bank could combat unemployment by adopting an inflationary, expansionary monetary policy to stimulate growth.

Inflation reduces the real wage, thus the labor cost of production. The Goodwin model (1967) centers on the feedback loop connecting income distribution, business cycles, and employment. This link is propelled by the shifting dynamics of bargaining power between labor and capital. With increasing employment, workers wield greater bargaining power, resulting in a rise in their income share. Conversely, when unemployment surges, workers experience a decrease in bargaining power, leading to a decline in their share of income. Barbosa-Filho and Taylor (2006) examined the US economy from 1929 onwards, uncovering consistent counterclockwise cycles involving capacity utilization (on the horizontal axis) and the labor share (on the vertical axis). In the US context, the labor share increased in tandem with capacity utilization. Changes in the profit share were determined by real wage levels and labor productivity. Moura and Ribeiro (2013) investigate the Goodwin growth-cycle in Brazil, utilizing both the original Goodwin model and an extension proposed by Desai et al. (2006). The results demonstrate a partial alignment, both qualitatively and quantitatively, with both models over the studied timeframe. Additionally, the authors scrutinize specific aspects where the Goodwin dynamics require refinement to provide a more precise depiction of economic system dynamics.

But what does that mean for the distribution? Dutt (1992) emphasizes that inflation affects the relative bargaining power of the workers and capitalists. The leverage in negotiations impacts income distribution, consequently shaping the accumulation dynamics within the economy. This, in turn, influences the shifting balance of bargaining power between workers and capitalists over time. In this model, cyclical growth ensues, driven by fluctuations in real wages influenced by shifts in labor and goods market conditions, affecting the rates of wage and price changes.

Concerning inflation, individuals who are already disadvantaged typically experience greater hardships compared to any benefits they may receive. Easterly and Fischer (2001) analyzed polling data from 38 countries, encompassing 31,869 households and adjusting for country-specific effects and found that that individuals with lower income levels suffer more from inflation compared to their wealthier counterparts, also due to real wage decreases. Kim and Lin (2023) found that inflation decreases wage and salary earners more in countries with less advanced financial sectors. Kim and Lin (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.

Albanesi (2007) suggests that households with lower incomes tend to hold more of their total spending in cash reserves, which leaves them more susceptible to the negative impacts of inflation. Moreover, disparities in labor productivity contribute to inequality, further diminishing their ability to negotiate for better conditions. In their study spanning from 1970 to 2019, Kim and Lin (2023) examined both developing and developed nations. They found that unexpected inflation exacerbates income inequality by diverting income away from wage earners and savers towards profits. This is facilitated by the decrease in the real interest rate, which enables entrepreneurs to repay their debts with devalued currency. Consequently, wealth inequality widens as affluent entrepreneurs, who often constitute a significant portion of the wealthy, benefit from unexpected inflation, while lower and middle-income households, primarily savers, bear the brunt of the consequences (Kim and Lin, 2023).

There is also support for the wage lag hypothesis. Jordà and Nechio (2023) analyzed the effects of monetary stimuli post-Covid-19. They found that a 5% increase in money supply led to an initial inflation rise of approximately 0.1%, escalating to 1% after one quarter, over 2% after two quarters, and peaking at nearly 3% after four quarters. Their calculations revealed that inflation reacts slightly faster than wages, with the multiplier ratio eventually stabilizing around one. Additionally, they observed that wages respond to inflation expectations, albeit at a slower pace. Given the relatively sluggish response of expectations thus far, the impact on wages has been relatively moderate.

However, the distributional effects of inflation are disputed among researchers. There is also the opinion, that through stimulating real economic activity and reducing unemployment, monetary easing disproportionately benefits low- and middle-income households, as they are more susceptible to unemployment during recessions (Mitman, Broer & Kramer, 2022) and derive a larger portion of their income from wages. The significance of these channels has been emphasized in both academic literature (Ampudia, Slacalek, Vermeulen & Violante, 2018; Lenza &

