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Abstract

Following a period characterized by consistently low inflation, the Austrian economy experienced a remarkable acceleration in prices in 2022. This sudden surge in prices does not only pose major puzzles to politics but also provoked an intense debate among economists on the potential causes of inflation. Some economists proposed the wage price spiral as a potential explanation, while others highlighted the role of profits as a main driver of recent inflationary trends. By applying a vector autoregressive (VAR) model, we conduct a time series analysis to empirically investigate both arguments. Based on these results, we can neither confirm the existence of a wage price spiral nor the emergence of a profit price spiral on an aggregate level. However, our research does uncover a disparity between firms and workers in bearing the burden of inflation. We find that firms manage to adjust swiftly to rising inflation levels, ultimately increasing their profits - in nominal and real terms. Workers, on the other hand, merely experience moderate and delayed adjustments of nominal wages in response to price changes, leading to significant real wage losses. In line with expectations due to the nature of the inflationary crisis, we find that the energy sector has played a key role in the recent price increases. Moreover, the energy sector exhibits an exceptionally pronounced response of profits to an increase in inflation. In fact, our results point into the direction of a profit price spiral within the energy sector.

Zusammenfassung

Die Inflationsraten erreichten im Jahr 2022 in Österreich ein historisches Maximum. Diese Entwicklung stellte nicht nur politische Entscheidungsträger:innen vor erhebliche Herausforderungen, sondern entfachte außerdem eine intensive Debatte über Inflation und ihre potenziellen Ursachen. Einige Ökonom:innen griffen auf die sogenannte Lohn-Preis-Spirale als Erklärung zurück, während andere neue theoretische Ansätze entwickelten, die insbesondere die Rolle der Unternehmensgewinne in der Inflationsdebatte betonten. In dieser Arbeit untersuchen wir mittels eines vektorautoregressiven Modells beide Argumente empirisch.

Unsere Resultate deuten weder auf die Existenz einer Lohn-Preis-Spirale noch einer Profit-Preis-Spirale auf aggregierter Ebene hin. Allerdings konnten wir zeigen, dass bedeutende Unterschiede zwischen Unternehmen und Arbeitenden hinsichtlich der Bewältigung von Inflationsschocks bestehen. Basierend auf den Ergebnissen, reagieren Unternehmen vergleichsweise rasch auf steigende Preise, was ihnen wachsende, reale und nominelle, Gewinne beschert. Die Löhne der Arbeitenden dagegen reagieren weitaus rigider und mit einer bedeutenden Verzögerung auf Preisschocks. Diese Tatsache führt zu signifikanten Reallohnverlusten für Arbeitende in den ersten drei Quartalen.

Unsere Ergebnisse unterstreichen zudem die bedeutende Rolle des Energiesektors in der Inflationskrise. Obwohl diese Beobachtung aufgrund des Charakters dieser Krise intuitiv erscheinen mag, ergab sich zudem eine interessante Beobachtung: Die Profite im Energiesektor steigen als Reaktion auf Preisschocks besonders stark an. Wir finden erste Anhaltspunkte für eine mögliche Profit-Preis-Spirale im Energiesektor.

Contents

List of Figures

1 Introduction

European countries departed from a long period of low inflation rates in 2021, reaching extraordinarily high inflation levels in 2022, which has been exceeded almost 50 years ago in 1974 [Statistik Austria, 2023]. The discussions on the potential causes of inflation gained interest not only in the economic but also in the political sphere, as the need for policy measures for mitigating inflation is urgent and controversially discussed.

Phillips [1958] is a well-known economist for linking inflation rates to the unemployment rate in his empirical investigation. Subsequently, price increases have often been linked to the labor market in economics. This relationship is not only supported by several empirical investigations, but has also found its way into economic theory. Blanchard [1986] was the first and most popular economist studying inflation rates not only in a labor market context but more specifically in a wage setting context. Today, this relationship is known as the so-called wage price spiral, which has been introduced by Blanchard in his accordingly named paper "The Wage Price Spiral". Many economists studied the wage price spiral since the publication of Blanchard [1986] paper for different countries using a variety of measures and providing diverse results. Darrat [1994] for example examines the causal relationship of prices and wages using unit root and conintegration methods leading to the conclusion that wages and prices do not seem to be conintegrated over time. Similarly, Emery and Chang [1996] conclude by their findings that the link between the variables of interest is rather loose. They base their analysis on Granger Causality Tests and out-of sample forecasts. Hess and Schweitzer [2000] apply comparable methods and find similar results, according to which wage inflation does not help predicting price inflation. Instead, they find that price inflation rather causes wage increases. Regardless of these findings, there are several papers supporting the implication of a wage price spiral. Bobeica et al. [2019] find a strong link of wages and prices using data for four European countries. So does Hahn [2021] by using a Bayesian Vector Autoregressive

Model (BVAR), even though the link does not seem to be constant over time. When drawing conclusions from existing literature and research, one has to bear in mind that results might differ across countries and with time. This might be one of many reasons why most researchers working with data from the US seem to be unable to find strong evidence for a link between wages and prices. For Europe however, the existing literature provides some indication for the existence of a wage price spiral even though results are ambiguous.

Economic models, such as the wage price spiral, often serve as the basis for political decision-making. Political parties, institutions and employers' representatives have been making use of the discussions around the wage price spiral during the wage negotiations in the last fall in Austria. In this debate, they appealed to unions to hold back with their wage demands in order to avoid greater economic damage. By contrast, their political counterparts, such as workers associations and unions, argued that firms have become the main drivers of the recent acceleration in inflation through their price setting schemes. According to their explanation, companies make use of their market power and use supply shocks as an excuse to increase prices even further. This argument has also gained the interest of various researches, such as Weber and Wasner [2023]. By applying the method of the GDP Deflator Decomposition, Weber et al. indeed find evidence for a so-called "Greedflation", an inflation caused by companies setting higher prices in order to increase profits for the US. This study has been adapted to the European market by the ECB ECB [2023] and to Australia by Saunders and Denniss [2022]. They find similar results, indicating that the investigation of profit-price mechanisms might be of interest beyond the US.

In the course of this thesis we focus our analysis on Austria, where the evidence for wage-price mechanisms is scarce. There are only very few researchers, who included Austria in their investigation, such as the paper of Alvarez et al. [2022]. The discussion regarding the wage price spiral in Austria arose in 2022, where inflation climbed up to a historical maximum and the unions' demand for wage increases adjusted accordingly. At the same time, the potential share of firms increasing their profit markups as one driver of inflation gained a lot of attention in political debates. However, detailed studies on the existence of a profit price spiral in Austria have not been conducted yet. We want to fill this gap. We base our investigations on a Vector Autoregressive (VAR) model and other tools for examining causal relationships, such as the Granger Causality test. Our results do not support the existence of neither a wage price spiral nor of a profit price spiral. However, we do find evidence for significant effects of inflation on both wages and profits. We show that these effects differ in magnitude and persistence, indicating that the consequences of inflation might be borne unequally. This seems to be particularly true for the recent economic developments.

2 Link to existing Literature

2.1 Wage Price Spiral

The codependent relationship between wage increases and inflation, known as the so-called wage price spiral, is well discussed in economics and has gained interest in the past. Several researchers have studied this potential link from an empirical point of view, gaining different insights into the underlying mechanisms and dynamics. Most of the studies based their results on a lag and lead analysis, where price and wage fluctuations are being examined in a time series framework. By studying the literature, it seems rather unambiguous that wages move with prices at least to a certain degree. The evidence on actual wage-price spirals however, is scarce.

Keeping that in mind, the definition of a wage price spiral plays an important role in the actual analysis. For example Alvarez et al. [2022] define the wage price spiral as a period where three out of four quarters exhibit accelerating consumer price and nominal wages. They find 79 such periods for the 38 industrialized countries that have been included in their data set. However, they do not find strong evidence pointing into the direction of persistent effects of wage increases on prices. They claim that there are very few examples in history for periods of accelerating prices and wages, which are followed by even stronger accelerations in both variables after 8 quarters. Most of the studies conducted in that field however investigate the existence of the wage price spiral as a mutual interdependence between wages and prices across time.

Peneva and Rudd [2017] follow this approach and come up with similar results using a VAR model. They find that the predicting power of wages in determining prices has been overestimated in the past and is even becoming weaker over time (Note here that the study was conducted in 2017). Emery and Chang [1996] conduct among other methods Granger causality tests and claim that even though in periods of high inflation (pre 1980s) wage growth provided information on inflation, the predicting power of wages for inflation remains rather small. They thus conclude that policy makers should put little weight on wages when trying to mitigate inflation rates. In contrast to that Bobeica et al. [2019] gain deviating insights in their analysis on a potential wage price spiral for four major economies in the European Union: France, Germany, Italy and Spain. They derive several conclusions from their empirical investigations using a bayesian VAR (BVAR) model: According to their findings, the link between labour costs and prices is very tight across countries. Furthermore, they do not only find a strong connection between the two variables, they also identify a pass through of labor costs on prices. The intensity of the pass-through differs depending on the industry and country. In Germany and Italy for example, the service sector seems to be driving the price increases. In general, they find that the overall economic setting plays a role in determining wage effects on prices. In periods of very high inflation, the pass-trough seems to become stronger whereas in low-inflation periods the pass-trough seems to be systemically lower. Also, depending on the underlying shock, the mechanism might change. They claim that the probability of labor costs being passed on is greater if the economy faces demand shocks instead of supply shocks. Hahn [2021] supports these results with his investigation. He too, conducts a bayesian VAR (BVAR) analysis and distinguishes between two main causes of inflation: the demand-pull factor and the cost-push factor. The first explanation refers to a situation, where inflation is being induced by aggregate demand increases, which gives firms the opportunity to increase their prices. The latter explanation refers to inflation being provoked by an increase in costs, either in the form of increases in wages or material inputs, where firms pass on their costs to their consumers. Similarly, they come to the conclusion that the link between wages and prices depends on the shocks hitting the economy. According to their findings, supply shocks lead to an instant increase in wages, whereas demand shocks raise wages with a lag. Moreover, they find that the wage price pass through differs over time and that the service sector seems to play an important role.

In summary, the perspectives on the existence of wage price spirals remain controversial in economics. Several papers highlight the importance of differences across countries in this context, which emphasizes the relevance of investigating a potential wage price spiral mechanism for each country individually.

2.2 Profit Price Spiral

The sellers' inflation, in political debates and in the media often referred to as Greedflation, is a theoretical and empirical approach concerning recent trends in inflation, which has been officially introduced by Weber and Wasner [2023]. In contrast to previous papers regarding wage price mechanisms, they did not rely on time series analysis but based the investigation on the so-called GDP deflator decomposition and on microanalyses. The GDP deflator yields price increases within countries and can be decomposed into profits (including taxes) and compensation of employees. By analyzing the composition of the deflator over time, they suggest that the share of profits in overall price increases has been rising drastically since the year of 2021. Furthermore, pronounced surges in profits margins on a micro level can be observed for the same time period. The essence of this theory can be summarized as a codependent relationship between rising profits and prices in recent inflationary episodes. We will therefore refer to it as a profit price spiral throughout this thesis. The research of Weber and Wasner [2023] has gained a lot of attention and has also raised a lot of questions regarding inflation dynamics. It therefore comes as no surprise that the ECB dedicated a short study to the same research question for the euro area. Again, by decomposing the GDP deflator, it is being argued that the role of profits for explaining prices has been increasing in the years of the recent inflation crisis "we see that, most recently, the effect of profits on domestic price pressures has been exceptional from a historical perspective" ECB [2023]. Moreover, it seems that especially prices in the energy sector as well as in the agricultural sector contributed a substantial part to the observed developments in profits. The literature and research on the link between profits and inflation is scarce, despite the political and economic significance that underlie this relationship. The need for further research on that matter is urgent, as inflation poses major puzzles to economists as well as to policy makers.

3 Theory

This section provides an overview of the existing theory regarding the concept of the wage price and the profit price spiral. The wage price spiral is a thoroughly studied concept in economics with many different applications. We will split the subsection according to different approaches in explaing the wage price spiral. Subsequently we will depict the theoretical derivations of the above discussed profit price spiral, according to [Weber and Wasner, 2023] concept, in more detail.

3.1 The original Wage Price Model

Although Isabella Weber was one of the first economists to to introduce the concept of a profit price spiral from an empirical point of view, Oliver Blanchard himself did not exclude the possibility of such an inflationary dynamic. He states: "workers and firms had to understand that either real wages or profit margins or both had to decrease" in order avoid increasing levels in nominal prices Blanchard [1986]. He indicates that either workers or firms must hold back with their demands for rising real wages or real profits when the economy faces a (supply) shock. In this section, we want to get to the bottom of this argument and therefore expound his theoretical considerations in more detail.

Blanchard lays a special emphasis on the effects of changes in demand when constituting his model on the wage price spiral. He assumes monopolistic competition for the most part of his augmentations, as firms as well as unions are supposed to act as price/wage setters. He introduces different types of labor j, each represented by corresponding unions. Furthermore, the model is based on a multiple goods market, produced by different firms. He introduces variables for prices p_t, wages w_t, real money balances $\frac{M}{P}$ and elasticties θ, σ. Aggregate output for good i is defined as

$$Y_i = K_y \frac{M}{P} (\frac{P_i}{P})^{-\theta} \tag{1}$$

According to this formula, output depends on a constant,K_y, yielding technology and utility, the real money balance and the nominal price for good i, given the overall price level p. θ yields the price elasticity of demand for good i. Similarly, we can derive the labor demand of type j:

$$N_j = K_n \frac{M}{p}^{\alpha} (\frac{W_j}{W})^{\sigma} \tag{2}$$

where labor demand again depends on a constant K_n, on the real money balances and on the wage level W_j for labor of type j relative to the remaining wages W. α refers to the elasticity of labor demand with regard to real money balances and σ yields the wage elasticity of demand for the firms. By rearranging both of these equations, Blanchard deducts that an increase in wages shifts the marginal costs curve upwards, resulting in price increases. So does a rising level of real money balances as it stimulates demand. Furthermore it becomes clear that an increase in overall real wages $\frac{W}{p}$ leads to the unions' desire to further increase labor supply, ultimately leading to decreasing relative wages $\frac{W_j}{W}$. If however real money balances denote a raise, labor becomes more attractive, indicating an increase in relative wages W_i. The bottom line of the given theoretical considerations is the fact that an increase in real money balances raises both markups and real wages.

We can now describe the process of a shock in real money supply. As a first step aggregate demand is being stimulated, leading to rising levels of output and employment. By observing this process, unions will demand higher real wages, $\frac{W}{P}$, whereas firms will attempt to raise the markups $\frac{P}{W}$. Of course it is not feasible for both variables to increase simultaneously. Thus, the process will result in rising nominal wages and prices until eventually relative real money balances return to their previous level.

We have now laid a focus on the equilibrium conditions in a fully flexible wage and price environment. We will now introduce rigid wages and prices and we shall see that the dynamics in the model undergo some changes. In order to properly introduce staggering prices, the assumption of discrete time is required. All firms choose prices simultaneously and in an equal manner. The according prices are defined as p_t chosen in t for the period t and $t+1$. The price level depends on nominal money m_t and the lagged wage level w_{t-1}, again chosen in $t-1$ for the period $t-1$ and t. According to the described definitions, we state that prices and wages are equally flexible and are chosen every two periods. Note that, in contrast to the previous equations, we will now consider the logarithm version of our variables, denoted in lowercase letters. We refer to expectations, given the information at time t, as $E(|t)$. The equation is given in the following:

$$p_t = 1/2 * [(a * w_{t-1} + (1-a)m_t + (a * E(w_{t+1}|t) + (1-a)E(m_{t+1}|t)] \tag{3}$$

where the choice of prices is defined over the weighted average of optimal prices in t and $t+1$. Since wages are determined one period ahead of prices, we focus on w_{t-1}, defined in the following equation:

$$w_{t-1} = 1/2 * [(b * p_{t-2} + (1-b)m_{t-1} + (b * E(p_t|t-1) + (1-b)E(m_t|t-1)] \tag{4}$$

The optimal choice of wage for $t-1$ is a function of the weighted average of the optimal wage in $t-1$ and the optimal wage in t. Note that the price level is chosen every two periods, such that $p_{t-1} = p_{t-2}$. The parameters a and b denote the inflexibility of wages and mark-ups. As the parameters approach to 1, the response of both variables to shifts in demand becomes smaller.

