Dealing with exogenous inflation shocks in a small open economy with fixed exchange rate: the case of Denmark

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Abstract

After decades of relative consumer price stability and low interest rates, most developed economies are now faced with a resurgence in inflation. While the ongoing episode of high inflation is largely attributed to cost-push factors, central banks are responding to the rising inflation by increasing interest rates. This monetary policy tightening combined with the resurgence of cost-push inflation appears to present a lethal combination for both economic growth and financial stability. To investigate the question, we use an empirical stock flow consistent model calibrated on Danish data. Denmark offers an interesting example of a small open economy with its own currency, that follows interest rate changes of its bigger neighbour, the euro area. To ignite the inflation process, we introduce an exogenous increase in imported prices. Our model allows for a detailed presentation of how the increase in imported prices affects other prices as well as real macroeconomic variables, notably GDP components and unemployment. We then introduce several policy responses: monetary policy tightening in the form of higher interest rates and expansionary fiscal policy in the form of lower tax on labour income, as well as a combination of the two. We find that inflation is little affected by the various policy responses, while unemployment and activity are much more impacted. Our results contribute to raising a doubt on the appropriateness of monetary policy as a tool to address inflation in all circumstances.

1. Introduction

The topic of inflation has been the focus of much research in macroeconomics over the last decades, at times even dominating academic and political discussions. From being declared as public enemy number one by the US president Gerald Ford in 1974 to becoming the key objective of monetary policy, inflation has received a lot of attention. This is not surprising, since economic history contains many episodes of high inflation, often accompanied with desperate attempts to tame it.[1]

The interest in inflation as a research topic somewhat faded around the mid-1990s in the Western world, even though monetary policy divisions of the central banks maintained price stability as their core priority. The primary reason was that prices in most advanced economies remained low and stable – which was considered unquestionable evidence of the appropriateness and efficiency of monetary policy – while other pressing economic issues came to the spotlight, such as repeated financial crises and fluctuating unemployment. However, the situation changed dramatically during the aftermath of the Covid-19 crisis. After an initial decrease in prices in 2020, due to the collapse in the demand for energy associated with the temporary shutting down of several sectors in countries affected by Covid-19, the disorderly reopening of global supply chains created shortages and progressively pushed up the prices of many goods and services. The situation was further deteriorated by an increase in global energy prices associated with unanticipated geopolitical developments, raising annual inflation to roughly 8 percent in the euro area and 8.6 percent in the US in the middle of 2022. In response to the resurgence in inflation, most central banks have decided to raise their interest rates.

Despite being one of the oldest debates in macroeconomics, the mechanism through which prices change and adjust remains highly controversial. The controversy not only exists between Post-Keynesian and mainstream theories, but also within the mainstream theory (i.e., between New Classicals and New-Keynesians). The main difference between these schools is that Post-Keynesians do not assume neutrality of money and dichotomy between real and nominal variables at all, neither in the short nor the long run, whereas New Classicals make these assumptions in both the short and the long runs. New-Keynesian, whose views have dominated mainstream macroeconomics since the late 1980s (Gali and Gertler 2007), giving way to the New Macroeconomic Consensus (Arestis 2009), assume non-neutrality and non-dichotomy in the short-run before reverting to neutrality and dichotomy in the long run. However, the exact way that economic policy can affect the trajectory of real macroeconomic variables in the short

[1] For example, see a detailed survey by Laidler and Parkin (1975).

run differs between New Keynesians and Post-Keynesians. Consequently, the proposed policy responses to tame inflation also differ considerably.[2]

An extensive literature addresses the differences in the way nominal and real economic variables interact within the Post-Keynesian and New-Keynesian theories (Kriesler and Lavoie 2007, Hein and Stockhammer 2010, Melmies 2010, Stockhammer 2011). Two core areas can be identified, which form the basis of the disagreements between Post-Keynesians and New-Keynesians. Firstly, from a financial market perspective, the treatment of money (or credit) forms the basis of several disagreements regarding the interaction of real and nominal economy. Specifically, the contradictory explanations of the “non-neutrality” of money, besides having other implications, plays a central role in monetary policy decisions. Secondly, from a labour market perspective, the different treatment of prices and wages and the determination of employment can explain the key differences in the way nominal and real economic variables interact within the two frameworks. The former aspect has received a lot of attention in the Post-Keynesian literature, and the issue has been extensively analysed in a comprehensive modelling framework, following the publication of stock-flow consistent (SFC) models by Godley and Lavoie (2007). On the other hand, the dynamics of prices in relation to wages and employment, even though appears in earlier publications, has not received much attention in a coherent and comprehensive modelling framework, as inflation was not an issue of major concern until recently.

In the context of the global resurgence in inflation, this paper aims to fill this gap. From a theoretical point of view, this paper incorporates Post-Keynesian theory of wage and price determination in an empirical Stock-Flow Consistent model along the lines of Godley and Lavoie (2007). Even though, inflation dynamics are thoroughly covered in the theoretical SFC models in Godley and Lavoie, the empirical relevance of price and wage-setting remains unclear. Some empirical models such as Zezza and Zezza (2020) and Byrialsen and Raza (2021) endogenise prices and wages, but the investigation of inflation and labour market dynamics has not been addressed as a central question by these models. We fill this gap by using an SFC framework to investigate empirically the issue of inflation in relation to the labour market, using an exogenous shock in the form of higher imported prices, to study the effectiveness of monetary policy.

The rest of the paper is organised as follows. In the next section we highlight the absence of consensus in the literature regarding the effects of monetary policy, in the form of interest rate

[2] See, e.g., (Davidson 2006), Fontana (2009), Fontana & Palacio-Vera (2002, 2006), Gnos & Rochon (2007), Hein (2006a), Kriesler & Lavoie (2007), Lavoie (2004, 2006), Palley (2006, 2007), Rochon & Rossi (2006), Sawyer (2002), Seccareccia (1998), Setterfield (2006, 2009), Smithin (2007), Stockhammer (2008) and Wray (2007).

changes, on aggregate demand and inflation. We present the main features of our empirical SFC model for Denmark in the third section, before introducing the shock (an increase in imported prices) as well as several policy responses (monetary and fiscal) in the fourth section.

2. Literature Review

Being a social science, economics is inevitably subject to conflicts between rivalling theories, which often reflect differing principled positions and representations. As a result, there is no consensus among the economic profession with regards to, say, what causes unemployment or how to reduce public debt. However, one can confidently state that of all major economic concepts known to the general public, inflation – defined as the rate of growth in consumption prices – is by far the one whose origins and remedies are the least agreed upon between economists.

At the beginning of the 1980s major central banks adhered to monetarism, seeing inflation as a monetary phenomenon which can therefore be tamed by slowing down the growth of the money supply. Various failed experiments in the Western world to stabilise inflation using monetary aggregates, followed by the Japanese experience of the 1990s unveiling a negative correlation between the quantities of money (M1 or M2) and price levels (consumption prices, GDP deflator, stock prices) took the prevailing orthodoxy off-guard.