Slacalek, 2018). 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. This is because while high-wealth households benefit from rising stock prices, middle-wealth households benefit from increasing house prices. The stimulating impact of QE on aggregate consumption is enhanced both by its disproportionate boost to incomes in the lower part of the distribution and by the stronger effect this impulse has on consumption due to the higher Marginal Propensity to Consume (MPC) of constrained households. Yang (2025) examined optimal monetary policy guidelines within a quantitative model featuring heterogeneous agents in a New Keynesian framework. In this model, inflation impacts households differently due to their distinct consumption patterns, nominal wealth holdings, and sensitivity to economic cycles. Yang discovered that when the central bank accommodates stronger demand and higher inflation, it benefits low-income and low-wealth households by devaluing nominal debt and fostering increased earnings growth. Cutler et al. (1991), Mocan (1999), Coibion et al. (2017), Lorenzo Menna and Patrizio Tirelli (2017), Furceri et al. (2018) and Berisha et al. (2022) demonstrate either a reduction in income inequality or the absence of a significant impact from inflation.

Also, we look for inflation perception thresholds in the labor market. López-Villavicencio, A., & Mignon, V. (2011) examined how inflation impacts growth across a broad range of countries. They found that the detrimental effect of inflation starts with 17.5% for emerging economies but with 2.7% for developed economies. In developed nations, inflation promoted growth when below 2.7%. Sarels' (1996) study investigated the nonlinear impacts of inflation and uncovers evidence of a notable structural break. The break point is estimated to occur when the inflation rate reaches 8 percent. Below this threshold, inflation exhibits no discernible effect on growth, or it may even yield a slightly positive impact. Conversely, when the inflation rate surpasses 8 percent, the estimated effect of inflation on growth rates becomes significant, robust, and exceedingly influential. Inflation therefore does not appear to have a linear effect.

To sum it up, the effects of inflation are not clear. Against this background, we applied two behavioral experiments as an alternative research method to test the wage lag hypothesis. Behavioral modeling aims to sketch out the economic framework that guides behavior in various contexts, recognizing its departure from an exact portrayal of reality. In contrast to traditional economic modeling, which relies heavily on mathematics and assumes rational behavior, behavioral modeling utilizes experiments to explore behavior, striving for a more accurate reflection of real-world dynamics. These models concentrate on the pertinent factors that influence decision-making and examine the sociological interactions among multiple actors. Within these models, behavioral hypotheses are formulated and tested using human subjects, with the experimental design meticulously outlined for replication by other researchers. Following Popper's philosophy (1958), these hypotheses remain valid until contradicted by experiments yielding different results. The identified behavioral tendencies can then become foundational for the development of new economic theories and policy strategies (De Grauwe, 2019, Conrad 2022, 2024).

3. Experimental Design

The wage lag hypothesis had to be tested: wage adjustments lag behind price increases, granting entrepreneurs greater excess profits.

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, summer semester 2023 and the winter semesters of 2024/25. MS Teams and Excel were used as primary tools. The study A enlisted a cohort of 148 different participants (72 in game AA and 76 in game AB), divided into ten groups and study B enlisted a cohort of 103 different participants in game BA and 104 in game BB, divided into eight groups, drawn from diverse Business Bachelor programs such as macroeconomics and political economy at the University of Applied Sciences HTW in Saarbrücken. Prior to commencing the experiment, participants were provided with comprehensive explanations regarding the experiment's regulations.

Game A: Inflation and wage formation in the labor market

The players were divided into two groups: workers, i.e. suppliers of work, and companies, i.e. demanders of work. The employees had to sell 1,000 hours per round and the companies had to buy 1,000 hours and had a budget of 30,000 euros per round. They could increase or decrease their bids by a maximum of 10% per round. We started with 0% inflation and a wage of 30 euros. The employees whose wage bid was above the average bid wage could sell 20% of the 1,000 hours at their wage bid, those whose wage was below could sell 100% at their wage bid. The missing 80% was then calculated using the employers' average wage offer. The companies had to buy 1,000 working hours per round with their budget of 30,000 euros and the employees had to sell 1,000 working hours. The companies whose wage bid

was higher than the average wage bid of all companies received 100%, those whose price was lower received 20% of the requested working hours at their wage bid and 80% at the lower average wage bid of the employees. This aligns with the dynamics of the market: individuals willing to pay more than the average price receive the product promptly, while those offering below-average prices must eventually acquiesce to the suppliers' pricing. Sellers offering below the average price make immediate sales, while those above it have to yield to the demands of buyers and accept their price offers.