If we now assume an unexpected increase in nominal money under these circumstances, firms adjust nominal prices to the extent they want to compensate increases in output. Subsequently wages increase in the following period since unions want to avoid real wage losses. As this reflects a rise in labor costs for the companies, we can deduct from the given formula that prices will adjust also. The pace of adjustment depends on the rationality of expectations and on the degree of workers' and firms' desire to compensate real wages and markups to inflation. Moreover, the more inflexible wages and price, the stronger the initial response of nominal wages to a shock in money balances. A numerical example for the described process is depicted in figure 1.

By examining table 1, we can observe the simulated dynamics in nominal wages as well as in prices, which Blanchard ultimately refers to as the wage price spiral. However, these simulation results do not provide evidence for wages causing an actual acceleration in prices, instead they indicate an extension of inflation. Blanchard makes an additional, interesting point: he argues that increases in real wages as well as simultaneous increases in real mark-ups are not necessarily a contradiction when assuming rational expectations and rigidity in prices and wages. This explains the finding that real wages and real markups can both exhibit positive values in his computed numerical example. Note, however, that this builds on the assumptions of an alternating, two-period sequence of price and wage choices. As an addition, Blanchard concludes that real wages do not deviate persistently but instead oscillate around the equilibrium wage as output returns to its equilibrium level.

3.2 Model of Wage-Price Determination

[Blanchard and Kiyotaki, 1987] extended his theoretical considerations regarding the wage price spiral by incorporating recent inflationary trends.[Bernanke and Blanchard,

Table 1

The Effects of an Increase in Money on Relative and Nominal Prices.

Time	p	w	w-p	y	average real wage*	average mark up**
0	0.133	0.0	-0.133	0.877	-0.076	
						0.009
1	.133	.247	.144	.877		
					.007	
2	.346	.247	-.100	.654		
						.007
3	.346	.432	.085	.654		
					.005	
4	.508	.432	-.076	.492		
						.006
5	.508	.572	.064	.492		
					.003	
6	.629	.572	-.057	.371		
						.004
7	.629	.678	.049	.371		
					.003	
8	.721	.678	-.043	.279		
						.003
9	.721	.757	.036	.279		
					.002	
10	.790	.757	-.033	.210		
						.003
11	.790	.817	.027	.210		
					.001	
12	.842	.817	-.025	.158		
						.002

a = b = 0.99

All numbers in the table should be multiplied by dm

* The "average real wage" is the average value of the real wage for the two period interval during which the nominal wage is fixed.
** The "average mark up" is the average value of the mark up during the two period interval during which the nominal price is fixed.

Figure 1: Numerical example for wage and profit adjustment [Blanchard, 1986]

2023] The wage equation in this setting is given by the following:

$$w = p^e + \omega^A + \beta x \tag{5}$$

where wages are explained over the expected price level for a given quarter p^e, where e denotes expectation, a variable for real wage aspiration ω^A, where A represents the aspiration and an indicator for the labor market situation x with an according weight β. The bigger x, the tighter the labor market. The aspiration real wage ω^A can be expressed as a function of lagged wage levels w_{t-1}, lagged price levels, p_{t-1}, past real wage ambitions ω^a_{t-1} and a shock term z_ω

$$\omega_t^A = \alpha\omega_{t-1}^A + (1-\alpha)(w_{t-1} - p_{t-1}) + z_{\omega,t} \quad (6)$$

By merging the two previous equations, we obtain

$$w_t - w_{t-1} = (p_t^e - p_{t-1}) + \alpha(p_{t-1} - p_{t-1}^e) + \beta(x_t - \alpha x_{t-1}) + z_{\omega,t} \quad (7)$$

Following this equation, the difference in wage increases can be explained over the price changes in the past, expected price increases, the "correctness" of the beliefs, $p_{t-1} - p^e_{t-1}$, and the changes in labor market tightness. The correctness of the beliefs plays a role in determining actual wage increases since workers usually desire to be compensated for unexpected inflation, as it eventually results in real wage losses. α in this formula yields the extent that workers and their according representatives put weight on their beliefs. Higher values of α lead to more rigid real wages. Given that workers do not base their inflation expectations on the accuracy of their beliefs in the past, which corresponds to setting $\alpha = 0$, we write

$$w_t - w_{t-1} = (p_t^e - p_{t-1}) + \beta x_t + z_{\omega,t} \quad (8)$$

Under these circumstances, nominal wage growth merely depends on expected prices in a given period minus the actual prices in the last period, $p_{t-1} - p^e_{t-1}$, the tightness of the labor market and an error term.

We shall see now that Blanchard indicates a mutual interdependence of wages and prices, as he defines the price level as a function of wages w and a shock term z_p:

$$p = w + z_p \tag{9}$$

and in terms of first differences:

$$p_t - p_{t-1} = (w_t - w_{t-1}) + (z_{p,t} - z_{p,t-1}) \tag{10}$$

According to this formula, the difference in price levels for one period depends positively on the increases in wages and on the shock term. The shock term can be interpreted as exogenous factors influencing prices such as supply chain problem, productivity etc. Thus, variables that might have an effect but are not already reflected in the equation. Given the definitions provided, we can now derive inflation expectations, both for the long and the short run. In the short run, inflation expectations depend on the anticipation of long-run inflation, π^*, and on the lagged price changes:

$$p^e_t - p_{t-1} = \delta\pi^*_t + (1 - \delta)(p_{t-1} - p_{t-2}) \tag{11}$$

The long run inflation expectations on the other can be described by past long-term inflation expectations, π^*_{t-1} and by the realization of actual inflation rates:

$$\pi^*_t = \gamma\pi^*_{t-1} + (1-\gamma)(p_{t-1} - p_{t-2}) \tag{12}$$

where the the parameters γ and δ yield the accurateness of expectations of short and long run inflation. If γ or δ are set equal to 1, the second part of the given formulas drop out, meaning that inflation expectations precisely correspond to the inflation realizations. In return, lower values of γ and δ represent more persistent price shocks. Note that long-run and short-run inflation are precisely identical if $\gamma = \delta = 0$.

The model provides one straight-forward intuition: inflation heavily depends on its own past. This indicates that inflationary shocks necessarily do not die out immediately. The effect might even be particularly persistent, depending on the size of the underlying parameters γ and δ . As a consequence, the steady state value of inflation rises in context of a positive price shock, denoted by z_p, and vice versa.
We examine two cases, where the price shock z_p rises by 1, providing insights into the importance of the choice of parameters in the system. In the first case α is chosen to be rather small, whereas δ and γ are chosen to be larger. The choice of the parameter δ and γ indicates that the inflation expectations of workers are very well-anchored whereas the choice of α implies that workers put little weight on their inflation expectations in the past. Simulating a price shock under these conditions results in comparably non-persistent surges in prices, where prices approximate original levels promptly. Nevertheless, it should be noted that even under this mild conditions, the overall steady state level of inflation increases slightly and reaches a level of 0.06 percent. This effect intensifies, if parameters are chosen differently. If we select small

values for δ and γ, we indicate that workers are facing an unforeseen surge in inflation rates. As a result, they demand an increase in real wage compensation in response Furthermore, if the level of α is greater, it reflects that inflation expectations more heavily depend on the accuracy of past expected inflation levels, the shock becomes more persistent. The price shock under these circumstances affects long-run inflation to rise up to 0.34 percent, which is considerably larger than we have seen before . The described results are consistent with common beliefs of central banks, according to which well-anticipated inflation rates lead to less persistent and lower inflation rates in the long run. As these results stem from simulating price shocks, the focus lies on price-wage mechanisms rather than investigating causal links between wages on prices. However, after a shock in labor market tightness, resulting in increases in nominal wages, inflation rises as a consequence too and remains high, given that the labor market continues to be tight. The persistence as well as the intensity again depends on the accurateness of inflation expectations.

3.3 New Keynesian Phillips Curve

The Phillips curve is a well-known and well-studied model in explaining inflation rates in economics. According to the traditional Phillips Curve, inflation depends on the unemployment rate and the lagged version of inflation, the according formula is given below

$$\pi_t = \pi_{t-1} - \alpha(U - U^*) \tag{13}$$

where π_t denotes inflation, π_{t-1} inflation one period ago, U the unemployment rate and U^* the natural rate of unemployment (NAIRU). Alan Philips was the first one to identify this relationship, which originated from an empirical observation. The model indeed provided satisfactory insights into the inflation dynamics in the

post-war period in the US as well as in Europe. However, it has been subject to a substantial amount of criticism as the model lacks of theoretical foundations due to its mainly empirical origins. [Roeger and Herz, 2018]
Nowadays, the New Keynesian Phillips Curve is most commonly used in economics, providing a theoretical understanding of inflation in a neoclassical synthesis framework. It differs from the traditional Phillips Curve in some aspects, which can be deducted by the formula below [Rumler et al., 2006]:

$$\pi_t = \gamma E_t(\pi_{t+1}) + \kappa(mc_t) \tag{14}$$

Where π denotes inflation today, $E_t(\pi_{t+1})$ expectations of inflation in the future, and mc_t marginal costs. In this context, several researchers proposed to approximate marginal costs by the real output gap, such that the Phillips curve can be rewritten as

$$\pi_t = \gamma E_t(\pi_{t+1}) + \gamma(y_t - y_t*) \tag{15}$$

Thus, one fundamental distinction between the traditional and New Keynesian Phillips Curve (NKPC) is the fact that the former constitutes a backward looking model whereas the latter adapts a more forward-looking approach by incorporating inflation expectation. Furthermore, the NKPC originally relies on marginal costs rather than unemployment rates for explaining inflation. However, this new formulation of the Phillips Curve has not been found to be useful for empirical applications, as the pure forward looking nature of the model did not seem to provide much explanatory power and further, estimates for γ surprisingly turned out be negative . Interestingly, according to empirical investigations, the original Phillips curve turned out to be more effective in fitting the data.[Galı and Gertler, 1999] One reason for that might be the fact that inflation does not seem to lead the output gap, as implied by the New Keynesian approach, but rather depends positively on the lagged output gaps. Therefore, many researchers agreed on a mix of both concepts, given in the following formula, where x_t denotes the output gap and the second part of the equation represents a weighted average of past and expected inflation [Galı and Gertler, 1999]

$$\pi_t = \delta x_t + (1 - \phi)E_t[\pi_{t+1}] - \phi\pi_{t-1} \tag{16}$$

Nevertheless, even by adapting the New Keynesian Phillips Curve, the success in empirically explaining inflationary mechanisms is limited. According to Galı and Gertler [1999], there are two possible explanations for these limitations. One of the concerns is the use of the output gap as an inappropriate proxy for marginal costs. The second explanation raises doubts on the output gap as a measure in general, asserting that it is prone to substantial estimation errors, as the natural rate of output y^* cannot be observed. In order to avoid the described issues, researches have frequently been using labor costs as a proxy for marginal costs, which has proven successful for at least some analyses. Rumler et al. [2006] As labor costs significantly contribute to overall marginal costs, there is a theoretical foundation for this approach. The resulting model resembles the wage price spiral in many aspects, making it interesting for the analysis in this thesis.

3.4 Seller's Induced Inflation

In the previous section we examined the wage price spiral and its roots in the New Keynesian Synthesis framework. In this subsection, we want to present the theoretical considerations of economists, who explain recent inflation dynamics by the price setting schemes of firms enabling them to increase their profits.

Glover et al. [2023] introduce their analysis by putting forth the argument that recent inflationary trends can neither be traced back on excess demand nor on structural shifts in market power. The idea of a demand driven inflation is well-established in economics and has gained interest in recent debates. [Shapiro et al., 2022] Following this concept, the amount of supply in an economy surpasses the extraordinarily high levels of demand, which ultimately results in increasing prices. Excess demand can emerge for instance due to government spending and/or exceptional nominal wage increases. According to Glover et al. [2023], a demand induced inflation is not empirically observable for recent inflation trends. They underline their hypothesis with the finding that the industries facing the steepest increases in demand do not necessarily coincide with the branches exhibiting the highest price increases.

In order to understand the theoretical origins of inflation in economics and to get to the bottom of the idea related to the profit price spiral, a brief revision of monopolistic competition and market power is required. More specifically, we want to briefly discuss the effects of increases in marginal costs in a monopolistic setting. In figure 2, we depict a typical monopolistic market, where profits are maximized and prices are set by the firms, such that marginal costs equal marginal revenue.

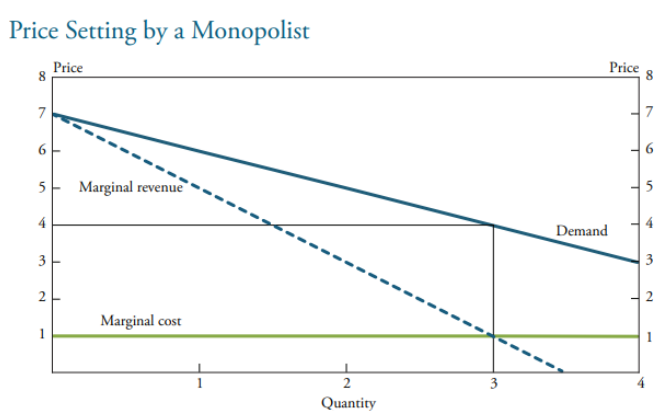

Figure 2: Monopolistic Market, [Glover et al., 2023]

If we now simulate an increase in marginal costs, the function for marginal costs shifts upwards, as shown in figure 2

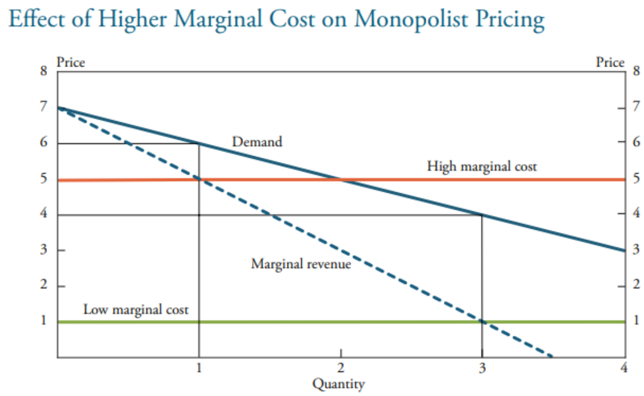

Figure 3: Monopolistic Market with increases in MC, [Glover et al., 2023]

In the first scenario the monopolist chooses a price of 4. In the second case, in which the marginal costs function shifts upwards, the monopolist must adjust his prices, as he would have to put up with losses otherwise. She therefore increases the price to 6. Note that in this process of adjustment, the markup of the monopolist decreases from 4 to 1.2. In general, if we simulate an increase in demand as opposed to a surge in costs, prices would rise too. However, price adjustments due to a stimulation in demand lead to increases in profit markups.