In an attempt to reuse most of the existing monetarist framework, it was progressively decided to invert the theoretical roles of money and interest rates: money became endogenous and interest rates became the exogenous main policy variable. From a monetary phenomenon in the long run with possible deviations from neutrality in the short run, inflation became a function of the output gap in the short run, while reverting to a supply-side-determined path in the long run (Clarida & al. 1996). This new consensus, associated with the New Keynesian approach, emerged progressively before becoming dominant in the aftermath of the GFC.

In spite of this apparent consensus, there are notable disagreements between economists regarding the subject. Post-Keynesian economists, which had underlined the endogenous nature of money for decades before it rose to prominence with the new consensus, tend to see interest rate policy as relatively ineffective against inflation. Wray (1997) and Setterfield (2007) even stress the existence of a cost-push channel, whereby an increase in interest rates can put prices up through higher financial costs for companies. Generally, post-keynesians tend to see fiscal policy as a better tool to influence the output gap, while at the same time discarding the existence of an inverse relationship between output gap and inflation when the economy is not at full capacity utilisation. This is why post-keynesians were the first school to suggest the existence of a flat horizontal Phillips curve (Hein 2002, Lavoie XXX).

The disagreement does not stop here: even among mainstream economists, there is no consensus with regards to the direction in which a change in interest rate operates. New classical economists, whose theories are based on rational expectations, do not agree with the idea that a change in policy rates will trigger a variation of inflation in the opposite direction. In the famous two-generation model of Lucas (1972), the random inter-generational interest rate increases the nominal demand for goods from the older generation, thereby pushing prices higher. A decade later, Sargent & Wallace (1981) showed that in a context marked by Ricardian equivalence – whereby agents put an upper limit to the real value of public debt – as well as fiscal dominance, an increase in interest rates can result in higher inflation if total government spending increases[3]. Generally speaking, the real business cycle approach, which assumes perfect flexibility of prices, considers that monetary policy cannot affect relative prices, and real interest rates in particular, meaning that an increase in nominal interest rates will bring about a corresponding increase in prices – it should be emphasised that even New Keynesians accept this is the case in the long run too, since they depart from the New Classicals viewpoint only in the short run, when they assume prices to be sticky. Table 1 sums up the differences between the various approaches.

Approach	**Is money neutral?**	**Influence of interest rate changes on inflation**
Monetarists New Keynesians	Only in the long run	In the opposite direction
Institutionalists Post Keynesians	Never	Indeterminate
New Classics Real Business Cycle theory	Always	In the same direction

Table 1: Monetary policy and inflation

The lack of theoretical consensus on the effects of monetary policy on inflation is compounded by inconclusive empirical evidence. Drawing on the VAR analysis of Ramey (2016), Cochrane (2022) states that "monetary VARs show that higher nominal interest rates raise real interest rates and reduce *output*, but they have slow small and uncertain effects on *inflation*". The first

[3] Interestingly, a similar mechanism exists in Post-Keynesian stock-flow consistent models, which Setterfield (2007) calls 'rentier stimulus'.

part of the sentence goes against rational-expectation-based approaches, but the second part directly contradicts the alleged usefulness of interest rates as a tool to fight inflation. It is therefore rather puzzling that all major central banks adopt a policy framework which is the subject of much theoretical disagreement, as well as unsupported by existing evidence[4].

To bring some clarity to the debate, we review the literature to identify the different channels though which changes in central bank interest rates can affect inflation. It must be highlighted that there often isn't a clear-cut separation between these channels (especially the interest rate, asset price and bank lending channels) which interact and reinforce each other.

<u>Interest rate channel:</u> The first obvious effect of a change in policy rates, is that they affect all the other interest rates in the economy, such as the rates on bank lending, deposits and securities, which have multiple consequences. In what follows, we will use the example of a reduction in policy rates.

The reduction in the interest rate on deposits can induce households to save less and spend more on consumption, while the reduction in bank lending rates can induce households and firms to invest more. Furthermore, if the interest rates remain at a lower level for a long enough time, the income of fixed-income asset owners can decline as the debt they own gets rolled over at lower rates. On the other hand, agents who borrow from banks or mortgage lenders may be able to renegotiate their debt at better conditions. A decline in interest rates therefore tends to redistribute disposable income from creditors to borrowers, which in theory is beneficial to aggregate demand as the propensity to spend of the former is lower than the latter.

It should be noted that while most of the effects associated with the interest rate channel relate to demand, there also exist effects on the supply side, e.g., through changes of non-financial companies' costs.

<u>Asset price channel:</u> As interest rates decline, the valuations of most financial assets increase. This is particularly true for debt-related securities, whose prices are mathematically linked to the policy rate through a discount rate, but it also applies to stock prices through portfolio arbitrage or changes in margin call conditions. The increase in assets prices increases the wealth of agents, which in the case of households can drive their consumption up – amplifying the interest rate effect.

[4] If anything, evidence have long been against the use of interest rates to fight inflation, at least since Keynes (1930) pointed to the existence of the 'Gibson paradox' which highlights the existence of a positive correlation between interest rates and inflation.

Bank lending channel: As interest rates declines and the balance sheets of potential borrowers improve, banks become more willing to lend. This is because the improvement in collateral and the lower interest rate reduces the probability of default. Furthermore, agents can borrow more from banks for a given repayment schedule, once the share of interests is lower.

Exchange rate channel: A decrease in the yields of domestic assets tends to provoke a depreciation of the currency – if the exchange rate is allowed to vary. The depreciation brings about imported inflation as well as an increase in net exports, assuming sufficient import and export price-elasticities. However, if agents owe debt denominated in foreign currencies, they could see their financial burden increase.

Expectation channel: It is often considered that central banks must act and communicate to anchor the inflation expectations of agents. Therefore, even a small increase in interest rate could send a signal that the central bank is serious about fighting inflation, thereby lowering inflation expectations. However, this approach has three caveats. First, since there is no clear agreement within the literature on the exact effect of interest rate changes on inflation, one can wonder why agents should assume that interest rates necessarily reduce inflation. Second, the approach fails to distinguish between inflation coming from internal factors and inflation coming from outside, due to largely exogenous causes. Third, the data available on inflation expectations shows that these tend to be backward looking, which means that agents are not good at forecasting future inflation when the variance of inflation increases (Rudd 2021).

On top of the channels identified above, which are quite common in the literature on the subject, we also identify two channels which are less frequently mentioned.

Future prices: A decrease in interest rates has a direct (negative) effect on the formation of prices on future markets. The formula to calculate the future value of a commodity is

$$FP = SP.(1+r)^n$$

Where FP is the future price, SP the spot price, r the interest rate per period and n the number of periods in the future the future transaction will take place. It can be seen from the formula that a rise in the interest rate increases the future price, for a given spot price.

Longer term effects of investment on the supply side: If lower interest rates stimulate investment, this will increase the production capacity in the economy, in particular in sectors suffering from supply constraints. When inflation is due to bottlenecks, as this has been the case after the COVID-19 pandemic, a decrease in interest rates can help alleviate the causes of inflation in the longer run[5]. Furthermore, new investment is the only way to implement technological innovation, which can improve productivity and therefore reduce costs of production (Setterfield 2007). If one accepts that there is no pre-determined long term path for the economy, as post-keynesians do, lower interest rates can contribute to lowering inflation in the long run.