The game master conveyed inflation information to the participants at the round's conclusion, which affected the outcome by reducing wages according to the inflation rate. This reduction applied to both what the entrepreneur paid as demander and what the provider, or the worker, received during the same round in Experiment AA, with a comparable one-year time lag from the previous round, or in Experiment AB, with a comparable two-year time lag. This adjustment thus corresponded to the impact on purchasing power.

Game B: Inflation reaction on the labor market

The aim was to determine the reaction of employees to inflation. The experimental design was the same, but the inflation changes were more subtle. First, inflation was increased in Game BA by 0.5% per round in absolute terms and then in Game BB by a relatively constant 40% per round. Do employees react rationally by adjusting their wage demands proportionally to inflation or are there perception thresholds at which they react more strongly? The prevailing research opinion is still the assumption of rational behavior. We therefore formulate the hypothesis that the reaction of workers is proportional to the increases in inflation.

4. Results

Game A. Labor market and inflation

Inflation rose from 0% to 16% in Round 6 and then subsequently fell back to 0% (see Figure 1). Initially, the workers were surprised by the rising inflation but then pushed for increasingly higher interest rates (see Figure 2), leading to a decrease in distribution advantages. The wage lag hypothesis had to be tested: wage adjustments lay behind price increases, granting entrepreneurs greater excess profits. The hypothesis was confirmed. When inflation fell, the distribution effects reversed, as interest rates decreased more slowly than inflation, putting companies at a disadvantage. Economically, inflation initially had a positive impact but later turned negative, because workers later enforced higher wages. In the end, inflation was the same as at the beginning, but wages were significantly higher. Real wages (the difference between nominal wages and the inflation rate) declined while inflation was rising. Once the trend reversed starting in Round 7 and inflation fell, real wages increased disproportionately due to the now heightened inflation expectations of the workers. From this perspective, inflation led workers to enforce a risk buffer in their wages, as the rise in interest rates over the 10 rounds was higher than inflation. Therefore, inflation resulted in a higher real wage in the game. Initially, inflation favored companies in terms of distribution and disadvantaged workers. However, this later reversed (see Figures 4 and 5). The same result occurs when workers are informed about inflation with a delay of two rounds (years), meaning a greater time lag. However, the reaction is even stronger.

Results one Round

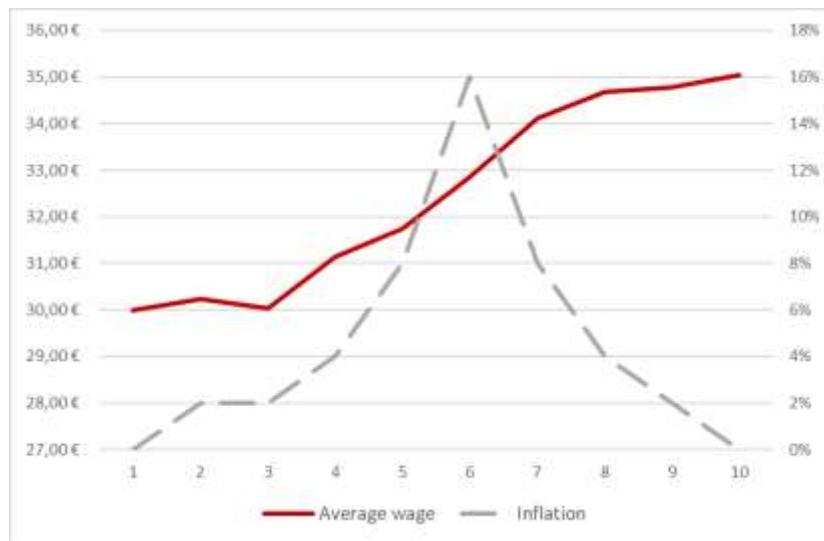


Figure 1a. Average wage and inflation (one round)