We have seen now that shocks in marginal costs as well as in demand can lead to systematic price increases in a monopolistic setting. However, it must be emphasized that we considered a static model, where firms cannot anticipate future developments in wages or costs. This basic model might therefore not depict the whole truth, when rising price levels and simultaneous hikes in profit margins are being observed. In the previous section, the New Keynesian Phillips curve provided one important insight: firms might not only adjust prices to marginal costs in the present but also to expected marginal costs. This argument is consistent with the derivations of Glover et al. [2023]. If we extend the analysis to a dynamic model where firms set prices for a given period of time, they must consider future costs. Firms will set prices, such that they at least break-even in the medium run. If they anticipate a shock in marginal costs in the future, they will hike their prices in the presence as they might not be able to adjust flexibly to new market conditions. In the absence of the shock, firms will exhibit rising profit margins. However, as soon as the shock in costs emerges, profits eventually decrease again. These considerations might provide some insights into the inflation dynamics we are facing today. However, there are important implications in this derivation: 1) Glover et al. [2023] cast doubt on an increase in monopolistic power or demand in recent periods. Furthermore, their explanation implies that firms have no other option as to increase prices in order to break even in the medium run. This is where Isabella Weber comes into play. As opposed to Glover et al. [2023], she does not rule out the possibility of dynamic changes in market power in exceptional economic situations. In her theoretical considerations, the economy shifts from a period of stable prices to a sudden increase in prices in upstream sectors by an impulse. This has an impact on the cost structure of firms along the supply chains, leading them to increase their prices in order to protect profit margins. As a consequence, unions and workers' institutions attempt to protect real wages and therefore adjust their demands for nominal wages increases. The derived policy implications, given these economic circumstances, suggest price caps and price controls rather than a bargain between workers and firms, as proposed by Blanchard. [Bernanke and Blanchard, 2023]

Given the fundamental significance of this concept for this thesis, we want to provide more detail for the underlying mechanisms. A main argument is the fact that firms avoid lowering prices in order to refrain from potential price wars with their competitors. As each firm would aim to lower the prices even further, eventually it will destroy the profitability in the industry. Since firms anticipate this outcome, only new entrants or firms who have little to lose will engage in price wars. In general, [Weber and Wasner, 2023] claim that firms will not hike prices just so. They will only dare to engage in price increases, if they do not worry about loosing market shares. However, there are two possible reasons for individual firms choosing to increase prices anyways: New technology or the expectation that other firms will act accordingly. The latter situation can emerge by a sudden increase in prices due to a supply shock, just as witnessed in 2022 due to the war in Ukraine. Given these circumstances, firms anticipate other firms to surge prices, resulting in rapid and sometimes also drastic changes in the market power and as a consequence, the market structure. If input goods are rare, the existing firms can hardly satisfy demand. Consequently, the potential issue of additional firms entering the market decreases and so does competition. This can result in price hikes that do not only compensate rising costs but also increase profit margins.

In such exceptional economic conditions, one might ask why consumers do not attempt to "punish" firms that try to make use of these economic conditions. Economists have frequently pointed out that the price elasticity plays a crucial role here. It is commonly and reasonably assumed that basic needs, such as food, housing, electricity, and gas, exhibit a severely inelastic demand. Anderson et al. [1997] Those are exactly the goods exhibiting the steepest surges in prices in 2022. This is one reason why consumers might not be able to adjust their consumption pattern when facing a supply shock. An additional argument addressed by Weber and Wasner [2023] is the fact that consumers anticipate price increases when observing a supply shock, which consequently creates acceptance for the rising price levels. The acceptance among consumers arises, as they do not posses full information on the cost structure of firms. Therefore, it is almost impossible for consumers to distinguish between reasonable price increases that result from firms passing on their costs and those that serve the purpose of raising the profitability. All of these factors combined constitute an advantageous environment for firms.

To summarize, according to Weber and Wasner [2023], market power can in fact adjust surprisingly quickly to new market circumstances. This insight differs from the considerations of Glover et al. [2023], who stated that the market structure and market power mechanisms remain rigid in the short run. Nevertheless, both agree on the fact that corporate profits contributed substantially to recent accelerations in prices.

4 The Model

4.1 Theoretical framework

In the course of this thesis, we will establish a time series model, which will be set up following theoretical derivations and considerations. The aim of this model is the investigation of the wage price spiral as well as the seller's induced inflation, which Weber and Wasner [2023] refer to. In this chapter we want to give an introduction to the empirical model and briefly depict the theoretical framework for our analysis in Austria.

From the theory discussed in the previous section we can deduct that the concept of the wage price spiral and the concept of the profit price spiral are related in some aspects. Especially, when considering the New Keynesian Phillips Curve this becomes clear: In this theoretical framework marginal C costs, often even future marginal costs, play a crucial role in determining prices and consequently inflation. It should be noted in this context that marginal costs in the new keynesian framework do not necessarily coincide with wages. The importance of costs can also be found in the theoretical considerations of Glover et al. [2023], who claim that firms aim to increase their prices according to their expected costs in order to break even in the medium run. Weber and Wasner [2023] build on this arguments and apply it to an environment, where the economy is being hit by a supply shock, which creates a momentum for firms to increase their prices and thereby their profitability. In this setting, the market power of firms and the resulting diminishing competition is a crucial point. These developments have an impact on the economy and on the purchasing power of consumers. When inflation levels rise, workers must put up with real wage losses as long as nominal wages are not being adjusted. As Oliver Blanchard describes in detail in his paper Blanchard [1986], unions want to avoid real wage losses by all means. In Austria, unions and the employers' representatives negotiate wages every year. The results of these negotiations are all put on record in the "Kollektivverträge" - the contract including the general regulations for each branch. The calculations for inflation, which form the basis of these negotiations, follow the so-called Benya rule, "according to which nominal wage increases should be equal to the sum of consumer price inflation in the past year and medium-run productivity growth, which roughly implies a constant wage share in the medium term." Fenz et al. [2019] Regardless whether the objectives of this rule for nominal wage growth has been met in the past (which is evidently not the case according to Fenz et al. [2019]), it casts no doubt that this arrangement produces conditions of exceptionally sticky wages in Austria. Several European countries, such as Belgium for instance, follow a different path and exhibit a wage indexation. This regulation enables workers to maintain their purchasing power by all means, as nominal wages are adjusted to inflation automatically. [ECB, 2008] For Austria on the other hand, the wage adjustment arrangements conceptually result in a situation where a surge in prices leads to at least a temporary decline in real wages and consequently in the purchasing power. In contrast, firms can adjust relatively swiftly to new market conditions due to their flexibility in their price setting scheme. Of course, these circumstances do not necessarily include or exclude the possibility of either a wage price spiral or a profit price spiral. However, they provide important insights into the general sequence of economic processes in Austria, which the model builds on.

There is a wide range of potential explanations for the recent acceleration in inflation and for the general causes of price fluctuations. Whether the wage price spiral or the profit price spiral prevails is yet to be determined, in any case there is no unambiguous evidence for either in economics. In the previous chapters, we have issued different theoretical considerations as well as empirical results. In this thesis we want to analyse the link between both variables and prices over time. We will set up a vector autoregressive (VAR) model to do so. In the next section we will briefly describe the technical details and conditions for the methods that will be applied in order to find answers to the posed research question.

4.2 Model Specification

As presented in the previous section(s), we are interested in analysing the link between inflation and wages as well as the relationship between inflation and profits. We will do so, by establishing a vector autoregressive model (VAR), which allows us to study dynamic time series processes. Vector Autoregressive Models are a common tool, especially in macroeconomics, for studying multivariate time series relationships. One reason for the popularity of VAR models is stated in Zivot and Wang [2006]: "The vector autoregression (VAR) model is one of the most successful, flexible, and easy to use models for the analysis of multivariate time series." The VAR model is useful for forecasting, which is an interesting feature in time series analyses. There are different types and adaptations of VAR models, enabling researchers to incorporate theoretical considerations or even analysing causal relationships. These adapted VAR models are usually referred to as structural VAR (SVAR) models as opposed to the so-called reduced form VAR models. In general, reduced form VAR do not serve the purpose of finding causal links, the analysis is mostly restricted to studying interconnections between variables over time providing a foundation for forecasting. It is worth noting that reduced form VAR models usually do *not* capture contemporaneous effects, raising potential doubts. Furthermore, in reduced form models the error terms are assumed to be serially uncorrelated, which again is considered unrealistic due to the complexity of the time series model. In this thesis, we will generally rely on reduced form VAR models although we will apply some structural methods to avoid the described issues in the interpretation. Even though we make use of structural methods it is a main concern of this thesis to limit the risk of overidentification by reducing the complexity of the model. Additionally, we want to restrict the number of theoretical identifications for similar reasons.

For reduced form VAR models, it is important to guarantee the stationarity of the variables included. "Stationary processes [...] have time invariant expected values, variances, and covariances." Lütkepohl [2005] Due to this requirement, researches often include the first (log) differences or the growth rates of the respective variables, which is a common approach for detrending data. The interpretation most often remains straight-forward and useful. The formal definition of VAR models of the $p_t h$ order is given in the form:

$$\boldsymbol{Y_t = c + \Pi_1 Y_{t-1} + \Pi_2 Y_{t-2} ... \Pi_p Y_{t-p} + \epsilon_t} \tag{17}$$

Where Y_t is the vector of n endogenous variables and Π_t is a matrix yielding the coefficients. ϵ_t refers to the error terms, usually interpreted as shocks or innovation. In this thesis we define the vector of endogenous variable as given below.

$$Y_t = \begin{pmatrix} Employment \\ HICP \\ GDPDeflator \\ Surplus \\ CompensationofEmployees \end{pmatrix} \tag{18}$$

Note that we did not introduce any exogenous variables to our empirical model. This specification stems from the theoretical derivations we have seen before, where an intertwined relationship between the given variables is reasonable to assume. Therefore, strictly exogenous variables, with the exception of a constant term, are not appropriate for the underlying research question and are thus omitted.

One first task when working with VAR models is the choice of lags. There are different methods for determining the order of the model. Many researchers rely on a combination of visual inspection, hypothesis tests and on the so-called information criteria, such as the AIC or BIC. [Lütkepohl, 2005] When the number of lags is chosen accordingly, the model can be estimated. Comparable to standard OLS regressions, the matrices Π_i yield the coefficient estimates. However, usually researchers refrain from putting to much weight on the interpretation of the actual coefficients, as the dynamic responses of the system are not reflected in the coefficient estimates. As a consequence, researches apply additional methods that offer insights into the dynamic behavior of the model. We will follow this approach and apply the widespread methods of the impulse response analyses, forecast error variance decomposition and additionally conduct granger causality tests. [Zivot and Wang, 2006]

4.2.1 Impulse Response Functions

The Impulse Response Analysis is a very popular presentation of results in complex, dynamic processes. The according interpretation is very intuitive and can be derived easily. We briefly want to outline the idea behind this method. Any stationary process can be transformed to a so-called Wold representation

$$\boldsymbol{Y_t = \mu + \epsilon_t + \Psi_1 \epsilon_{t-1} + \Psi_2 \epsilon_{t-2}} \tag{19}$$

Where the (i,j)th element of the matrix Ψ_1 can be interpreted as the impulse

$$\frac{\partial y_{i,t}}{\partial \epsilon_{j,t-1}} = \psi^s_{i,j} \tag{20}$$

However, as already stated, for this interpretation the assumption of uncorrelated error terms is required, which is very unlikely given the system of interlinked variables. Luckily, there are some methods to circumvent this issue. In this thesis, we will apply the Choletsky decomposition, which is very common. In order to do so, we write down the process in its structural form

$$\boldsymbol{BY_t} = \boldsymbol{c} + \boldsymbol{\Gamma_1 Y_{t-1}} + \boldsymbol{\Gamma_2 Y_{t-2}} + \boldsymbol{\Gamma_p Y_{t-p}} + \boldsymbol{\eta_t} \tag{21}$$

B is a lower triangular matrix and has 1s in the diagonal. Due to the multiplication of Y_t with the matrix B, we can conveniently assume that there is no cross correlation among the error terms. However, there are some theoretical implications when applying these structural methods. In this case the order of the variables entering the system implies a causal, chronological process. We have seen before that the reduced form VAR models inherently do not reflect contemporaneous effects. When orthogonalizing the error terms we can circumvent this issue and include simultaneous effects into our impulse response analysis. The first variable to enter the system, is assumed to be contemporaneously uncorrelated with any of the other variables, the second variable is merely dependent on the first variable though uncorrelated with the remaining variables and so on. We chose the order as depicted above 18 according to theoretical considerations described in the previous section. It is consistent with several existing studies to chose the cycle component (such as GDP or employment) to move first. Hahn [2020] However, we provide robustness checks in the Appendix, to guarantee full transparency. The graphical representation of the described method is the so-called orthogonal impulse response function (OIRF). Zivot and Wang [2006] In general, impulse response functions yield the response of the system reacting to a one standard deviation shock in one specific variable. However, this interpretation is frequently considered difficult to grasp. Therefore, researchers often standardize the shocks to a 1 unit increase instead. The actual interpretation will follow in next chapter.

4.2.2 Forecast Error Variance Decomposition

"The forecast error variance decomposition (FEVD) answers the question:what portion of the variance of the forecast error in predicting $y_{i,t+h}$ is due to the structural shock η_j ?" Zivot and Wang [2006] A convenient characteristic of this method is the fact that the proportions add up to 1, meaning that the interpretation can be performed in percentage terms. The idea behind this method is strongly related to the impulse response functions, since it likewise builds on the idea of introducing shocks to variables. The h-step forecast error variance is given as

$$var(y_{i,T+h} - y_{i,T+h|T}) = \sigma^2_{\eta_1} \sum_{s=0}^{h-1} (\theta^s_{i1})^2 + ... + \sigma^2_{\eta_\eta} \sum_{s=0}^{h-1} (\theta^s_{in})^2 \quad (22)$$

from which the forecast error variance decomposition can be derived:

$$FEVD_{i,j}(h) = \frac{\sigma^2_{\eta_j} \sum_{s=0}^{h-1} (\theta^s_{ij})^2}{\sigma^2_{\eta_1} \sum_{s=0}^{h-1} (\theta^s_{i1})^2 + ... + \sigma^2_{\eta_\eta} \sum_{s=0}^{h-1} (\theta^s_{in})^2} \quad (23)$$

Note, that similar to the IRFs, the resulting FEVD depends on the choice of order of the variables entering the system.

4.2.3 Granger Causality

Clive Granger introduced the concept of granger causality in 1969, which has gained considerable attention in the past because of its straightforwardness and widespread acceptance. Lütkepohl [2005] However, it should be emphasized that Granger causality must not be confused with actual causality. Granger causality can be indentified, if the prediction of one variable improves by including another. We will formalize the intuition behind it on the basis of a bivariate VAR model. We can reject Granger causality if the system looks like the following

$$y_{1t} = c^1 + \pi_{11}^1 y_{1t-1} + \cdots + \pi_{11}^p y_{1t-p} + 0y_{2t-1} + \cdots + 0y_{2t-p} + \epsilon_{1t} \tag{24}$$

In the formulation above, we can see that all coefficients linking y_1 to y_2 are equal to 0, meaning that the prediction of y_1 cannot be improved by including y_2, therefore Granger causality is not rejected. Note that Granger causality does not incorporate immediate effects as opposed to the orthogonalized IRFs. Furthermore, Granger causality tests do not offer insights into the direction or sign of the underlying relationship.