As can be seen, the overall effect of a change in interest rates on inflation is far from being clear-cut. Most of the effects take place through aggregate demand stimulation. According to the New Keynesian approach, an increase in aggregate demand pushes inflation higher, while according to Post-Keynesians there is no automatic link between the two, the effect depends upon a variety of factors including technologies employed, institutional arrangements, and capacity utilisation across various sectors.

The direct effects on prices are no less ambiguous. While a decrease in interest rates is accompanied by higher prices of financial assets and imports, they also come with lower financial costs for borrowing companies and lower future commodity prices. Furthermore, insofar as lower interest rates stimulate investment, they can help solving scarcity caused by bottlenecks and foster innovation – both having disinflationary effects in the medium and long run.

The absence of a comprehensive framework to investigate and compare the possible channels linking interest rates and inflation calls for further theoretical work which is beyond the scope of this article. In the next section, we endeavour to explore the question from an empirical perspective, using the case of Denmark.

3. Data and Methodology

3.1 Data and estimation

To explore a broad variety of channels through which nominal and real economic variables interact and to get a deeper understanding of the pricing mechanism, we exploit the advantages of a stock-flow-consistent model while using sectoral national account data for Denmark over the period 2005Q1-2020Q2. The data used in the model consists of 5 assets (deposits, loans, securities, equities, and pensions) and 5 institutional sectors (household, firms,

[5] This point was brought to our attention by Nathan Tankus.

financial corporations, government, and rest of the world).[6] The assumptions involved in the construction of our databank consisting of the balance sheets and transaction flow matrix are discussed in the appendix.

After constructing the databank, we define accounting identities to identify certain key relationships. However, the equations involving structural parameters are estimated using dynamic regressions. While estimating the structural parameters, we also log-linearise certain relationships, if theoretically intuitive. Even though our estimation strategy attempts to choose a functional form that attempts to best fit the data for a given dependent variable, our choice of variables in every equation is purely based on theory. Furthermore, we also include dummies in most of the behavioural equations, to control for the effect of structural breaks.

3.2 Model description

We now turn to presenting the key equations of the model, starting with the real side of the economy. The entire output of the economy, equal to GDP, is assumed to be produced by the firms (also referred to as non-financial corporations (NFC)). The standard GDP identity in nominal terms is given by:

$$Y_t = C_t + I_t + G_t + X_t - M_t$$

where C_t represents private consumption, I_t represents gross fixed capital formation, G_t represents government spending on goods and services, X_t represents exports, and M_t represents imports of the economy.[7] All components of output, except G_t, are endogenous in the model.

Before going through the GDP components in more details, we will first present the core equations determining the wage and price setting behaviours in the model.

Labour market: Wage- and Price-setting

To produce output, firms hire workers and pay them wages. The number of people employed in the economy is determined by the level of aggregate demand.[8] Assuming all other factors

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[6] Note: the technical terms used for assets and institutional sectors are different in the system of national accounts, however, we use simplified terms for an average reader.

[7] Variables represented in capital letters represent nominal variables whereas variables written in small letters represent real variables.

[8] We do not assume constraints on the labour supply.

constant, an increase in aggregate demand requires more workers to produce; on the other hand, if productivity increases for a given level of output, firms need less workers:

$$N_t = \frac{y_t}{a_t}$$

where a_t represents productivity, which is exogenous in the model.

The number of individuals unemployed in the economy is the difference between the labour force (LF) and the number of individuals (N) employed:

$$UN_t = LF_t - N_t$$

The labour force is exogenous and determined as a fraction of the Danish population:

$$LF_t = \emptyset Pop_t$$

We now turn to wage- and price-setting in the model. Focusing on wage-setting, our equation is in line with the view of conflicting claims from workers and firms mediated through a wage bargaining process. Specifically, nominal wage rate is determined by 3 main factors, namely the targeted (or desired) wage rate of the labour union, labour productivity, and unemployment rate. The equation in its general form can be represented as follows:

$$W_t = f(W_t^T, UR_t, A_t)$$

The targeted wage W_t^T is determined by an autonomous component and annual inflation. Specifically, the labour union, apart from an autonomous desire for higher wage rate, wants prevailing wages to increase by the rate of annual inflation.[9] This can be represented as follows:

$$W_{t+1}^T = \alpha_0 + W_t(1 + \pi_t)$$

where π_t represents past annual inflation.[10]

[9] Moreover, we assume that the labour union wants the increased wages to be implemented in the very next period.

[10] Annual inflation is defined as:

$$\pi_t = \left(\frac{P_t^c}{P_{t-4}^c} - 1\right)$$

We assume that the wage negotiation takes place every year, and the labour union implements new wages in the very next period following the period of wage negotiations. The new targeted wage then remains the same across the quarters until new wage negotiations take place. For the ease of representation, the component of targeted wage determined by inflation can be defined as: $W_{t+1}^{\pi} = W_t(1 + \pi_t)$. Thus, the targeted wage can also be written as:

$$W_t^T = \alpha_0 + W_t^{\pi}$$

For the purpose of estimation, we feed the targeted wage W_t^T as an explanatory variable in the wage rate equation and estimate all the parameters in one step. Theoretically, targeted wage rate of the union only affects the long run dynamics of wages, as the bargaining process does not take place in every period. For this reason, the targeted wage rate is included only in the long run part of the error correction model along with other variable(s). The estimated equation in its specific form is represented as follows:

$$\Delta \ln W_t = (0.235 - 0.22\, \Delta UR_{t-4} - 0.16\, \Delta UR_{t-5} + 0.17\Delta \ln A_t - 0.007 D_{2008q2} + 0.009 D_{2009q1,2} + 0.007 D_{2013q2} - 0.006 D_{2018q3} + 0.0003T - (0.17\, \ln W_t - 0.2 \ln W_{t-1}^{\pi} - 0.15 lnA)$$

Focusing on the implications of the equation, the autonomous component (0.235) can also be considered as a proxy for the bargaining power of the labour union. That is, low parameter values imply a low bargaining power whereas high parameter values imply a strong bargaining power.[11] The equation suggests that wage rate in the short run is affected by the rate of unemployment and productivity. In the long run, wage rate is affected by the targeted wage of the union and productivity while unemployment rate was found to have no long run effect. This can also be observed in the data, where unemployment has remained low and stable (within a corridor of 3-7 percent since the great financial crisis) while the wage rate has followed an upward trend. In simple words, wages and unemployment rate in Denmark have followed very different trajectories over the long run.

In the model, real wages are determined by dividing the nominal wage by the consumer price index:

$$w_t = \frac{W_t}{P_t^c}$$

[11] However, it is difficult to assess whether our estimated value can be treated as a strong or low bargaining power since we are looking at only one country. A comparative analysis of different countries will reveal more interesting insights in this regard.

Our wage-setting implies that the response of wages to inflationary shocks is sluggish. This is a reasonable assumption as most workers have wage contracts and the process of wage negotiations is not instant. Thus, if the economy is hit by an inflationary shock, the purchasing power of workers will reduce in the short run as they will experience lower real wages.