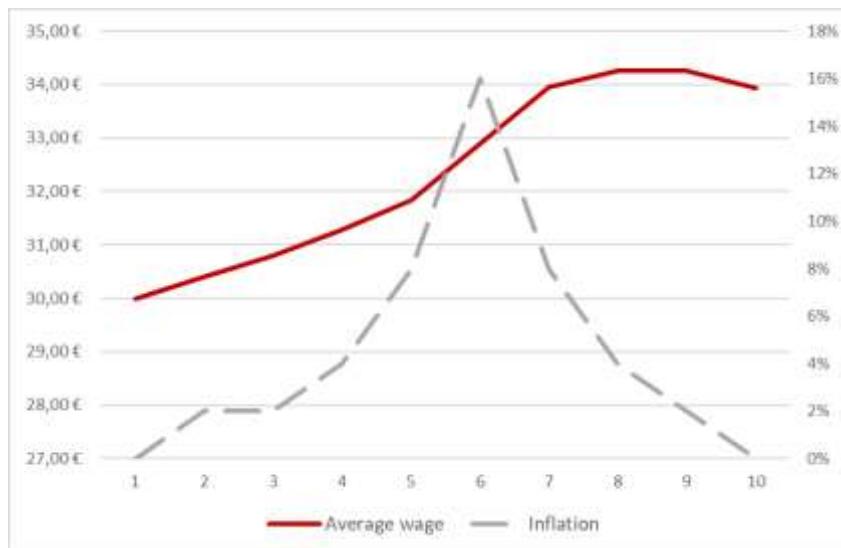


Figure 1b. Average wage and inflation (two rounds)

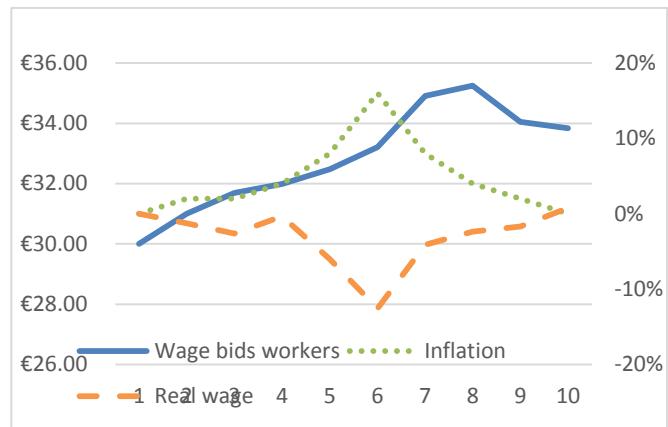


Figure 2a. Wage bids workers, inflation and real wage (one round)

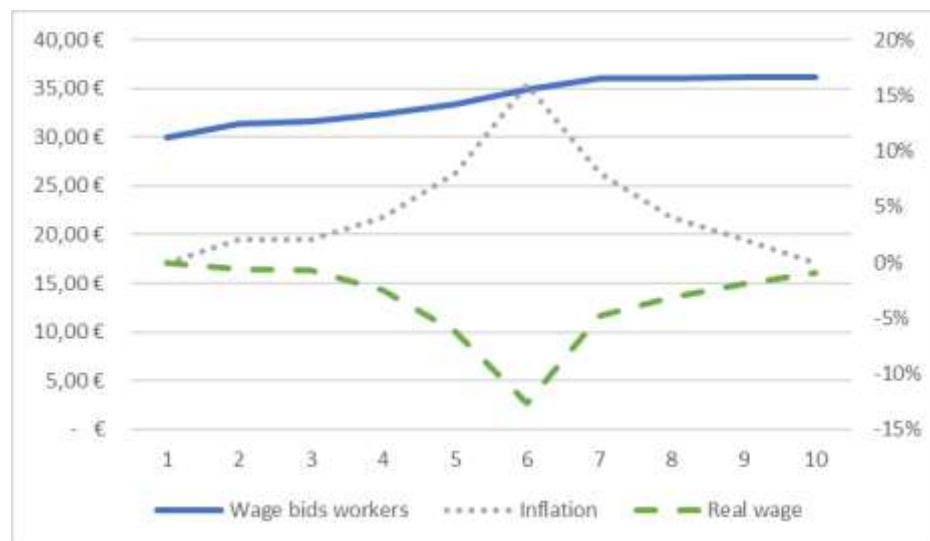


Figure 2b. Wage bids workers, inflation and real wage (two rounds)