5 Data

In this section we provide a detailed description of the data base for the empirical analysis. In general, there are two different approaches for estimating wages in the context of the wage price spiral. In the literature, researchers either included labor costs or nominal wage indices in their analysis. Altough both approaches seem to be common and acknowledged according to existing research, the underlying concepts vary. Labor costs do not only include the wages paid to the employees but also capture tax rolls, health insurance etc, upon which policy makers decide. Labor costs usually exceed nominal wages significantly, especially in Austria where the levy on labor is considered rather large. However, including labor costs instead of nominal wages does have advantages such as the fact that productivity developments are being accounted for. For example, if we consider a significant increase in nominal wages but simultaneously labor productivity increases to a larger extent, firms might even reduce the number of employees, which ultimately leads to a reduction in labor costs. Therefore, when working with nominal wage indices, there is no need to additionally include productivity in the analysis. [Hess and Schweitzer, 2000] Moreover, labor costs serve as a good proxy for nominal wages as they usually move in the same direction. For the analysis in this thesis we will include the labor costs that can be retrieved from the national accounts calculations from Eurostat. We divide the labor costs by the number of employees in order to adjust for fluctuations stemming from changes in the number of workers. The national accounts data is divided into the corresponding branches according to the NACE classification. This enables us to extend our time series analysis to different economic branches. Unfortunately, there is no accessible data base for the actual nominal wages in Austria. However, we do additionally have access to the so-called standard wage index ("Tariflohnindex"), which captures the minimum wages recorded in the collective contracts ("Kollektivvertrag"). The according minimum wages differ across industries and are being bargained by unions for each branch. As this index only captures minimum wages, it does not reflect actual wage developments sufficiently and therefore defeats its purpose for this thesis. Furthermore, the index is to date only available until the second half of 2022, which excludes the period of very high inflation rates. For transparency, we conducted the analysis for the minimum wage index regardless, which can be found in the Appendix. For the price variable we include the HICP as one common measure for inflation, which also underlies the wage negotiations in Austria. The HICP "provides information on the developments of the selling prices to consumers. It includes both the prices of domestically produced consumer goods as well as those of imported ones " [Hahn, 2020], which is a useful feature for the analysis in this thesis. We defined profits in line with Weber and Wasner [2023] as the gross operating surplus "Profits are before taxes and before deductions for consumption of fixed capital, taxes on production and imports less subsidies plus business current transfer payments (net), and net interest and miscellaneous payments. This aggregate measure of profits is close to the firm-level measure of earnings before interest, taxes, depreciation, and amortization (EBITDA), a common indicator used to reflect firms' ability to generate cash profits." In order to calculate unit profits- a widespread measure for profit margins- we divide profits by real GDP. ECB [2023] Unfortunately we could not get hold of quarterly time series data on the branch specific employment levels. As a result, we included the aggregate compensation of employees and the overall profits for the sector analysis. Therefore one should be cautious, when drawing comparisons for the branch-specific results and the findings on the aggregate level. Finally, we want to include one component to reflect the business cycle in our system. Real GDP usually reflects the business cycle very well, however it is highly correlated with profits margins (correlation coefficient of 0.88). Therefore, we chose employment as an instrumental variable instead. We make sure that employment serves as an appropriate alternative, as it is strongly correlated with real GDP (coefficient of 0.81) and does not seem to be highly correlated with neither wages nor profits.

6 Results

In this section we summarize the main empirical findings of this thesis using the methods described in the chapter on the model specification. We split the results into subchapters according to the statistical methods applied.

6.1 GDP Deflator Decomposition

Weber and Wasner [2023] provided evidence for their theoretical deductions using the method of the GDP deflator decomposition. Their analysis has already been applied to the euro are by the ECB [2023], where similar conclusions have been derived. As we want to investigate price dynamics in Austria, we adapted the approach to Austrian data only. In figure 4, we can see the plot, pointing into a similar direction: Starting with the second quarter of 2021, profits accounted for the majority of homemade inflation (given by the GDP deflator). In the last quarter of 2022, profits even contributed about 75% to overall price increases within Austria. As depicted in the same graph, the strong link between profits and prices is a rather recent development, in which wages seem to play a subordinated role.

To gain a comprehensive and in-depth understanding of the causes of inflation, we follow the approach of Weber and Wasner [2023] and conduct a detailed decomposition of the GDP deflator, segmenting it into various economic sectors based on the NACE classification Connects [2022]. We have seen before that recently profits seem to play a crucial role in determining the pace of price growth in Austria. In order to find the sectors, where profits contributed the most to overall price increases, we calculated the respective shares, as depicted in 5.

We gain interesting insights: In the fourth quarter of 2022, profits in the energy sector lead to price increases of 2.36%, contributing about 36% to overall GDP deflator growth. As expected, the role of the energy sector in a supply shock resolving

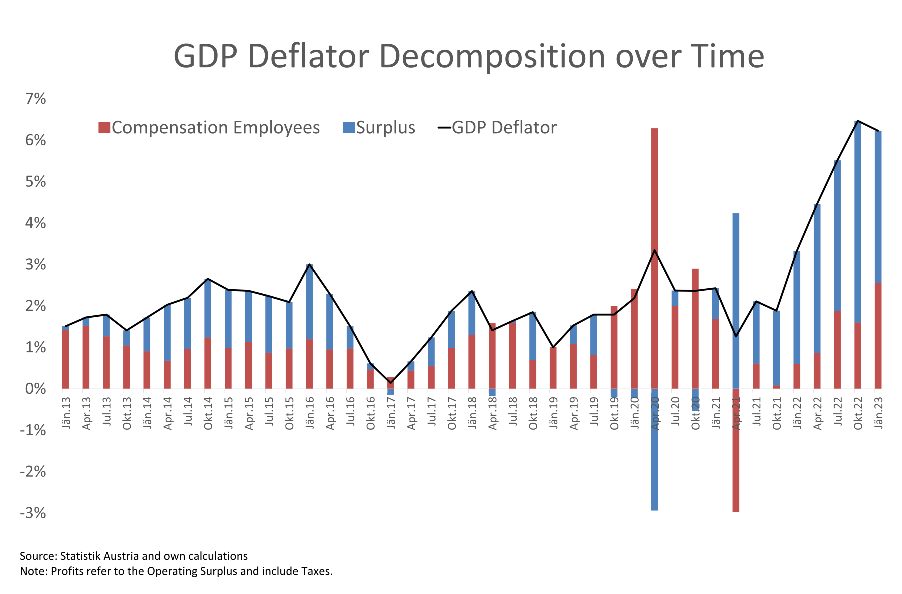

Figure 4: GDP Deflator Decomposition over Time

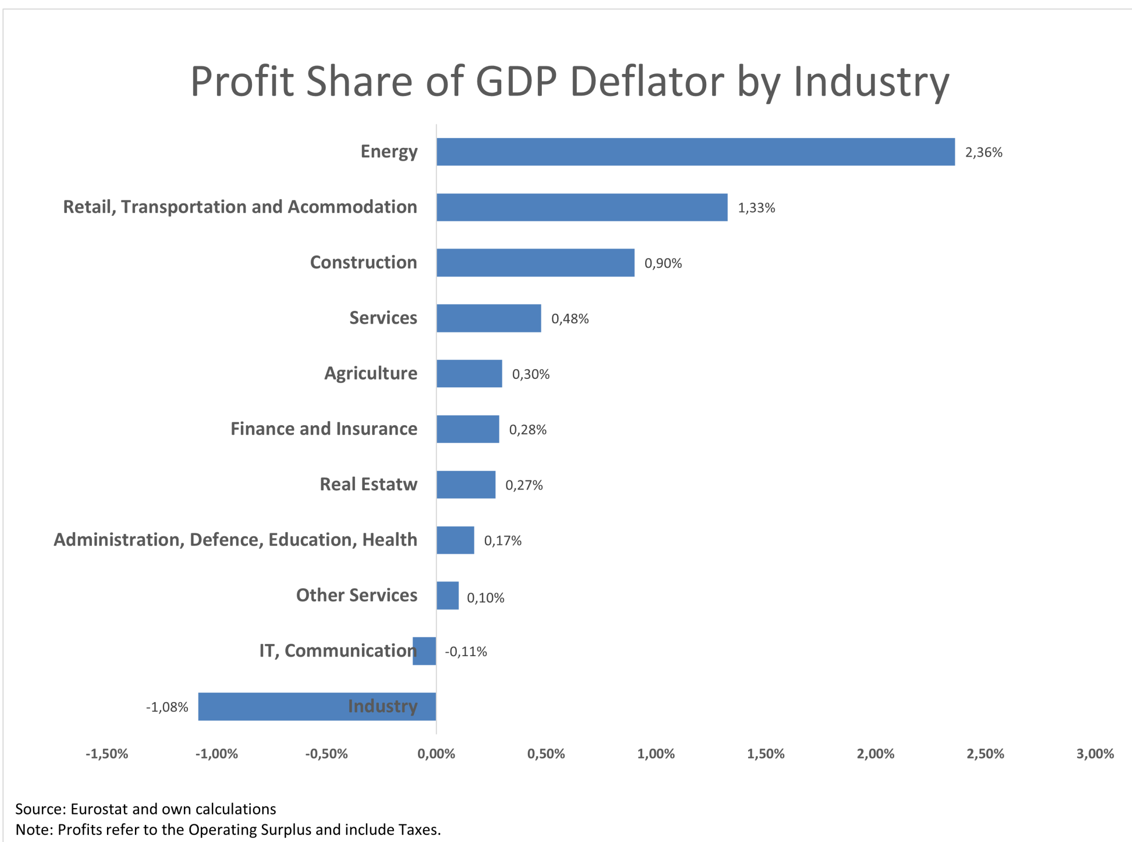

Figure 5: Contrubtion to GDP deflator per industry

in a sudden surge in gas prices is crucial. However, it might come as a surprise that not only the sector as a whole but particularly the profits in the energy branch may have served as a main accelerator in prices. In this context, the discussion around the merit order system as a mechanism to set prices has been questioned frequently. [Standard, 2022] The merit order system allocates energy production through an auction, where the marginal costs of the last firm required to satisfy the overall energy demand determines the energy price. This procedure is subject to a lot of criticism, which resulted in discussions among policy makers as well as economists on potential alternatives or reforms. Roeger and Welfens [2022] However, not only the profits in the energy sector may have been important in determining homemade inflation. According to preliminary results, retail and construction together accounted for 35% of the acceleration in GDP deflator in the last quarter of 2022. In contrast, we can deduct from figure 5 that the profits in the manufacturing branch may have even reduced the homemade inflation by one percentage point.
These results serve as a motivation for the following time series investigation. In this thesis we lay an emphasis on a setting that captures changes in the price-wage and price-profits dynamics.

6.2 Descriptive Statistics and Insights

We have briefly discussed the possibility of a demand driven inflation in this thesis. [Glover et al., 2023] conclude that there is a lack of empirical evidence for increasing price levels due to excess demand for recent inflation trends. Likewise, we find no evidence for exceptional levels of consumption in Austria, which is one potential measure for demand. 6 On the contrary, it seems that consumption rates have not yet returned to pre-pandemic levels.

As a first step, we conduct a brief eyeball analysis of our variables of interest. By a first glance at the plot in figure 7, we can infer that unit profits seem to be subject

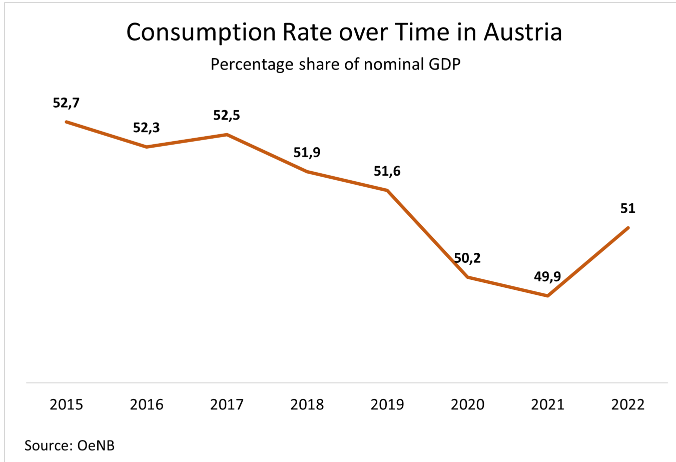

Figure 6: Consumption Rate

to stronger fluctuations than the remaining variables in the system. In contrast to that, it can be noted that inflation, with exception of the past one and a half years, seems to be moving almost perfectly stable around a growth rate of approximately 2%. This stems from the fact that the 2% growth rate in prices is a key objective of monetary policy makers.
Furthermore, the pandemic is reflected in our data in the form of a severe break-down in unit profit growth and a smaller but still remarkable drop in nominal wage growth in 2020. Due to this large break-down in unit profits, the recovery results in a large peak altough the actual level of profits merely return to their pre-pandemic levels. One should therefore not infer too much when interpreting this outlier as it originates from a statistical property. A brief inspection of our data insinuates that wages seem much more sticky and slow-moving.

Note that figure 7 depicts the nominal growth rates for unit profits and compensation per employees, leading to both variables exhibiting significant increases in the period of the inflationary crisis. However, if we adjust both variables for the HICP, the picture changes, as shown in on in graph 8. The effect on the compensation per employees is especially remarkable as real wages seem to have decreased drastically when inflation accelerated. We find similarities for real unit profits although they solely denote one breakdown in growth rates in the year of 2022 whereas real com-

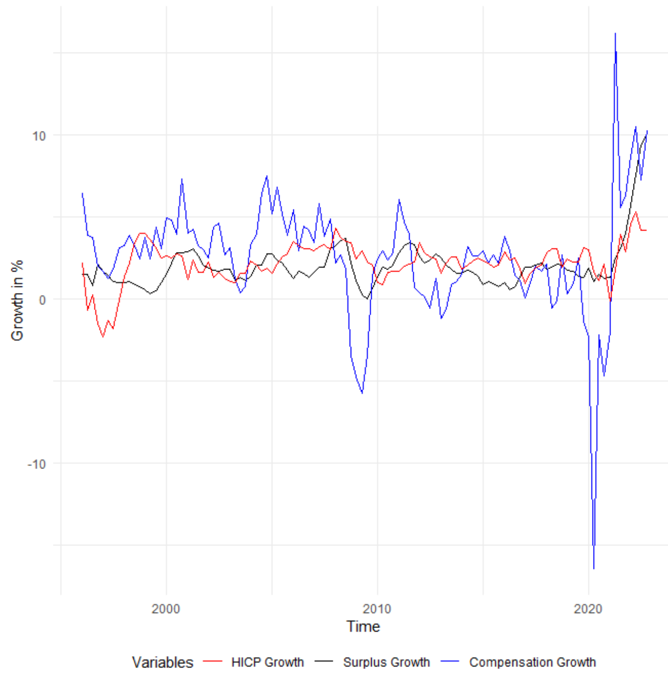

Figure 7: Time Series Plot

pensation per employees remains negative throughout the year. We again find an indication for the flexible adjustments in unit profits and the rigidity in real wages.

Figure 8: Time Series Plot, adjusted

As a last step in this section, we want to look at the scatterplots of the variables of interest to gain further insights into the underlying relationship between the variables of interest. A scatterplot is a graphical representation of the relationship between two variables, where each data point is plotted as a point on the graph, enabling us to graphically illustrate potential links. Note that scatterplots disregard dynamic, time-dependent settings. Figure 9 depicts the scatterplots of nominal unit profit growth, real unit profit growth, nominal compensation of employees and real compensation of employees with inflation (HICP). It becomes clear that nominal wages as well as nominal profits seem to be positively related to inflation, indicating that price increases hike nominal profits and wages. However, when regarding the graphs with the real values of the variables, we find remarkable differences. There is a clear negative link between inflation and real wages, which is unsurprising, given the previous results and lack of flexibility in wage adjustments. However, the link between real unit profits and inflation represented by the scatterplot is not so clear. Similarly as we have already seen before, this could be one indication for more robust unit profits when facing inflationary shocks as opposed to the rather rigid wages. Regardless of these interesting descriptive findings, we want to make use of proper statistical tools in order to make conclusions on the actual dynamic correlation between the variables in the system. These descriptive findings serve as a motivation for the following econometric analysis and provide preliminary insights.