We now focus on the dynamics of domestic prices. Our model has specific prices for different GDP components. Following the standard post Keynesian theory of pricing, we assume that prices of final consumption goods set by the firms are determined by the cost of production, which consists of wage to productivity ratio and import prices. The equation in its general form can be represented as:

$$P_t^c = f\left(\frac{W_t}{A_t}, P_t^m\right)$$

After log-linearising the pricing equation, the error correction version of the estimated equation can be represented as follows:

$$\begin{aligned}\Delta \ln P_t^c = &-0.18\Delta \ln P_{t-1}^c - 0.23\Delta \ln P_{t-2}^c - 0.12\Delta \ln P_{t-3}^c + 0.42\Delta \ln P_{t-4}^c + 0.08\Delta \ln W_t \\ &+ 0.13\Delta \ln P_t^m + 0.03\Delta \ln P_{t-2}^m - 0.009D_{2007q3} + 0.008D_{2011q2} - 0.007D_{2013q1} \\ &+ 0.009D_{2017q3} - 0.006D_{2018q1} \\ &- [0.054 \ln(P_{t-1}^c) - 0.057 \ln(W_{t-1}) + 0.04 \ln(A_t) - 0.046 \ln(P_{t-1}^m)]\end{aligned}$$

The estimated equation is in line with the Post-Keynesian theory of pricing, indicating that an increase in the cost of production can increases prices. Furthermore, the log-linearised functional form of the equation reveals some interesting insights: an increase in productivity can lower prices, but this effect is much lower than the effect associated with price hikes due to an increase in the cost of production via wages. This suggests that price levels in general has a tendency of increasing, resulting in (positive) inflation.[12] Moreover, the estimation also suggests the existence of a long-run static relationship between prices and our regressors.

In our model, the process of wage adjustment in response to inflationary shocks is sluggish as discussed earlier, but the process of price adjustment in response to the changes in cost of production (e.g., changes in wages) is relatively faster. We assume that firms are not bound by any price agreement and can therefore adjust prices quickly if the cost of production changes. Finally, we can note that while changes in demand exerts very little direct influence on prices, it does indirectly through its indirect effects on wages. This is in line with finding by Melmies

[12] The non-linear functional form of this equation in the theoretical literature assumes symmetric effects of wages and productivity on prices but with opposite signs. That is, wage to productivity is included as a ratio.

(2010) who compiles empirical evidence on the main factors due to which firms change prices: the evidence at large suggests that labour costs and material costs are the two biggest causes of price changes, while demand never appears as the main factor.

Goods market: Aggregate demand

We now turn to explaining the key components of aggregate demand. Private consumption is assumed to be a function of disposable income and net financial wealth. The aggregate disposable income part of the households consists of two components. The first component of disposable income (yd1) consists of wages and social benefits received by the households, which we will refer to as labour income for the sake of simplicity. The second component of disposable income consists of capital income (or property income). Net financial wealth of the households is defined as the difference between financial assets and liabilities of the households. The specific function form of our estimation consumption function is given by:

$$\Delta\ln(c_t) = 0.75 - 0.38\Delta\ln(c_{t-2}) - 0.18\ \Delta\ln(c_{t-3}) + 0.12\ \Delta\ln(yd1_t) + 0.03\ \Delta\ln(yd2_t) - 0.02D_{2008q4} + 0.01D_{2018q2} - 0.03D_{2020q1} - 0.0005T - [0.26\ln(c_{t-1}) - 0.13\ln(yd1_{t-1}) - 0.05\ln(yd2_{t-1}) - 0.05\ln(fnw_{t-2})]$$

We can define nominal consumption as follows:

$$C_t = c_t \cdot P_t^c$$

The estimated equation for real consumption is in line with theory and suggests that consumption positively responds to income and wealth, both in the short-run as well as in the long-run. Furthermore, the propensity to consume out of labour income is higher than the propensity to consume out of capital income, which is not surprising.

We now focus on investment (or gross fixed capital formation). Gross capital formation consists of two types of investments: investment in machinery and equipment as well as in buildings and dwellings. We differentiate between these two types of investments because investments in buildings and dwelling form a major portion (roughly 30 – 40 percent) of the total investment. From a theoretical point of view, our investment function related to equipment and machinery is very similar to the Neo Kaleckian investment function (Hein 2014), where investment to capital stock $\left(\frac{i_{equip,t}^{NFC}}{k_{equip,t-1}^{NFC}}\right)$ positively depends on capacity utilization (u_t) and profit share (Π_t). Moreover, we augment the standard investment equation with a proxy for Tobins q, which is defined as the ratio of the market value of the outstanding shares to the nominal capital stock (including both machinery and equipment as well as buildings and dwellings). From an empirical point of view, the specific function form of our estimated equation is given by:

$$\Delta\ln\left(\frac{i_{equip,t}^{NFC}}{k_{equip,t-1}^{NFC}}\right) = -0.02 - 0.17\Delta\ln\left(\frac{i_{equip_{t-1}}^{NFC}}{k_{equip,t-2}^{NFC}}\right) + 0.007\Delta\ln(\Pi_t) + 0.31\Delta\ln(u_t) - 0.24\Delta\ln(\mathrm{q}_t) + 0.17D_{2010q3} - 0.13D_{2011q2} - \left[0.40\ln\left(\frac{i_{equip_{t-1}}^{NFC}}{k_{equip,t-2}^{NFC}}\right) - 0.44\ln(\Pi_{t-1}) - 0.46\ln(u_{t-1}) - 0.06\ln(q_{t-1})\right]$$

The estimated equation suggests evidence of a long-run static relationship, where investment positively depends on profit share, capacity utilization, and Tobins q.

Following the same estimation strategy, firms' investment in buildings and dwellings is given by the following equation:

$$\Delta\ln\left(\frac{i_{BD,t}^{NFC}}{k_{BD,t-1}^{NFC}}\right) = 0.37 - 0.48\Delta\ln\left(\frac{i_{BD_{t-1}}^{NFC}}{k_{BD,t-2}^{NFC}}\right) - 0.09\Delta\ln(\Pi_t) + 0.83\Delta\ln(u_t) + 0.008\Delta\ln(q_t) - \left[0.37\ln\left(\frac{i_{BD_{t-1}}^{NFC}}{k_{BD,t-2}^{NFC}}\right) - 0.42\ln(\Pi_{t-1}) - 0.95\ln(u_{t-1}) - 0.08\ln(q_{t-1})\right]$$

Once again, the estimated equation suggests evidence of a long-run relationship, where investment to capital stock $\left(\frac{i_{BD,t}^{NFC}}{k_{BD,t-1}^{NFC}}\right)$ positively depends on profit share (Π_t), capacity utilization (u_t), and Tobins q.

We now focus on the interaction of the domestic economy with the rest of the world. In this regard, real effective exchange rate plays a crucial role, which is defined as the ratio of domestic prices P_t^c to foreign prices P_t^f times the nominal exchange rate (xr):

$$rer_t = \left(\frac{P_t^c}{P_t^f}\right) xr$$

An increase in the real exchange rate implies real appreciation whereas a decrease in it implies real depreciation.