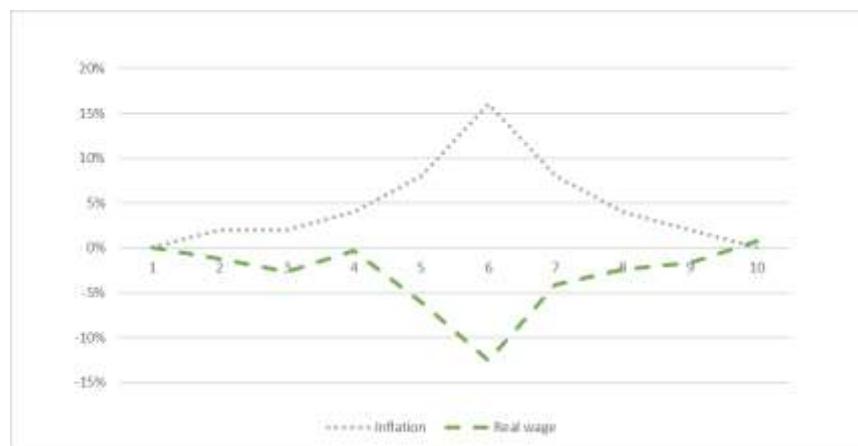


Figure 3a. Inflation and Real wage (one round)



Figure 3b. Inflation and Real wage (two rounds)



Figure 4a. Earnings workers (one round)



Figure 4b. Earnings workers (two rounds)

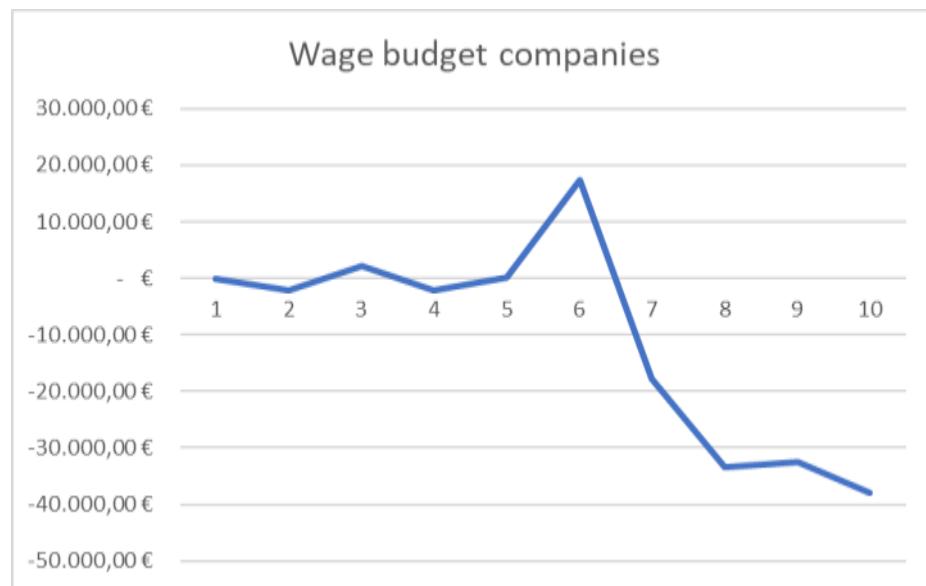


Figure 5a. Wage budget companies (one round)



Figure 5b. Wage budget companies (two rounds)

Game B

The reactions of labor providers, i.e. employees, to wage demands in response to inflation were not rationally delayed by one round. At the beginning, when the inflation rate rose from 0.5 to 1 percent, there was a disproportionate reaction. Here, the equilibrium wage first had to settle in line with the negotiating positions. After that, a habituation effect seems to have set in because the reaction was disproportionately low. There were disproportionate reactions in the 4th round when inflation had previously risen from 1.0 to 1.5%, in the 8th round when inflation had previously risen from 3.0 to 3.5% and in the 10th round when inflation had previously risen from 3.0 to 3.5%. The economic actors reacted to inflation with a delay and then more strongly. There were inflation perception thresholds at 1.5%, 3.5%, and 4.5% (see Tables 1 and 2 and Figures 6 and 7).