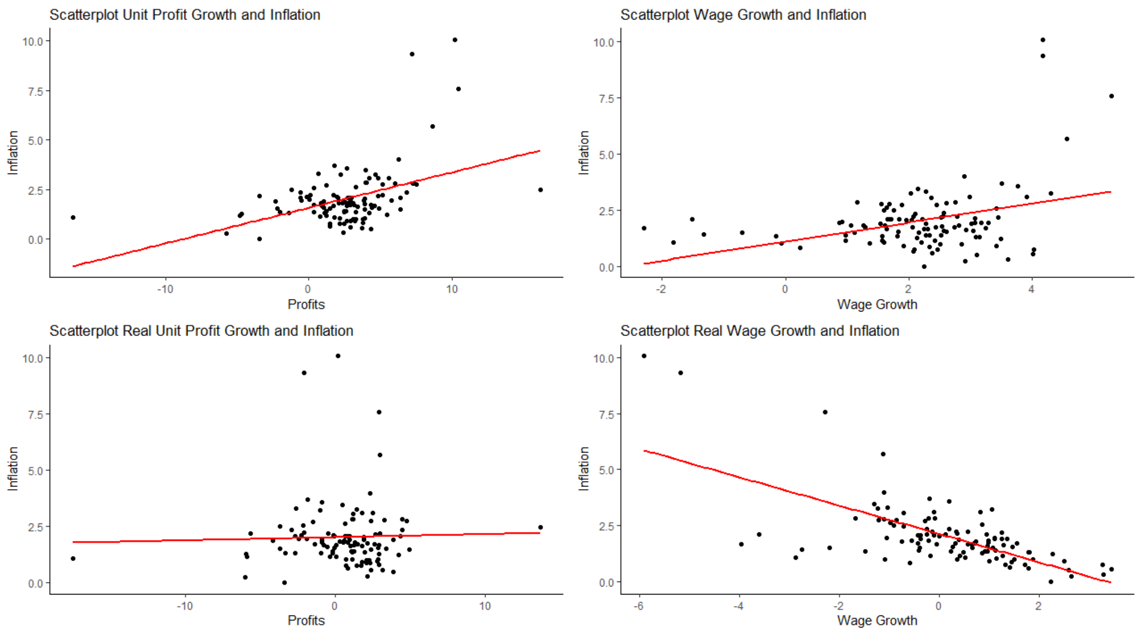

Figure 9: Time Series Plot

6.3 Time Series analysis

As stated in the chapter on the model specification, economists are usually interested in the so-called impulse response functions when working with VAR models. In this section we will analyse the respective impulse responses and provide an economic interpretation. As suggested by the AIC criterion, we estimate our model including 7 lags. This implies that current values in our model can be explained by past values ranging up to 7 quarters back in time. We are primarily interested in the interrelation of inflation, surplus and wages. We provide robustness checks in the Appendix.

We want to gain a deeper understanding of the dynamics starting with the surge in prices. Thus, we will conduct the analysis twice. First apply our methods, given that the period of accelerating prices, namely the second half of 2021 and the whole year of 2022, is included in our data set. Then we will proceed by applying the same methods, given that the inflationary crisis is omitted from the model.

6.3.1 Granger Causality Tests

The Granger causality test constitutes one first step in the time series analysis. It is supposed to deliver insights into the relationship between the variables in our system, without implying actual causality. Furthermore, it is a useful tool for testing whether the the model is correctly specified. Note that the rejection of Granger causality does not necessarily imply a lack of significance in the impulse responses. This stems from the fact that Granger causality does not capture immediate effects or the dynamic interaction of the lags.

We conduct Granger causality tests for all variables included in the model as depicted in table 1. We test by including up to seven lags, which equals the order of the VAR model. First, we focus on inflation and profits. We find that profits significantly improve predictions of inflation by choosing a lag order of one. This finding implies that we can amerliorate the forecasts of inflation by including the profits of the last quarter into the regression. Thus it seems that the last quarters' profit hold some information for the price developments. Interestingly, we cannot find evidence for the relationship going into the opposite direction, where inflation helps predicting profits.
Given these results, the Granger causality test indicates that the link between wages and prices appears to be the exact opposite. The prediction of wages can be improved by including inflation, given a significance level of 10%. However this effect becomes significant only after five lags, meaning that wages take some time to adjust to changes in prices. Based on the test results, there is no support for the opposite case, where wages contribute to predicting inflation..
Although it is not the main objective of this thesis, we examine the relationship of wages and profits regardless. This might help us to further investigate the dynamics within our system. We find that both variables help predicting the respective other. However, profits seem to be highly useful in predicting wage growth throughout the whole time span tested whereas wages help predicting profits merely for the second

	Employment	Inflation	Profits	Wages
Employment		1 lag(*)	2 lag (**),3-7 lags(***)	1-7 lags(***)
Inflation	X		X	5,7 lags(*)
Profits	(2,3,5-7) lags(**), 4 lag (***)	1 lag (**)		1 lag (**) 2-7 lags (***)
wages	1,6 lag(*) 2 lag(**), 3,7 lags (***)	X	2,3 lags (**), 7 lag(***)	

Note: (*) refers to the 90% significance level, (**) to the 95% and (***) to the 97.5%. The granger causality test cannot be applied to one variable only, which is why the respective entries are kept blank. The entry "X" means that we fail to reject the Granger causality test.

Table 1: Granger Causality Test Results

and the third lag and again for the seventh and eighth lag.It seems that there is a delay in wages becoming useful for predicting profits. This may originate from the rigidity in wages. The cycle component is useful in predicting every variable within our system altough the link to inflation is rather lose.

The Granger causality analysis supports the existence of a significant link between all variables in the specified model, suggesting potential causality in at least one direction. The actual magnitude of the underlying effects and the sign of the impact will be further investigated in the impulse response analysis. Nevertheless, we gain some first insights rather pointing into the direction of a proft-price spiral than a wage price spiral.

6.3.2 VAR Analysis, Overall economy

The impulse response functions (IRFs) yield the dynamic response of a shock to one specific variable in our system to the remaining variables. As we included the (approximate) percentage growth rates, we can interpret the coefficients of the IRF as percentage changes, which is a convenient feature. In figure 10, we depict the system reacting to an exogenous, one-time shock in inflation. We can think of a shock in import prices for instance, such as we have seen in the year of 2022. This abrupt increase in prices has a significant impact on wages and profits, both in real and nominal terms. More precisely, given a confidence level of 95%, a 1% increase in prices raises nominal profits of about 0.62% in the same quarter, 0.38% after one quarter and 0.57% after two quarters until the effect ultimately dies out after one year. Thus, there is a significant and remarkable effect of prices on profits. Interestingly, the intensity and also the persistence of this shock diminishes when excluding the second half of 2021 and 2022, namely the period of high inflation rates. By doing so, we obtain an immediate increase in profits of about 0.48% after which the effect vanishes instantaneously. For nominal wages, the effect is less instantaneous and much more moderate. A significant effect, which corresponds to the peak, is reached after one year and denotes around 0.13%. Thus, a 1% shock in prices on average leads to 0.13% increase in nominal wages after four quarters. The finding that wages seem to be more sticky and need time to adjust to changes in prices is consistent with theory and with expectations. The finding, suggesting that the adjustment of wages to price increases takes about one year is a result of the specific regulations in Austria, where wage negotiations take place annually. In general, it comes as no surprise that nominal economic indicators adjust to rising prices at least to a certain degree. It might therefore present a different picture when conducting the same analysis for the price adjusted terms of the respective variables, which is shown in figure 10. Interestingly, profits and wages show opposite trends when adjusting them for inflation, in this case represented as the HICP. As an immediate response, real profits still seem to increase significantly although more moderately by about 0.38%. Subsequently the effect dies out quickly. Real wages on the other hand show a clear negative response to increases in wages. They drop about 0.21% immediately, after 1 quarter by about 0.28% until reaching the minimum of 0.31% after three quarters. After one year, real wages stabilize around zero. These first findings support our preliminary results in the descriptive statistics section. We find first evidence pointing into the direction of inflation driving inequality by increasing firms' profits on the one hand and diminishing the purchasing power of workers on the other - at least in the short run.

We have now studied the effect of sudden price increases on our variables of interest. Now we want to investigate the system reacting to the opposite shocks,

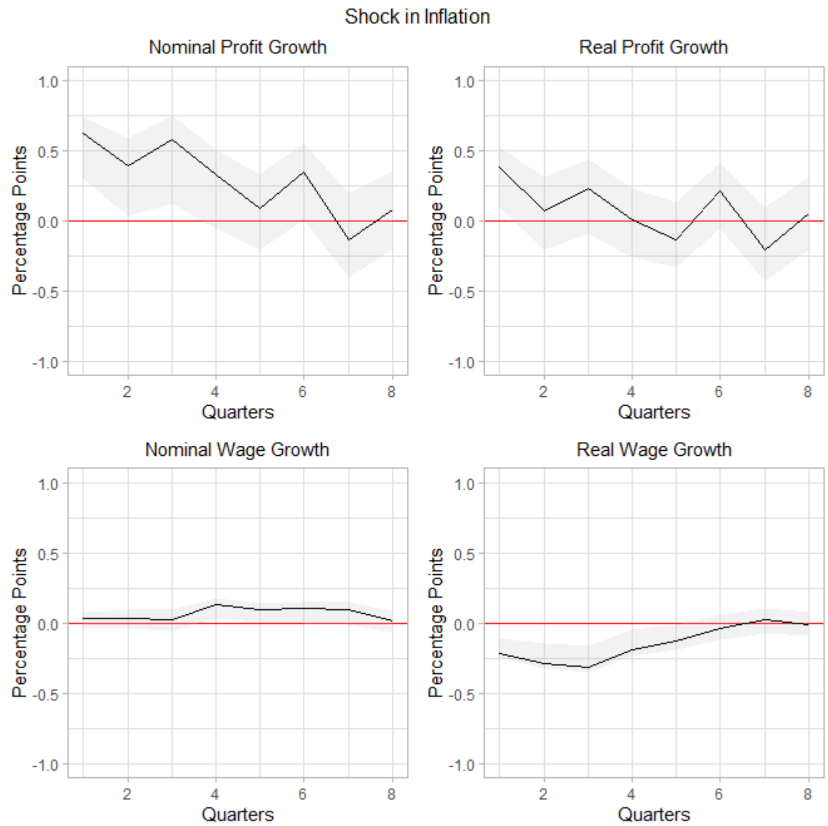

Figure 10: Shock in Inflation

where wages or profits suddenly rise by 1%, which is shown in figure 11. We can see that a shock in profits, in this case of 1%, does not seem to have a significant effect neither on wages nor on inflation. This result can have several causes. We however, want to emphasize in this context that we are estimating a linear time series model. Thus we are assuming that the link between the variables remains constant over time. This could be one reason for the insignificant results. Similarly for the effect of a wage shock on inflation, which remains insignificant over time too. In general, both of these results do not provide evidence to the contrary of a wage price or profit price spiral. Given our data and our choice of significance, we did not manage to find any evidence for a correlation over time. However, this is not true for the effect of a 1% increase in wages on profits. Concluding from the impulse response function, it seems that the wage shock increases profits after 7 quarters on average by about 0.65%. Although this finding might appear counterintuitive from microeconomic perspectives, there are possible explanations on an aggregate level. A sudden increase in wages, due to an advantageous economic situation in the labor market for instance, hikes aggregate demand, which in return can have a positive impact on profits. Blanchard and Kiyotaki [1987]

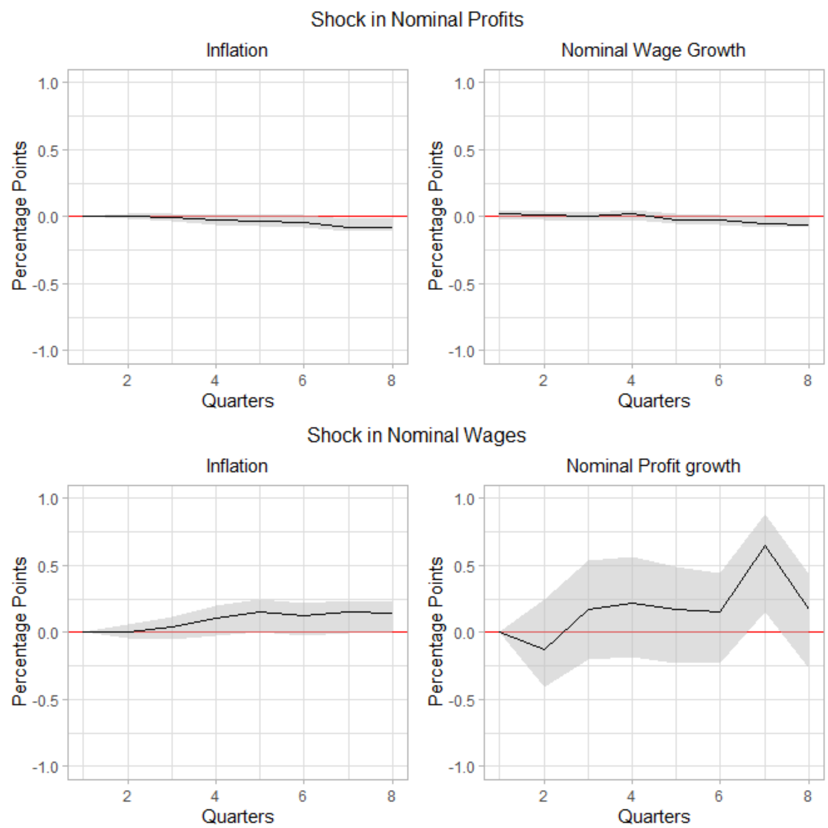

Figure 11: Shock in Nominal Wages and Profits

We will now proceed to the forecast error variance decomposition (FEVD) as described in the chapter on the methods. The concepts of the IRF and the FEVD stem from very similar calculations, which can be reconstructed by the formulas given in the respective section. Nevertheless, the interpretation of the FEVD varies as the underlying idea differs to a certain degree. The FEVD provides the percentage measure of how much a shock to one variable explains another variable. In graph 12, we illustrate the FEVD for each variable in the model. We find that the error variance in forecasting employment is mostly explained by shocks in employment itself. The same holds for inflation, where the majority of the variance can be traced back to a shock in inflation. After two years, 68% of error variance in inflation is composed by a shock in inflation, 14% by a shock in profits and about 10% by a shock in wages. This supports common economic theories and assumptions, according to which inflation strongly depends on its own (past) values. This is not necessarily true for profits. After 1 year, 43% of the error variance in profits can be traced back to employment, 22% to inflation, about 2% to wages and only about 32% are contributed by profits themselves. Thus, the cycle component as well as inflation seem to play a key role when predicting nominal profits. When examining real profits, the contribution of inflation declines and reaches 6% after 1 year. For nominal wages, it seems that most of the explanatory power in the error variance is contributed by shocks to the variable itself, about 78% after one year. Around 7% can be attributed to inflation, around 2% to profits and about 12 % to employment. Of course, this does not automatically imply that wages mostly depend on their past growth rates. It might as well be the case that some variables providing explanatory power are omitted in this model, such as the bargaining power of unions for instance. However, the picture changes when we consider real wages. After one year 55% of the error variance are attributed to inflation. From then onwards the contribution of inflation decreases again. This too, leaves us with the intuitive finding that wages need time to adjust to inflation, which consequently leads to severe real wage losses, similarly as we have seen in the course of the year 2022 in Austria.