Focusing on the trade balance, real exports and imports are determined in a standard way. From a theoretical point of view, real exchange rate and GDP of the trading partners are the two main drivers of the Danish exports. The specific functional form of the estimated equation can be represented as follows:

$$\Delta \ln(x_t) = 0.60 + 1.30\Delta \ln(y_{t-4}^{TP}) - 0.63\Delta \ln(rer_t) + 0.05D_{2008q2} - 0.01D_{2018q1} + 0.03\, D_{2019q3} - 0.001T - [0.61 \ln(x_{t-1}) - 0.24\ln(rer_{t-1}) + 0.61 \ln(y_{t-1}^{TP})]$$

The estimates are consistent with the theory, indicating that real depreciation as well as an increase in the level of economy activity of the trading partners can both positively affect exports. There is also evidence of the existence of a long-run static relationship between our variables.

Finally, real imports are determined by the real exchange rate and the income of the economy. This equation can be represented as follows:

$$\Delta \ln(m_t) = -3.75 - 0.12\Delta \ln(m_{t-2}) + 0.28\Delta \ln(rer_{t-1}) + 0.38\Delta \ln(rer_{t-3}) + 1.22\Delta \ln(y_t) - 0.07D_{2009q1} - 0.06D_{2009q4} - [0.30 \ln(m_{t-1}) + 0.57 \ln(y_{t-1})]$$

The estimated equation suggests that real appreciation as well as an increase in aggregate income can positively affect Danish imports. The effect of real exchange rate, however, is only limited to the short-run, as income is the only driver of real imports in the long-run, according to our estimates.

Financial market

Our model, even though focused on the labour market, has an explicit financial market which captures the interaction between production (or real side of the economy) and financing (or financial side of the economy). The primary reason we include an explicit financial market is to ensure that the effects of the real side of the economy on the balance sheets, and the feedback effects from balance sheet to the real side of the economy are properly captured. This is important to properly capture the effects of monetary policy.

The overall dynamics of the financial market are broadly similar to other empirical SFC models in the existing literature. The financial market is primarily demand driven. That is, financial corporations fulfil all the demand for credit as long as the borrowers fulfil the criteria for borrowing. Households also borrow loans from financial corporations. Households allocate their wealth in various financial assets. Overall, the portfolio allocation in our model is in line with the idea of Tobin's portfolio allocation theory discussed in Godley and Lavoie (2006). That is, investment in a particular asset is determined by its relative rate of return viz-a-viz other assets in the portfolio.

4. Results and Discussion

After estimating our structural equations, we numerically solve the model and compare our results with the actual data. Before relying on the model results, we validate the model by comparing model performance with the actual data. We find that the data is able to replicate the dynamics of our key variables. Even though the model fails to predict the fluctuations in some quarters, it is able to capture the overall trajectories of almost all the variables to a satisfactory level. We can therefore rely on the performance of the model but with some cautions.

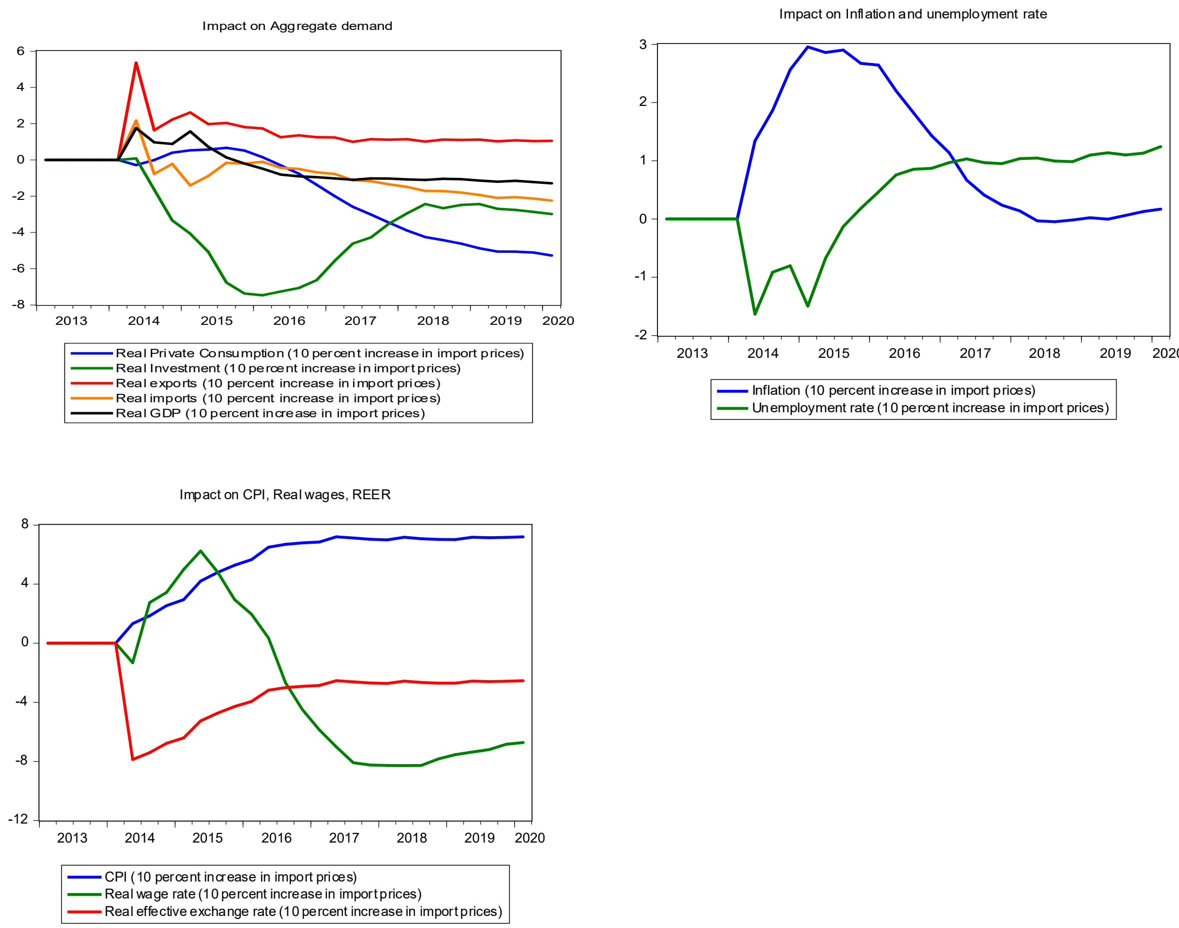
We now proceed to analysing the interaction between nominal and real economy by introducing various shocks, currently faced by the Danish economy. Our analysis can be categorised into two phases. 1) First, we purely focus on the pricing mechanism and introduce cost-push inflation from abroad. By doing so, we aim to get a deeper understanding of the price dynamics and to discuss the channels through which it can affect the economy. 2) Second, we evaluate various policy responses to deal with the ongoing issue of inflation. The motivation of conducting a thorough policy evaluation is to provide useful insights on this issue when it comes to policy making.

4.1 Cost-push inflation

Given the recent resurgence in inflation, we can identify import prices as one of the primary drivers of recent inflation. Denmark's import price index in 2022 has gone up from 105 to 117 (roughly 10-12 percent). In our model, we introduce a shock to import prices by 10 percent and focus on how a cost-push inflation from abroad propagates through the Danish economy.