Game BA

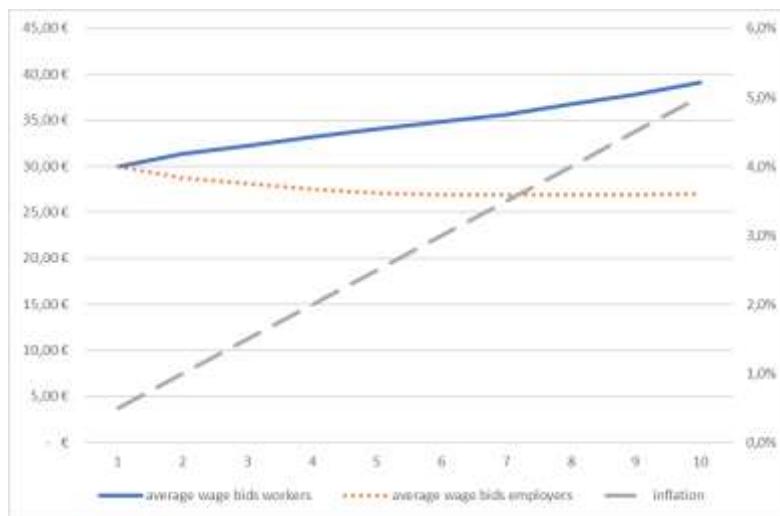


Figure 6. Average bids

Table 1. Average bids

	average wage bids workers	average wage bids employers	average wage	inflation
round 1	30,00 €	30,00 €	30,00 €	0,5%
round 2	31,36 €	28,72 €	30,01 €	1,0%
round 3	32,19 €	28,11 €	30,11 €	1,5%
round 4	33,17 €	27,48 €	30,28 €	2,0%
round 5	34,05 €	27,10 €	30,52 €	2,5%
round 6	34,87 €	26,94 €	30,84 €	3,0%
round 7	35,66 €	26,92 €	31,22 €	3,5%
round 8	36,72 €	26,86 €	31,72 €	4,0%
round 9	37,76 €	26,91 €	32,25 €	4,5%
round 10	39,08 €	26,96 €	32,92 €	5,0%

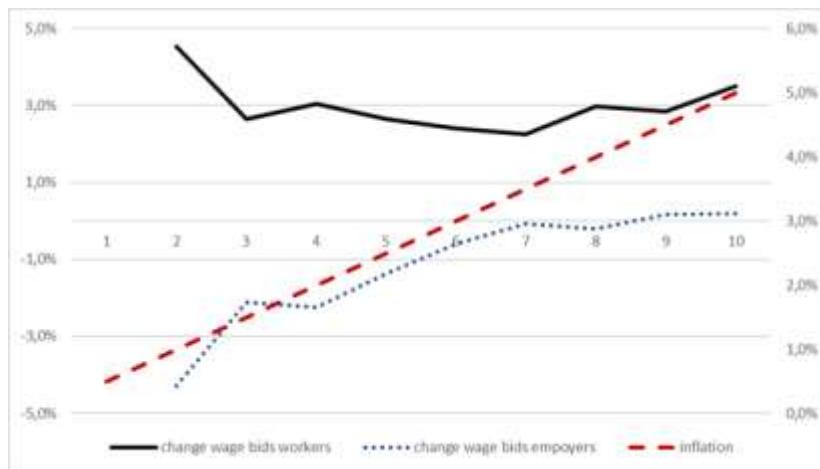


Figure 7. Relative bids

Table 2. Relative bids

	change wage bids workers	bids employers	inflation
round 1			0,5%
round 2	4,53%	-4,28%	1,0%
round 3	2,65%	-2,12%	1,5%
round 4	3,05%	-2,24%	2,0%
round 5	2,65%	-1,38%	2,5%
round 6	2,41%	-0,60%	3,0%
round 7	2,26%	-0,08%	3,5%
round 8	2,98%	-0,20%	4,0%
round 9	2,84%	0,18%	4,5%
round 10	3,49%	0,19%	5,0%

Game BB

In the second game BB, the inflation rate was constantly increased by roughly 40%. Here, too, the reaction was disproportionately low and not rationally proportionally delayed by one round. Initially, the labor suppliers reacted disproportionately less and from round 6 onwards disproportionately more. In this case, the equilibrium wage first had to settle in line with the negotiating positions. As before, the worker only reacted disproportionately in the sixth round, after inflation had risen to 2.69% in the previous round (see below). Thus there was a perception threshold at 2,69%. Afterwards the wage reaction was stronger as the absolute inflation increases were much higher. The hypothesis that the reaction of workers is rational thus proportional to the increases in inflation was not confirmed. The workers did not adjust their wage proportionally. Thus the hypothesis was falsified (see Tab. 3 and 4 and Fig. 8 and 9).