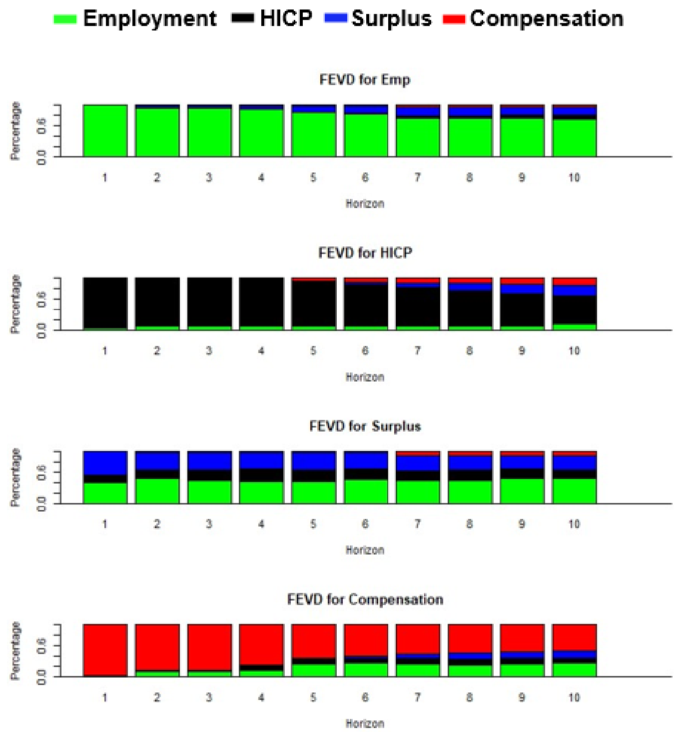

Figure 12: Forecast Error Variance Decomposition

6.3.3 VAR analysis, different branches

We have already discussed the descriptive findings for the dynamics in different economic branches. In this subsection we want to dig deeper and apply similar econometric time series methods. We will focus on two sectors: the energy sector as one of the main drivers of inflation and the manufacturing sector, even moderating recent price increases. This section provides some insights into the dynamics for two outstanding branches, however, we do not aim to provide a full branch analysis.

First, we will focus on the energy sector as the branch with the most pronounced impact on recent price increases according to the GDP deflator decomposition. Note again that the comparison of the results for the overall aggregate level and the findings for the branch analysis is limited due to differences in the data bases. We have chosen the number of lags according to the AIC criterion, which suggested 9 lags. In order to get a deeper understanding of the dynamics within our model, we again start by examining the IRFs. In figure 13 we study the impact of a 1% shock in energy prices. We can see that profits in the energy sector increase drastically, reaching the peak after one year with an effect of about 3.6% on average. We again observe a much more flexible adjustment to prices altough the strongest response is not necessarily immediate. In contrast to that, the response of wages to inflation is again delayed and the rigidity seems to be even more pronounced in the energy sector. Nevertheless, we find a comparably moderate but significant effect of about 0.60% after 7 quarters. For shocks in wages and profits, we cannot find any significant effects, as depicted in the figure 14

Figure 13: Impulse response function, energy sector

In this context it must be emphasized that we are investigating the effect of an increase in overall consumer prices on the profits and wages in one selected branch. Therefore we should not disregard the specific conditions that each sector is characterised by. The energy sector is subject to a lot of fluctuations, resulting in very high standard deviations for prices as well as profits (7.6 for energy prices and 11 for profits). Thus, a 1% increase in overall prices most likely comes along with a drastic hike in energy prices. Of course, this is particularly true for the recent developments in prices, which have been induced by shocks to the gas supply, leading to drastic impact on energy prices. For instance, in the last quarter of 2022, overall consumer prices increased by 10% whereas homemade energy prices rose about five times as much. It thus comes as no surprise that the effect of a 1% increase in HICP on energy profits more than halves to 1.6% after four quarters when considering the same model without considering recent inflationary trends. Also, the significant impact on wages vanishes. These results provide further support for the hypothesis that profits in the energy sector responded heavily to the increases in prices. However, given the underlying data, we cannot confirm a profit price spiral in the sense that profits in the energy sector in return have been driving consumer prices on an aggregate level. Nonetheless, we actually do find an effect of profits on the energy price deflator (homemade energy prices). According to the IRF analysis, a sudden increase in profits of 1% significantly increases energy inflation about 0.18% on average. This is an interesting finding, as it points into the direction of a potential profit price spiral within the energy sector. However, this effect only emerges when the series of high inflation rates is incorporated into the analysis. This finding provides further support for the hypothesis that the profit price spiral is a rather recent phenomenon.

Examining the forecast error variance in figure 15, we obtain similar results. The forecast of the error variance in profits can be explained by consumer prices to an extent of 68% after one and a half years. For wages, we find that the most part is explained by employment and the variable itself. We find similarities for inflation, where the vast majority of error variance stems from shocks in inflation itself.

We have now studied the energy sector contributing most to the acceleration in prices throughout the year of 2022. Now, we want to conduct the same analysis for the manufacturing sector as one of the branches with the lowest impact on overall prices in the recent inflation crisis. In fact, according to the GDP deflator decomposition,

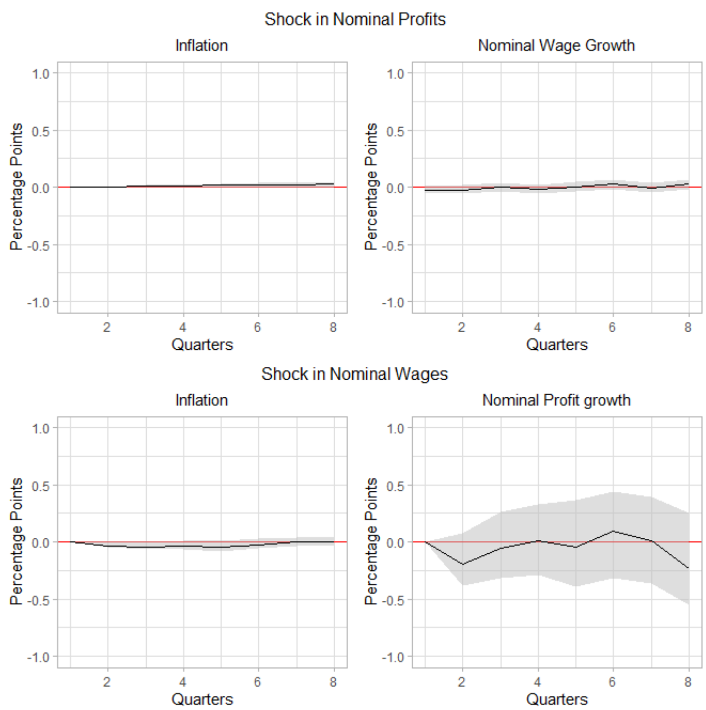

Figure 14: Impulse response function, energy sector

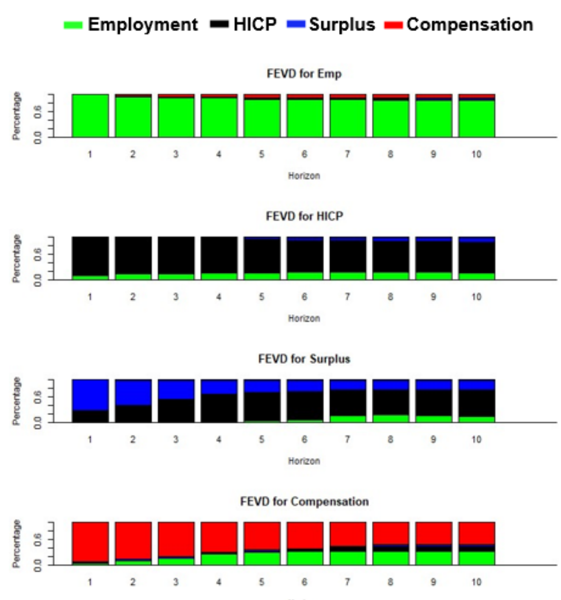

Figure 15: Forecast Error variance Decomposition, Energy Sector

the profits in the manufacturing branch even had a negative impact on homemade prices in 2022. Again, we study the according impulse responses to a shock in inflation.

The results for the manufacturing sector differ markedly from what we have seen before. First we focus on a shock in HICP, standardized to 1%, as shown in figure 16. In contrast to all the previous findings, it seems that profits are negatively affected by price shocks. More precisely, profit growth significantly declines by about 1.38% after five quarters as a response to a price shock. Moreover, profits do not seem to be as flexible as in previous analyses, as the significant effect and the corresponding peak in the impact occur with some delay. Note that the confidence bands here are comparably wide, indicating volatility and uncertainty in the estimation. If we consider a shock to manufacturing prices rather than to the HICP for the overall economy, we find a very moderate but still positive impact of prices on profits. Thus, unsurprisingly, the negative link between profits and the HICP either stems from import prices or prices in other branches.
Interestingly, we find the strongest average impact on wages so far. Again, consistent with the assumptions of rigid wages resulting from the regulations in Austria, it takes about four quarters for wages to adjust to prices. After this amount of time, wages respond on average about 0.27% to a 1% increase in prices. Note, however, that this refers to the average effect, where the confidence band range from 0.03% to 0.41%. One reason for this finding could be the fact that the manufacturing branch comprises some sectors in Austria, such as the metal industry, where the bargaining power of unions is particularly strong resulting in significantly higher wage settlements. [Eurostat, 2023]

In figure 17 we depict the effect of a shock in wages and profits to the system. Just like in the previous analysis we find no significant effects of shocks in wages or profits on the other variables in the model. By additionally examining the forecast error variance decomposition for manufacturing branch we find support for the findings. Compared to the energy sector, the explanation power of inflation for forecasting the error variance in profits is significantly lower and peaks at 12%. Interestingly, the cycle component plays a remarkable role in explaining wages and contributes about 68% to the forecast error variance after five quarters.

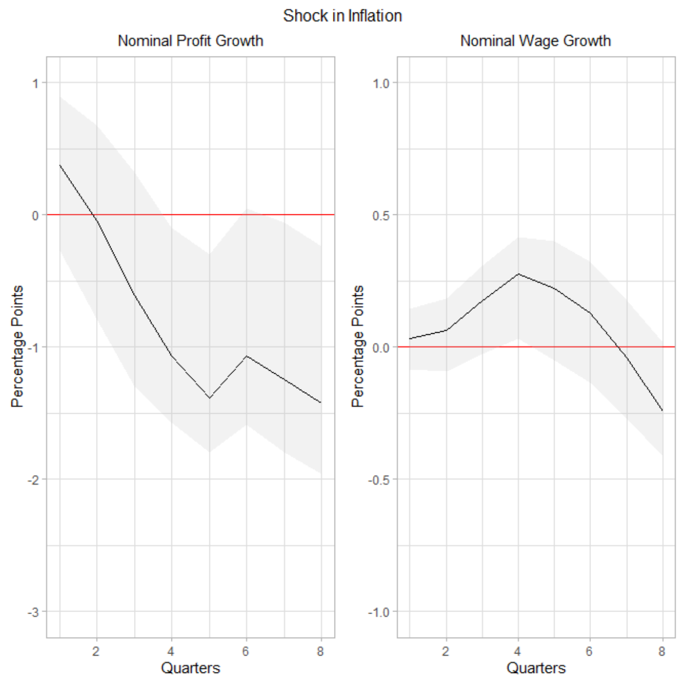

Figure 16: Impulse response function, Manufacturing Sector

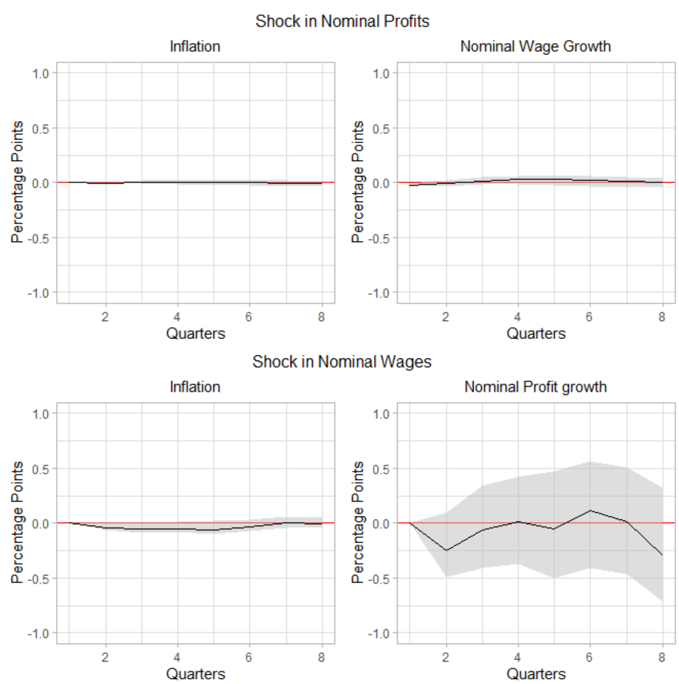

Figure 17: Impulse response function, Manufacturing Sector

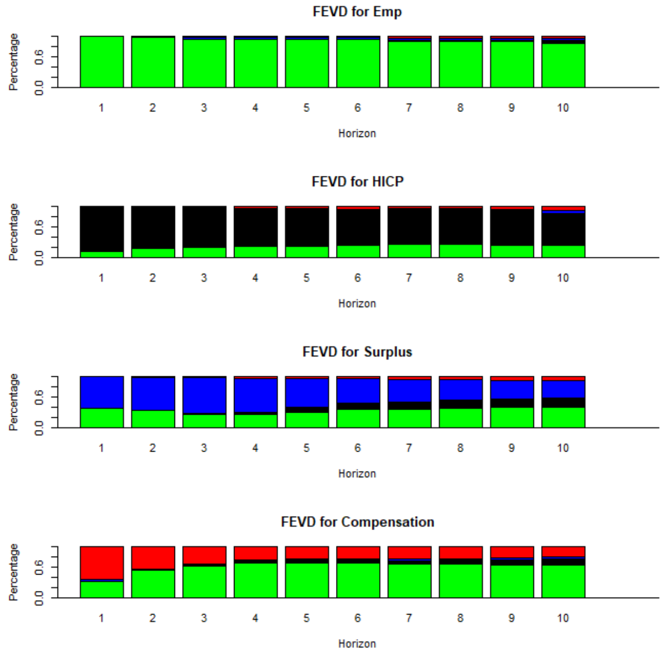

Figure 18: Forecast Error variance Decomposition, Manufacturing Sector

7 Limitations

The aim of this thesis is the investigation of a potential wage price or profit price spiral in Austria with a special emphasis on the recent inflation dynamics. We apply common macroeconomic methods and therefore cannot outcome widespread issues in macro analyses. One first key limitation in macroeconomics is the scarcity or the lack of data. This is unfortunately particularly true for Austria, where data is often non-existent, not accessible or costly to get hold of. As a consequence, we solely managed to include data ranging from 1995 to 2022 although we originally planned to include the time period from 1970 to 2022. It was one main objective to include two periods of high inflation rates and additionally to increase the number of observations. However, it was beyond the scope of this thesis to process existing data in a suitable manner for this thesis. Thus, we decided to restrict our investigation. We conducted our time series analysis knowing that the number of data points is comparably low, which might lead to the issue of either being unable to find any significant effects or even worse, of actually detecting effects that are sensitive and unstable. Therefore it is common practice to test for different variations of the specified model in order to provide robustness checks, which we include in the Appendix. However, it cannot be emphasized enough that this practice is solely an instrument to deal with these kind of issues, it cannot provide a definitive solution.

With the stated methods, we were able to find at least some significant results. In order to ensure full transparency, we want to emphasize that we did not aim or claim to find any causal links between the variables included in the model. We apply widespread and accepted macroeconomic methods to find correlations over time, providing us with a first intuition for the underlying dynamics. We have chosen these specific methods deliberately as it was one of our main concerns to reduce the number of theoretical assumptions for this empirical model. Nevertheless, as it is true for most researchers in that field, we did incorporate some theory into our model, such as the method of causal ordering.