The effect of the shock on our key variables are presented in Figure 1. Focusing on aggregate demand, we can see that overall output initially increases but then falls below the baseline. Unemployment rate roughly follows the trajectory of real GDP, i.e., it initially falls but then increases above the baseline. A very important driver behind this result is that domestic prices react sluggishly to the increase in import prices. Therefore, real exchange change rate initially depreciates but the pass through of import prices to domestic prices eventually leads to a deterioration in the real exchange rate in the medium term. Even though the economy ends up experiencing a slight trade surplus, the overall economic activity contracts in the medium term as the fall in domestic demand dominates the trade effect.

Figure 1: Effect of an increase in import prices



Focusing on individual components of domestic demand, consumption is affected positively in the short run, but negatively in the medium to long-term. The short run increase in consumption is explained by two main factors: i) The level of employment increases as a direct result of an increase economic activity in the short run. ii) Nominal wages increase more than prices, leading to an increase in the real wages. In the medium to long-term, however, as prices adjust, both the level of employment and the real wage rate decrease, which forces real consumption to fall.

When it comes to the response of real investment, we can see that investment responds by falling below the baseline, even though consumption and the overall economy activity initially increases. The reason is that wage rate as well as employment initially increases, leading to a decrease (increase) in the profit share (wage share), which adversely affects investment. In this case, the positive effect of capacity utilisation on investment is offset by an adverse effect of falling profit share. Investment in the medium term, even though still below the baseline, slightly improves as the profit share increases.

4.2. Policy scenarios

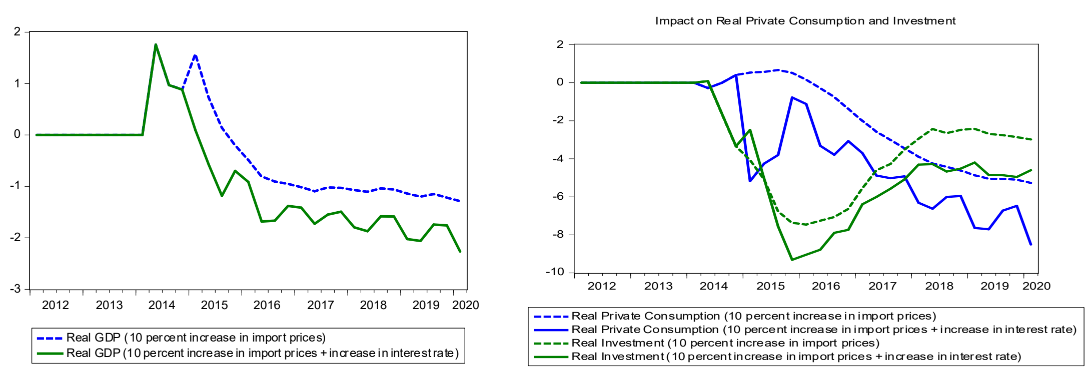
We now proceed to discussing a number of policy scenarios to deal with the ongoing issue of inflation. We first introduce a monetary policy response and then a fiscal policy response and evaluate the effects of these policies interventions.

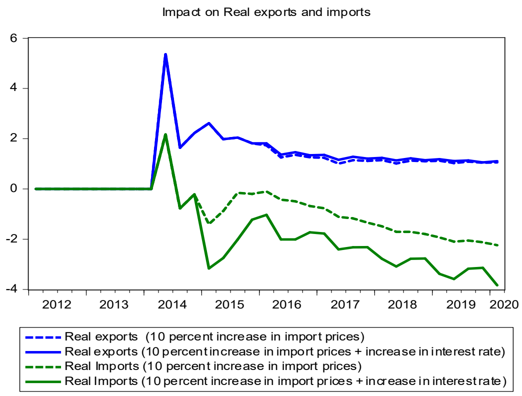
Monetary policy intervention

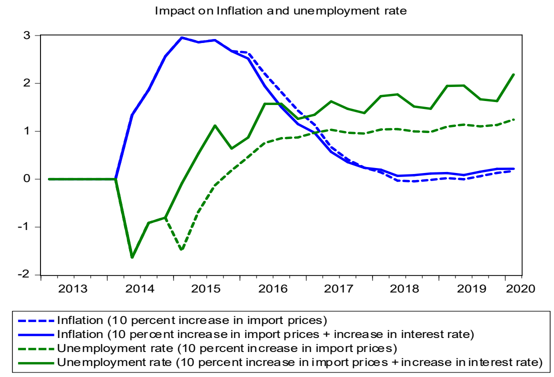
In response to the resurgence in inflation, most central banks are increasing policy rates and markets are expecting further increases due to central banks commitments to tame inflation using interest rates as a tool. The same is the case in Denmark, where general interest rates have sharply increased: specifically, 3 and 5 years fixed interest rates on mortgage loans have increased by roughly 150-250 basis points whereas long term interest rates on 30 years bond have increased more than 300 basis points.

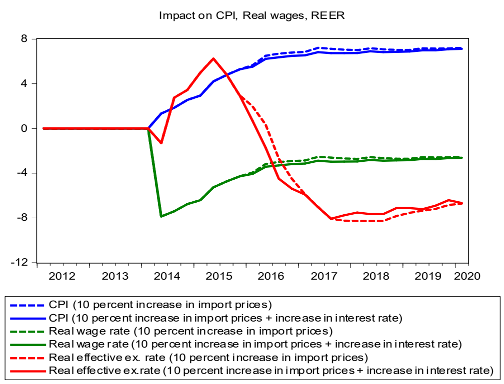
To evaluate monetary policy intervention, we supplement cost push inflation with an increase in the interest rates. Specifically, we increase all interest rates by 300 basis points. We introduce interest rate shocks 2 quarters after introducing cost push shock. We present our results in comparative way, i.e., the baseline deviations are compared with the results presented in section 4.1.

Figure 2: Effects of monetary policy intervention









Monetary policy intervention in response to cost push inflation does have a significant impact on the economy as expected. The decision to increase interest rates reinforces the adverse effects of inflation on the economy as shown in Figure 2. In particular, the drop in both investment and consumption causes the economic activity to drop further as a result even though the drop in import, resulting from lower domestic income, counteract the fall in economic activity.

Focusing on the price dynamics, monetary policy intervention leads a small reduction in inflation, but the overall inflation is still high. The main reason is that the interest rate hike reduces demand, which in turn has a very limited effect on prices. The demand-price channel would have been worthy of further consideration, if inflation was primarily demand induced. But the ongoing episode of inflation in Denmark is pre-dominantly driven by cost push channels via import prices. Thus, the overall results from this scenario suggest that using interest rates to tame inflation is not desirable, as it leads to adverse effects on overall economic activity with almost no effects on inflation. These adverse effects can be even more pronounced if issues related to financial stability, asset prices and house prices are taken into consideration[13]. There is historical evidence

[13] Asset prices and house prices are kept exogenous in the model, so the effect of a change in the level of interest rate on these prices are therefore beyond the scope of this paper. The expectation, however, is that making these prices endogenous would only support and reinforce the result presented in this scenario.

suggesting that interest rate increases have resulted in the collapse of the financial markets, causing serious recessions.