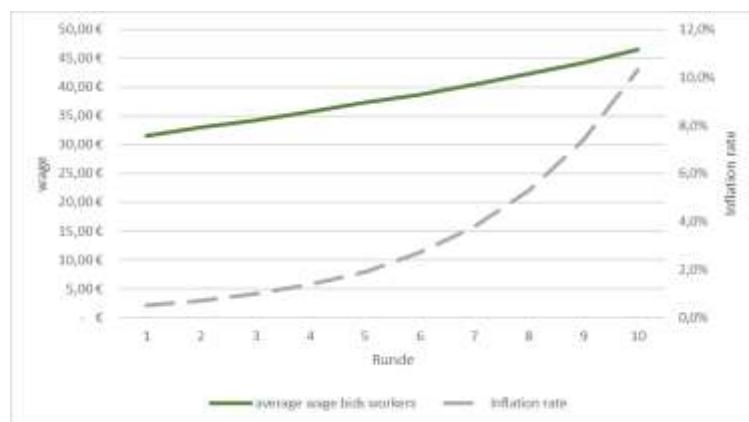


Figure 8. Absolute bids

Table 3. Absolut bids

	average wage bis workers	average wage bids employers	average wage	inflation
round 1	30,94 €	29,25 €	30,00 €	0,50%
round 2	32,25 €	28,52 €	30,25 €	0,70%
round 3	33,23 €	28,28 €	30,60 €	0,98%
round 4	34,23 €	28,02 €	30,93 €	1,37%
round 5	35,27 €	27,82 €	31,33 €	1,92%
round 6	36,27 €	27,85 €	31,81 €	2,69%
round 7	37,46 €	27,80 €	32,35 €	3,76%
round 8	38,78 €	27,59 €	32,87 €	5,27%
round 9	40,18 €	27,33 €	33,39 €	7,38%
round 10	41,83 €	27,18 €	34,11 €	10,33%

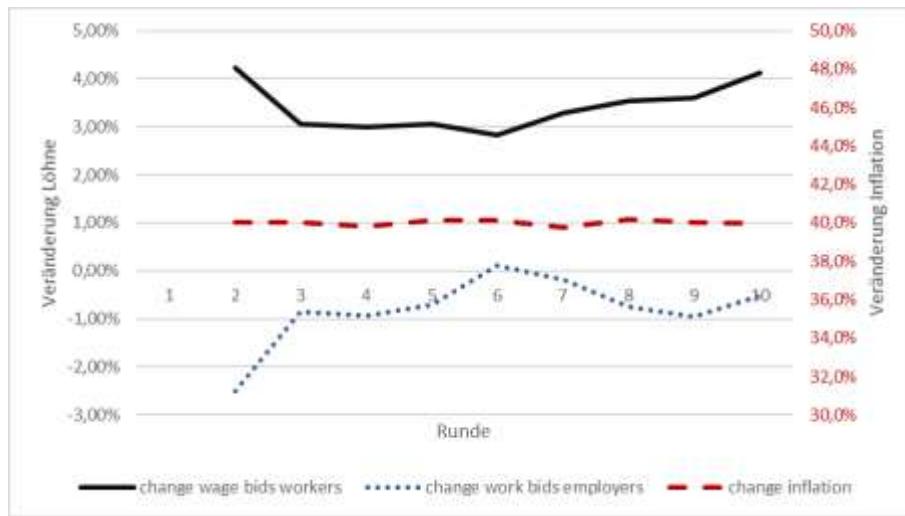


Figure 9. Relative bids

Table 4. Relative bids

	change wage bids workers	change work bids employers	change inflation
round 1			
round 2	4,23%	-2,5%	40,00%
round 3	3,05%	-0,8%	40,00%
round 4	3,00%	-0,9%	39,80%
round 5	3,06%	-0,7%	40,15%
round 6	2,82%	0,1%	40,10%
round 7	3,28%	-0,2%	39,78%
round 8	3,53%	-0,7%	40,16%
round 9	3,60%	-1,0%	40,04%
round 10	4,12%	-0,5%	39,97%

5. Conclusion

The task of this paper was to test the wage lag hypothesis, which claims that the workers suffer losses from unexpected inflation because of the devaluation of their wage purchasing power. The wage-lag theory indicates that nominal wages generally fall behind price increases. During inflation, wages do not rise at the same rate as prices, which enables entrepreneurs to gain higher profits. This unanticipated inflation transfers purchasing power from workers to entrepreneurs, increasing income and wealth inequality. Inflation resulting from expansive monetary policy can lead to an artificial decrease in real wages, functioning as an economic stimulus.