We generally want to point out that we are applying one definition of inflation to our time series analysis, namely the HICP. The effects and according explanations for this thesis build on the assumption of equating HICP and inflation, which might depend on the economic perspective. In general, there are many other indices for measuring inflation or price developments such as the producer price index or the GDP deflator. For future research it therefore might be interesting to conduct similar analyses including different price indices. This might further improve our understanding of inflation and its potential causes and additionally enable us to draw comparisons. Particularly for profits, it could be of interest to investigate its link to the GDP deflator or the producer price index, as both of these measures are directly affected by the companies' price setting schemes, whereas the HICP additionally comprises the prices of imported goods.

8 Conclusion

The aim of this thesis was to shed light on the ongoing discussions regarding the recent inflation dynamics and its potential causes. Many politicians, policy makers as well as economists have appealed to unions to hold back with their wage demands in order to prevent the economy from being trapped in a wage price spiral [Presse, 2023]. In contrast to that, an increasing number of institutions and economists, such as the Momentum Institute, the ÖGB or Isabella Weber, emphasized the role of rising profits in this debate. They argue that firms have made use of their market power in the economic crisis, which enabled them to increase their profit margins on the basis of price increases. Accordingly, they argue that currently the main concern should not lie on the prevention of a wage price spiral, but rather on the question of how to escape the already existing profit price spiral. We are aware of the fact that this discussion is not only of economic nature, but also depends on ideological and political perspectives. Nevertheless, we want to contribute some economic insights in order to find an empirical basis for the debate.

By making use of widespread macroeconomic methods such as VAR analysis and Granger causality tests, we attempted to study both arguments. We define that a wage price spiral as well as a profit price spiral emerges, if there is an evident interdependence between the respective variable and inflation. More precisely, such a spiral can be found if both, wages or profits, and prices significantly affect each other. With the methods applied in this thesis we can neither support the existence of a wage price spiral nor the emergence of a profit price spiral in the past 26 years. Rather, we discover support for the widespread approach, which can also be found in the wage-price considerations of Bernanke and Blanchard [2023] that inflation primarily depends on its own past. This, of course, does not imply that the variables move completely independently of each other. We find compelling evidence for significant impacts of inflation on wages and profits - both in real and nominal terms. Further, we state that profits and wages markedly differ in their ability to flexibly adjust to inflationary shocks. We therefore propose to treat assumptions, such as in the well-known paper of Blanchard [1986], indicating similar degrees of rigidity for profits and wages with some caution. We further find evidence for structural changes in the transmission mechanisms of profits, wage and prices since the start of the acceleration in prices in 2021.

Overall, the results of this thesis have helped disentangling the puzzle of inflation and its potential roots to some extent. Our findings provide evidence that the consequences of inflation might be borne unequally. While workers on an aggregate level have to put up with rather severe real wages losses, companies manage(d) to make use of their market power and increase their profits - at least to some degree. This does not only potentially lead to severe economic inequality, it also poses challenges for policy makers and politicians. Also, we find that the energy sector has played a key role in recent inflationary developments. Interestingly, our analysis reveals that the profits in the energy sector seem to be increasing the most when facing price shocks. It is therefore advisable to lay a special emphasis on the energy sector when attempting to mitigate inflation. Furthermore, the unequal consequences of inflation due to the differences in flexibility of profits and wages are a key finding of this thesis and should be further investigated.

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A Appendix

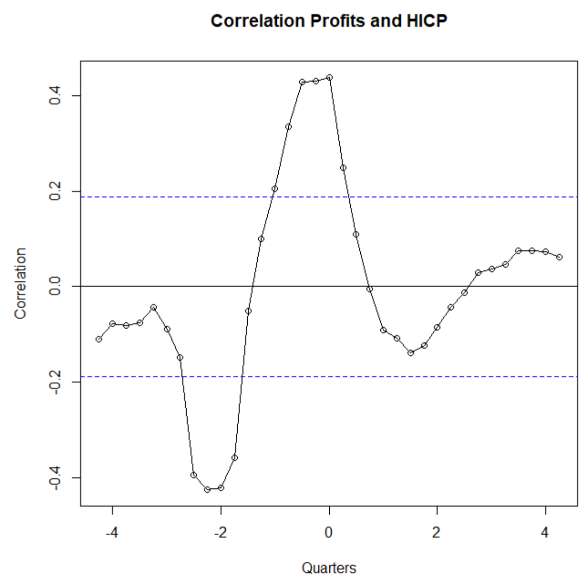

Figure 1: Cross-correlation, Profits and Inflation
Note: Profits are given in unit terms and refer to the operational surplus before taxes.

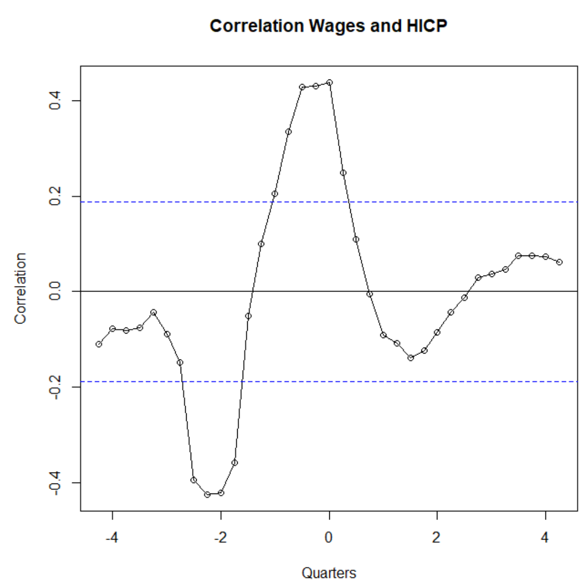

Figure 2: Cross-Correlation, Wages and Inflation
Note: Wages are defined as the compensation per employee.