Even though raising interest rates does not appear to be an effective policy intervention, from a policy making point of view in practice, the option of no monetary policy is not viable for Denmark, as it retains a fixed exchange rate with respect to euro. Thus, whenever interest rates in the euro area are increased, policy makers in Denmark adjust domestic rates. Therefore, we take this situation as given, and discuss other possible options that, within the current institutional and legal framework, can potentially reduce the adverse effects of inflation.

Fiscal intervention

Scenario 4: Lower income tax on labour income: tax rate on labour income reduced by 2 percent

As presented in scenario 3, the central bank ought to be careful with increasing in the overall level of interest rates to tame the high level of inflation, since it comes with a strong reduction in the level of economic activity and the level of employment. Even though raising interest rates do not appear to be the right policy response, it is important to remember that in the case of Denmark, being a small open economy maintaining a fixed exchange rate as its main monetary policy goal, the interest rates will follow the trajectory of the ECB.

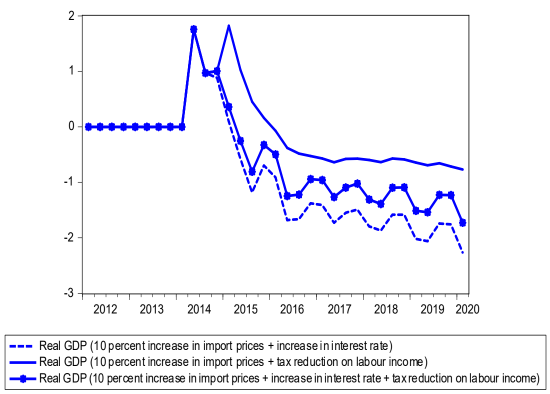
In this scenario, the increase in the level of interest rates is accompanied with a response from the government (a reduction in the tax rate of labour income), to avoid the reduction of economic activity.

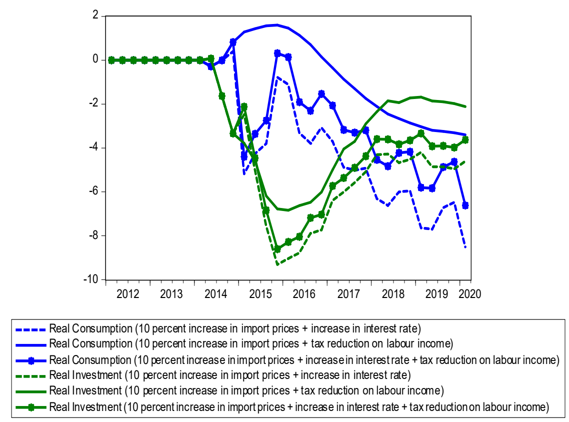
The motivation for introducing this tool of policy is that inflation in Denmark is not primarily demand induced but cost-push driven. As a result, policy makers need to come-up with measures of increasing demand without further triggering cost-push factors. In this regard, lower tax on labour income seems to be a good candidate for a taking advantages of a low-inflationary channel and preventing a sharp decline in economic activity at the same time.

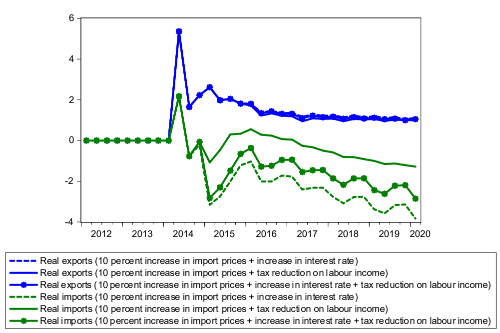
As seen from the results presented in the figures below, the reduction in the tax rate reduces the drop in consumption, since the fall in disposable income is reduced. At the same time, the fall in investment is smaller than compared to scenario 3, due to the accelerator mechanism from the lower fall in economic activity. The lower fall in the economic activity also results in a lower increase in the rate of unemployment as seen in figure x.4. The lower rate of unemployment affects the wage setting, which improves the real wages to a slighter degree. Despite the positive effect on the economic activity this expansionary policy doesn't result in a higher level of inflation as seen in figure x.x.

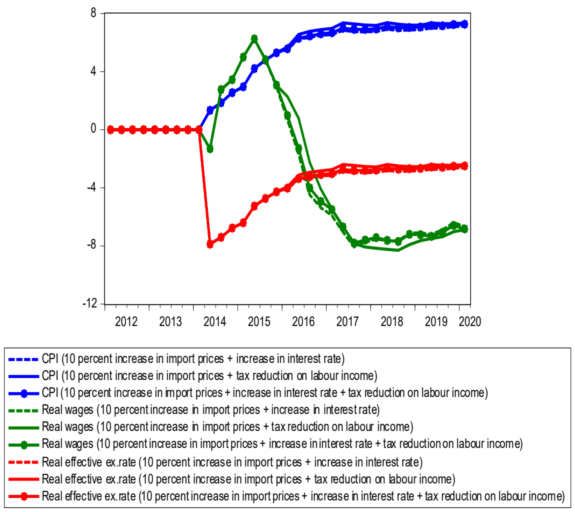
The use of an expansionary fiscal policy partly seems to offset the adverse effects of the tighter monetary policy. In particular, expansionary fiscal policy reduces unemployment caused by both higher imported prices and interest rates.

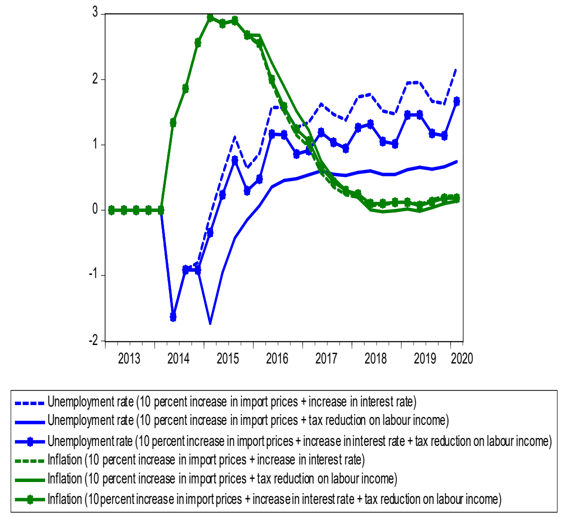
We also look at how this policy affects the public balance. Despite the lower rate of unemployment and the relative higher economic activity, there would still be a budget deficit. It is important to note that even without any governmental intervention, the public balance would be in deficit, due to the automatic stabilizers (lower income on taxes and higher expenditures related to social benefits) and higher interest on public debt.