In Game A, the initial effects of inflation favored companies while placing workers at a disadvantage, though this dynamic eventually changed. Workers were caught off guard by rising inflation, which led to a decline in real wages. For an extended period, the wage offers from workers were lower than the inflation rate. As inflation continued to rise, real wages fell. The wage lag hypothesis was confirmed by the behavioral experiment A. The workers had to adapt their inflation expectations to a higher actual inflation. Lower real wages, along with higher profits, motivate entrepreneurs to hire more workers and invest in production, which can boost employment and stimulate economic growth.

Starting from Round 7, when the trend shifted and inflation began to decrease, real wages increased disproportionately due to the elevated inflation expectations among workers. As inflation declined, the distribution effects reversed; wages fell at a slower pace than inflation, disadvantaging companies. Consequently, real wages rose. By the end, while inflation returned to its initial level, wages had increased significantly. This inflation scenario allowed workers to impose a risk buffer on interest rates, with the rise in interest rates over the ten rounds exceeding inflation, resulting in a higher real interest rate. Therefore, in the long term, inflation is detrimental to economic growth. Initially, inflation provided a positive stimulus effect, but ultimately this turned negative as workers pushed for higher real wages. Wages increases more than inflation, why real wages increased to a higher level than at the beginning, why inflation after all was negative for the economic development.

A similar outcome was observed when workers were informed about inflation with a delay of two rounds (or years), leading to an even stronger reaction. This can be explained by the fact that the longer it takes to adjust inflation expectations, the longer it takes for workers to raise their wage claims, resulting in a greater disadvantage for them in terms of distribution. As a result, they are motivated to rectify this disadvantage even more vigorously later on. Economically speaking, inflation initially had a positive impact, but subsequently turned negative as workers pushed for higher wages. Assuming a real wage-dependent labor demand in light of the profit maximization objective of companies, not only has the Phillips curve been confirmed from a behavioral science perspective, but also the thesis by Friedman (1968) and Phelps (1968), which posits that over the long term, the connection between inflation and unemployment dissipates, resulting in a vertical Phillips curve. Moreover, a negative effect on employment and the economy was identified, arising from the long-term real wage increase resulting from the overshooting of wage adjustments above the inflation rate.

When central banks' expansive monetary policies lead to inflation, the subsequent artificial reduction in real wages acts as an economic stimulus. In this context, the beneficial economic outcomes associated with low interest rates or quantitative easing largely stem from redistribution mechanisms that disadvantage workers, effectively subsidizing corporate growth. The outcome of experiment A and B corroborates empirical findings from other researchers (discussed in Section 2), which indicate that low inflation supports positive economic development in the short term. In the long run the positive economic stimulus is reversed. As inflation decreased, real wages surged disproportionately because workers raised their inflation expectations. The strategy of economic stimulus comes with significant distributional consequences. While job opportunities increase, real wages decline, leading to a surge in corporate profits at the expense of workers' share in national income. In the long term, the impact of inflation may vary, particularly if workers can counteract declining real wages through wage hikes. Consequently, even with policies like quantitative easing, initiating inflation may yield negative long-term repercussions. Thus, the findings suggest that expansive monetary policy is likely to be ineffective, detrimental and unfair in terms of distribution over the long term and leading to boom-and-bust cycles.

In addition, we tested in Game B whether workers respond rationally to inflation in their wage demands. This hypothesis was falsified, and instead, perception thresholds were identified. The same absolute or relative inflation increases were perceived differently and trigger different reactions: at lower inflation rates, inflation led to weaker wage reactions than at higher inflation rates. Since central bank models assume rationality in their DSGE-models they are therefore inappropriate.

The existence of perception thresholds as a delayed wage adjustment response to increased inflation, along with a subsequent leap in wage demands as an overreaction, would explain why central banks have such difficulty managing the inflation rate. With inflation thresholds the effects of inflation are difficult for a central bank to assess. Once inflation is perceived, there are unexpected reactions, such as wage increases, which increase inflation. Inflation then lasts longer than expected. More research is needed here.

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Authors Contributions

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

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Data sharing statement

No additional data are available.

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