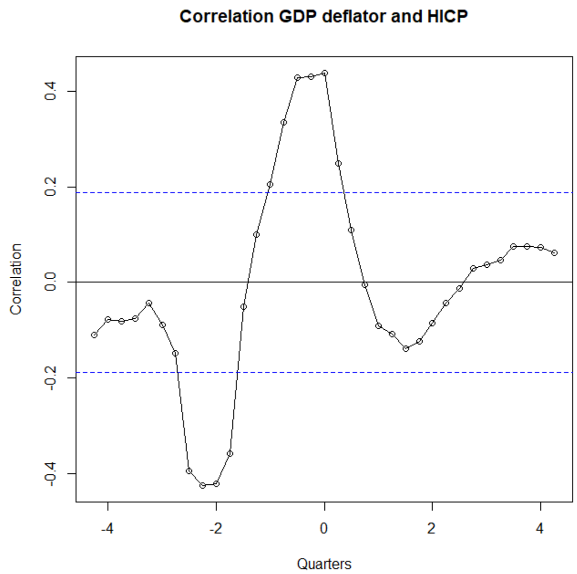

Figure 3: Cross-correlation, GDP deflator and HICP

```
$selection
AIC(n)  HQ(n)  SC(n) FPE(n)
     7      7      1      7

$criteria
                1          2          3          4           5           6
AIC(n) -1.5805320 -1.9665516 -1.9282741 -2.3246510 -2.55453982 -2.58241030
HQ(n)  -1.3671512 -1.5824661 -1.3734840 -1.5991562 -1.65834037 -1.51550620
SC(n)  -1.0529877 -1.0169717 -0.5566587 -0.5310000 -0.33885341  0.05531161
FPE(n)  0.2059386  0.1402294  0.1463166  0.0992142  0.07985416  0.07915661
                 7           8           9          10
AIC(n) -2.89788716 -2.74109039 -2.57725998 -2.82182655
HQ(n)  -1.66027840 -1.33277696 -0.99824190 -1.07210381
SC(n)   0.16187026  0.74070255  1.32656846  1.50403740
FPE(n)  0.05931389  0.07195404  0.08891588  0.07404556
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Figure 4: Output information criteria

Note: We have chosen the lag order according to the AIC criterion in this thesis.

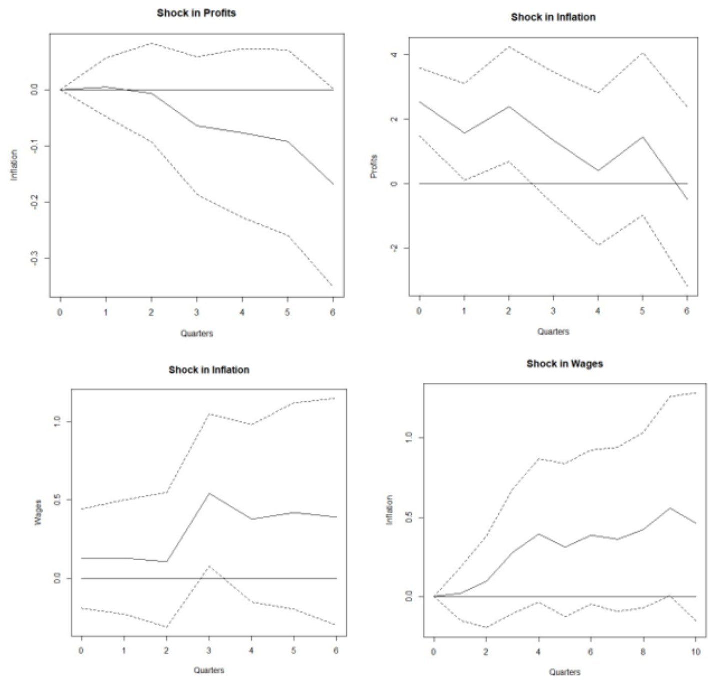

Figure 5: Bayesian Approach, Results
Note: We apply a bayesian methods to the same model using an uninformative pior.Profits are given in unit terms and refer to the operational surplus before taxes. Wages are defined as the compensation per employee.

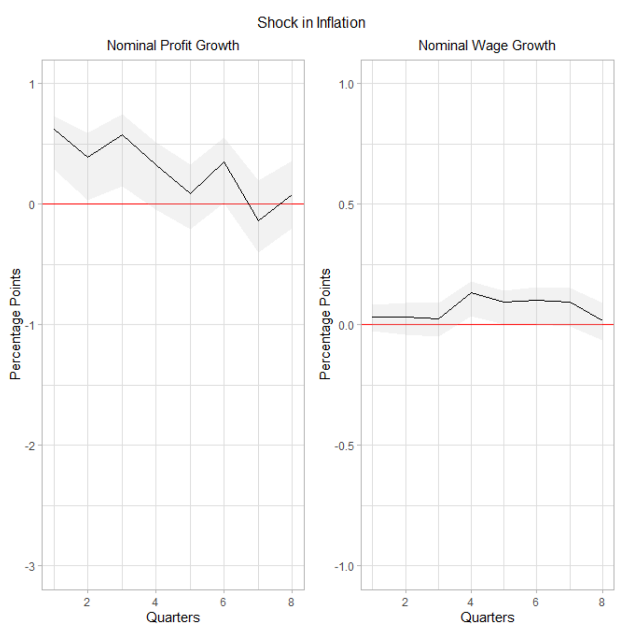

Figure 6: Robustness check 1, results to a shock in inflation
Note: We changed the ordering of the variables in the model, such that the vector of endogenous variables looks like the following: $y_t = (Employment, Inflation, Wages, Profits)$. Profits are given in unit terms and refer to the operational surplus before taxes. Wages are defined as the compensation per employee.

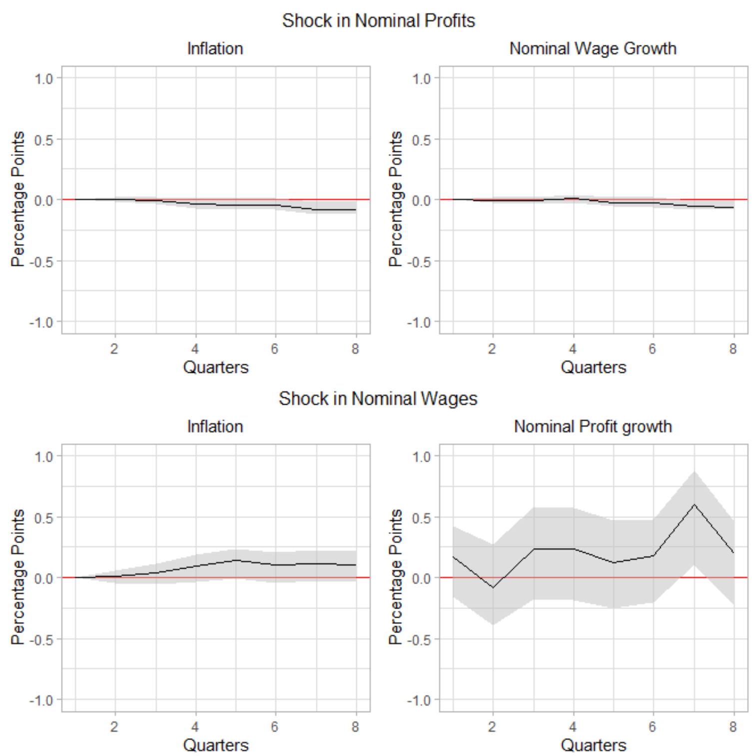

Figure 7: Robustness check 1, results to shocks in wages and profits
Note: We changed the ordering of the variables in the model, such that the vector of endogenous variables looks like the following: $y_t = (Employment, Inflation, Wages, Profits)$. Profits are given in unit terms and refer to the operational surplus before taxes. Wages are defined as the compensation per employee.

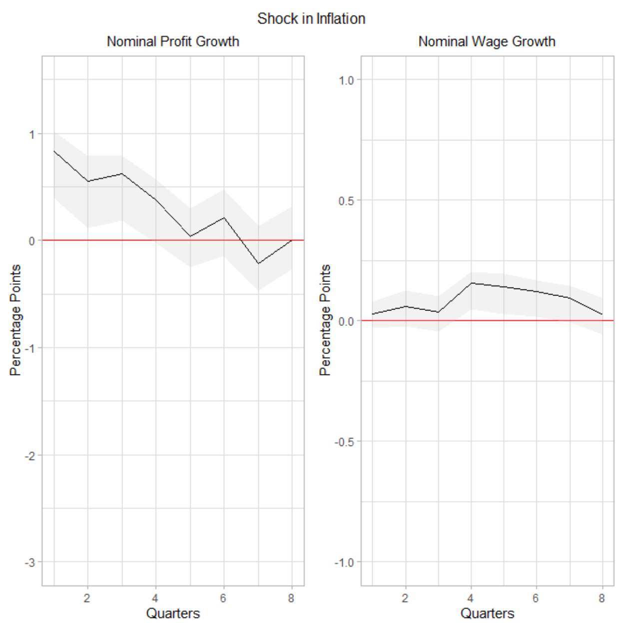

Figure 8: Robustness check 2, results to shocks in inflation

Note: We changed the ordering of the variables in the model, such that the vector of endogenous variables looks like the following: $y_t = (Inflation, Wages, Profits, Employment)$. Profits are given in unit terms and refer to the operational surplus before taxes. Wages are defined as the compensation per employee.

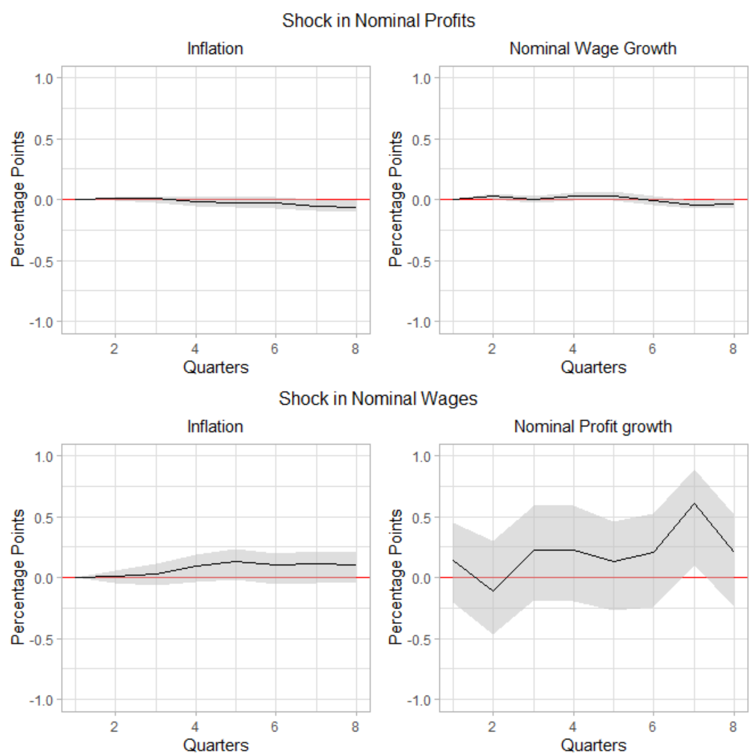

Figure 9: Robustness check 2, results to shocks in wages and profits
Note: We changed the ordering of the variables in the model, such that the vector of endogenous variables looks like the following: $y_t = (Inflation, Wages, Profits, Employment)$. Profits are given in unit terms and refer to the operational surplus before taxes. Wages are defined as the compensation per employee.

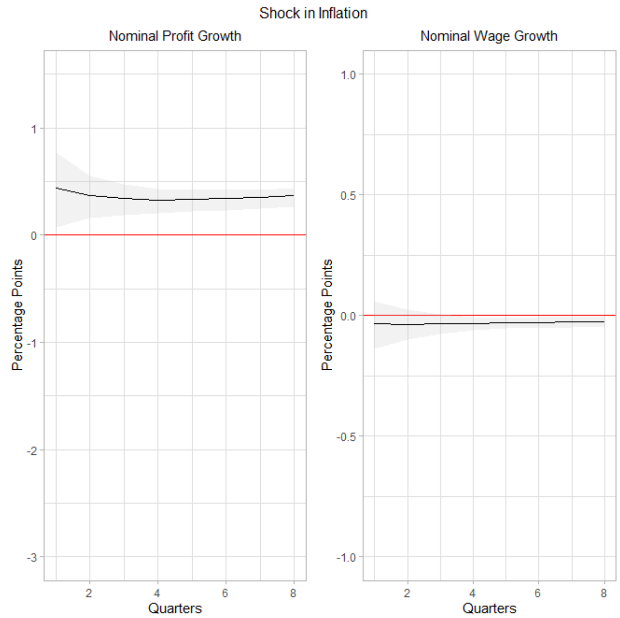

Figure 10: Robustness check 3, results to a shock in inflation
Note: We changed the lag order of the model from $p = 7$ to $p = 1$. Profits are given in unit terms and refer to the operational surplus before taxes. Wages are defined as the compensation per employee.

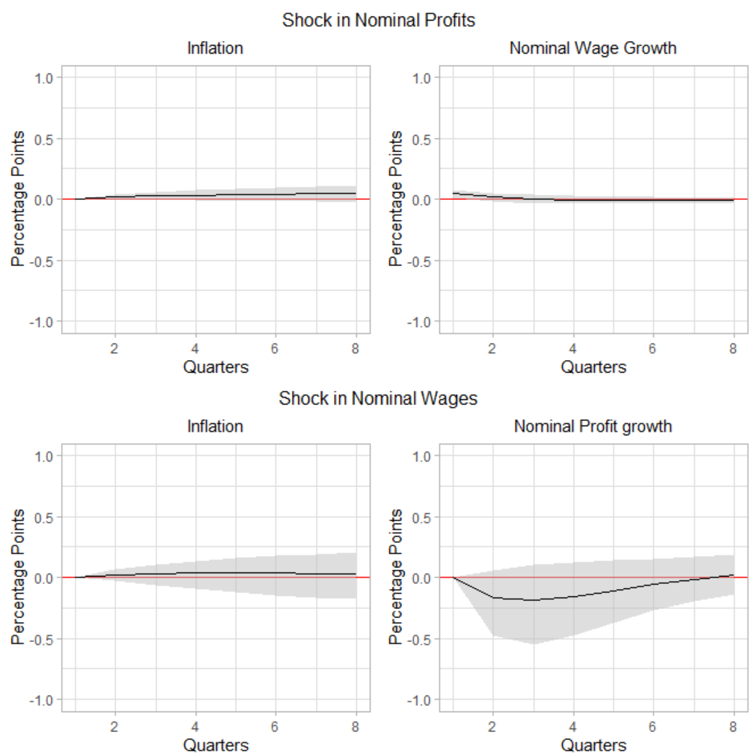

Figure 11: Robustness check 3, results to shocks in wages and profits
Note: We changed the lag order of the model from $p = 7$ to $p = 1$. Profits are given in unit terms and refer to the operational surplus before taxes. Wages are defined as the compensation per employee.

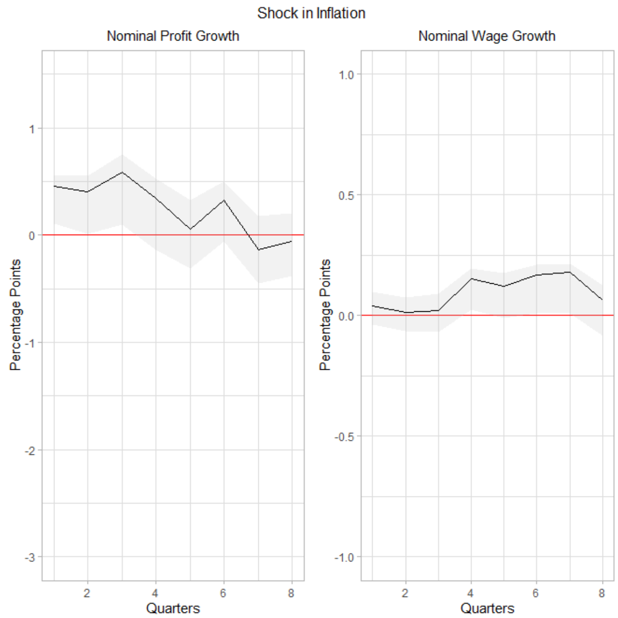

Figure 12: Robustness check 4, results to a shock in inflation
Note: We changed the lag order of the model from $p = 7$ to $p = 10$. Profits are given in unit terms and refer to the operational surplus before taxes. Wages are defined as the compensation per employee.

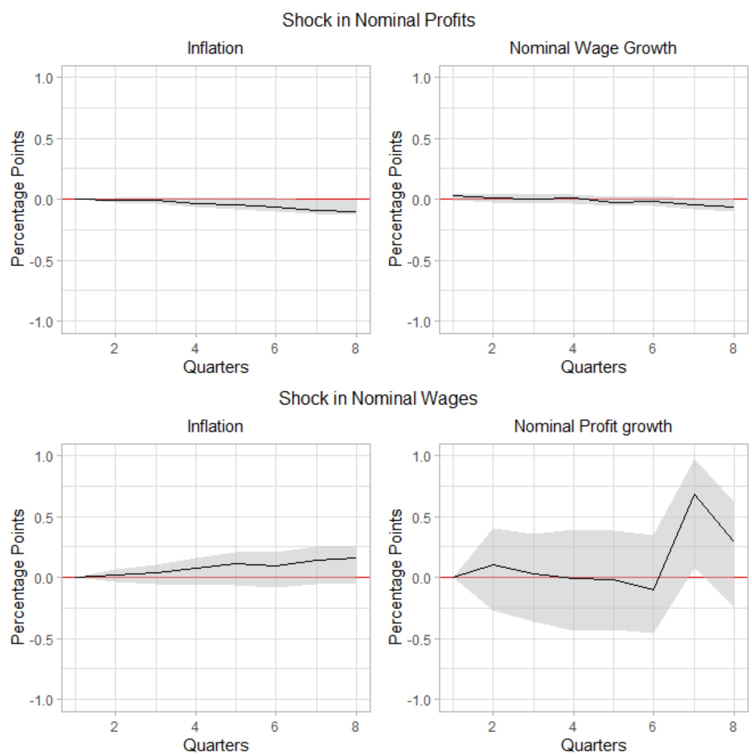

Figure 13: Robustness check 4, results to shocks in wages and profits
Note: We changed the lag order of the model from $p = 7$ to $p = 10$. Profits are given in unit terms and refer to the operational surplus before taxes. Wages are defined as the compensation per employee.

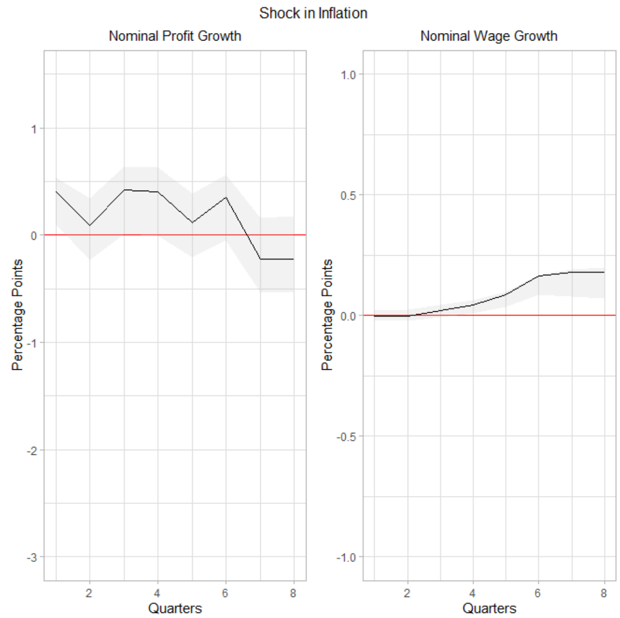

Figure 14: Results to a shock in inflation including minimum wages
Note: We include minimum wages rather than the compensation of employees. The suggested lag order of the model is now $p = 8$. We additionally include productivity as a variable in this analysis as the effects of minimum wages might differ when omitting the impact of productivity.

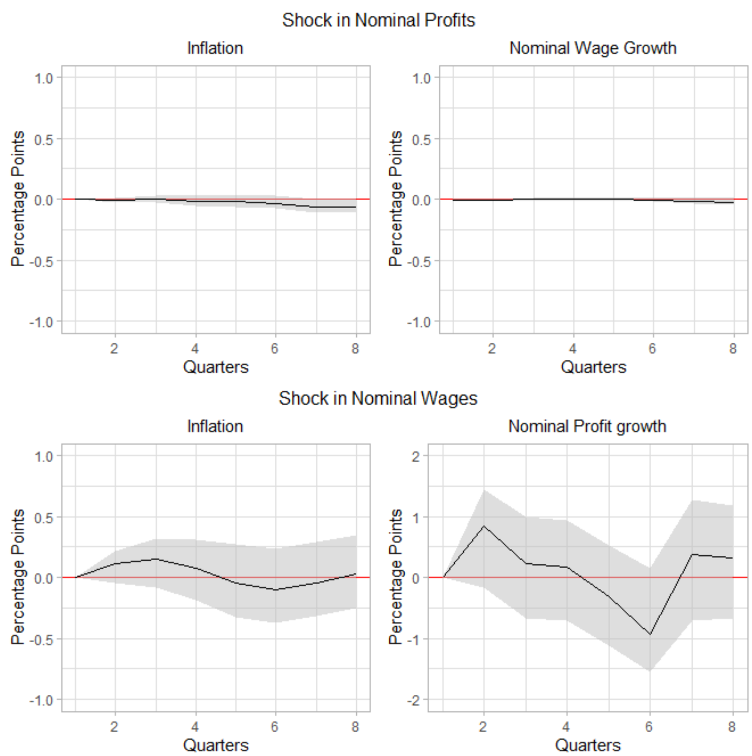

Figure 15: Results to a shock in wages and profits including minimum wages
Note: We include minimum wages rather than the compensation of employees. The suggested lag order of the model is now $p = 8$. We additionally include productivity as a variable in this analysis as the effects of minimum wages might differ when omitting the impact of productivity.

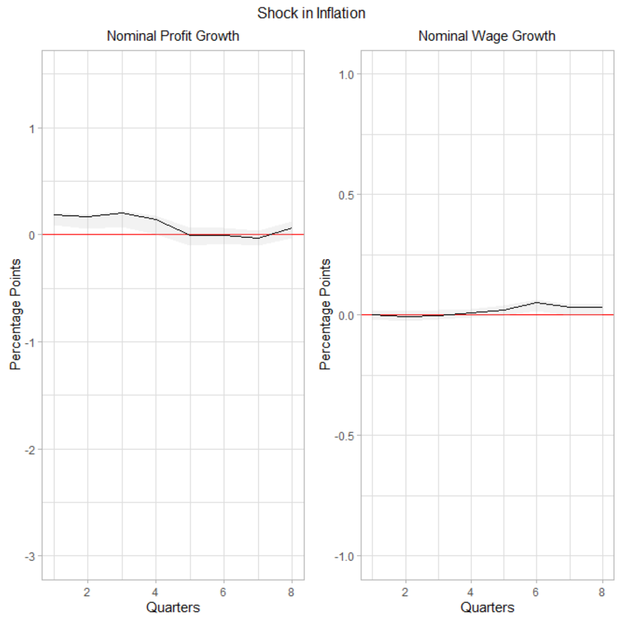

Figure 16: Results to a shock in GDP deflator, energy sector

Note: We estimated the model using the GDP deflator for the energy sector instead of the HICP for the overall economy. We find significant effects of prices on wages and profits for the energy branch.

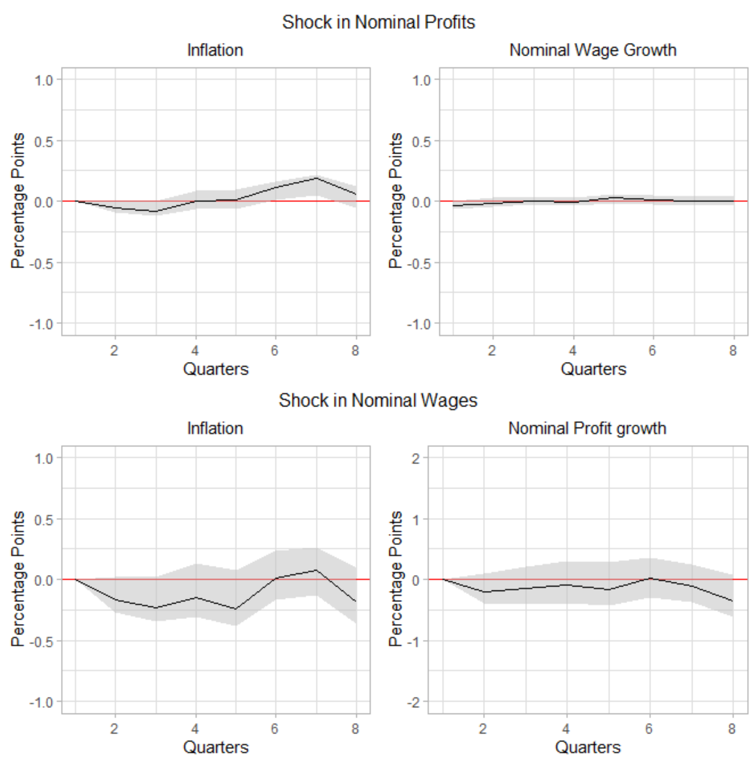

Figure 17: Results to a shock in wages and profits, energy sector

Note: We estimated the model using the GDP deflator for the energy sector instead of the HICP for the overall economy. We find a significant impact of profits on energy prices after 7 quarters.