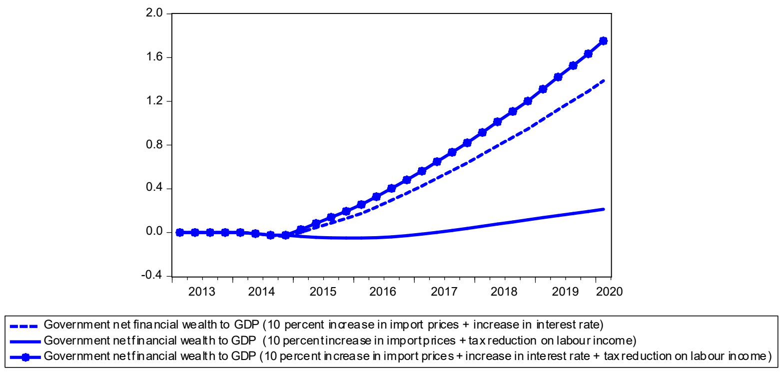












Our results reveal a clear dilemma for politicians, between the choice of no fiscal intervention resulting in a strong reduction in economic activity and fiscal intervention with a smaller reduction in economic activity but a larger public deficit and higher public debt.
For mainly two reasons we would suggest the Danish politicians to choose fiscal intervention with the acceptance of larger public deficit. Firstly, the cost to public finances would be marginal compared to the effect of higher interest rates. Secondly, the situation of the Danish current account, which has been in surplus for the last three decades, means the Government deficit would not lead Denmark to become a net borrower from abroad in stock terms.

Conclusion

Using an empirical SFC model calibrated on Denmark, we find that monetary policy is relatively ineffective for mitigating inflation, when the latter finds its origin in an increase in imported prices. Since there is no consensus in the literature on how interest rates affect inflation, the negligible effect we obtain strengthens the case against using monetary policy – in the form of interest rate management – as the main policy tool to tackle increases in consumer prices in any circumstance. Furthermore, we find that increasing interest rates has significant side effects in terms of unemployment as well as public finances. Considering the negligible impact of monetary policy on inflation, the trade-off therefore appears quite steep.

In the case of Denmark, the decision to increase interest rates is somewhat beyond the control of the Dansk Nationalbank. Since the Danish monetary policy aims to keep the krone stable against the euro, an increase in the euro area interest rates – regardless of whether it is an appropriate way to fight imported and largely exogenous inflation – will force the Danish central bank to increase its rates. We also find that resorting to fiscal policy in the form of lower taxes on labour income can offset the negative effects from the initial increase in imported prices and the monetary policy tightening. This is particularly true for unemployment and comes at practically no cost in terms of additional inflation. Further research could help refine the results. For instance, endogenizing house prices could uncover more transmissions channels. Other shocks could also be introduced, for instance an autonomous increase in wages. Lastly, additional policy responses could be investigated, such as commercial policy measures or price subsidies.

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Appendix

Table 1: Transaction Flow Matrix

	Households		Non-Financial Corporations		Financial Corporations		General Government		Rest of the World		Total
	Current	Capital	Current	Capital	Current	Capital	Current	Capital	Current	Capital	
Private Consumption	$-C_t$		C_t								0
Investment (Buildings and Dw.)		$-I^H_{BD_t}$	I_{BD_t}	$-I^{NFC}_{BD_t}$		$-I^{FC}_{BD_t}$		$-I^G_{BD_t}$			0
Investment (Equipment)		$-I^H_{E_t}$	I_{E_t}	$-I^{NFC}_{E_t}$		$-I^{FC}_{E_t}$		$-I^G_{E_t}$			0
Investment (Inventories)			$-I^H_{INV_t}$	$-I_{INV_t}$							0
Government Consumption	G^H_t		G^{NFC}_t				$-G_t$				0
Net Exports			NX_t						$-NX_t$		0
Wage Bill	WB^H_t		$-WB_t$						WB^{RW}_t		0
Gross Operating Surplus	GOS^H_t		GOS^{NFC}_t		GOS^{FC}_t		GOS^G_t				0
Net Indirect Taxes			$-NIT^{NFC}_t$				NIT^G_t		$-NIT^{RW}_t$		0
Net Interest on Assets	NIA^H_t		NIA^{NFC}_t		NIA^{FC}_t		NIA^G_t		NIA^{RW}_t		0
Net Income on Insurance	NII^H_t		NII^{NFC}_t		NII^{FC}_t		NII^G_t		NII^{RW}_t		0
Net Dividends	ND^H_t		ND^{NFC}_t		ND^{FC}_t		ND^G_t		ND^{RW}_t		0
Direct Taxes	$-DT^H_t$		$-DT^{NFC}_t$		$-DT^{FC}_t$		DT^G_t		$-DT^{RW}_t$		0
Social Contributions	$-SC^H_t$				SC^{FC}_t		SC^G_t		SC^{RW}_t		0
Social Benefits	SB^H_t				$-SB^{FC}_t$		$-SB^G_t$		SB^{RW}_t		0
Other Current Transfers	OCT^H_t		$-OCT^{NFC}_t$		OCT^{FC}_t		$-OCT^G_t$		OCT^{RW}_t		0
Saving/Current Account	$-S^H_t$	S^H_t	$-S^{NFC}_t$	S^{NFC}_t	$-S^{FC}_t$	S^{FC}_t	$-S^G_t$	S^G_t	CA_t	$-CA_t$	0
Capital Transfers		KT^H_t		KT^{NFC}_t		$-KT^{FC}_t$		$-KT^G_t$		$-KT^{RW}_t$	0
Others		$-NP^H_t$		$-NP^{NFC}_t$				NP^G_t		NP^{RW}_t	0
Net Lending		NL^H_t		NL^{NFC}_t		NL^{FC}_t		NL^G_t		NL^{RW}_t	0
Adjustment variable		Adj^H_t		Adj^{NFC}_t		Adj^{FC}_t		Adj^G_t		Adj^{RW}_t	0
Δ Interest Bearing Assets		$-\Delta NIBA^H_t$		$-\Delta NIBA^{NFC}_t$		$\Delta NIBA^{FC}_t$		$-\Delta NIBA^G_t$		$-\Delta NIBA^{RW}_t$	0
Δ Equities		$-\Delta EQ^H_t$		ΔEQ^{NFC}_t		$-\Delta EQ^{FC}_t$		$-\Delta EQ^G_t$		ΔEQ^{RW}_t	0
Δ Securities		$-\Delta SEC^H_t$		ΔSEC^{NFC}_t		$-\Delta SEC^{FC}_t$		ΔSEC^G_t		$-\Delta SEC^{RW}_t$	0
Δ Insurance		$-\Delta INS^H_t$		$-\Delta INS^{NFC}_t$		ΔINS^{FC}_t		$-\Delta INS^G_t$		$-\Delta INS^{RW}_t$	0
Δ Loans		ΔL^H_t		ΔL^{NFC}_t		$-\Delta L^{FC}_t$		$-\Delta L^G_t$		ΔL^{RW}_t	0
Rev. Interest Bearing Assets		$-Rev^H_{NIBA}$		$-Rev^{NFC}_{NIBA}$		Rev^{FC}_{NIBA}		$-Rev^G_{NIBA}$		$-Rev^{RW}_{NIBA}$	0
Rev. Equities		$-Rev^H_{EQ}$		Rev^{NFC}_{EQ}		$-Rev^{FC}_{EQ}$		$-Rev^G_{EQ}$		Rev^H_{EQ}	0
Rev. Securities		$-Rev^H_{SEC}$		Rev^{NFC}_{SEC}		$-Rev^{FC}_{SEC}$		Rev^G_{SEC}		$-Rev^{RW}_{SEC}$	0
Rev. Insurance		$-Rev^H_{INS}$		$-Rev^{NFC}_{INS}$		Rev^{FC}_{INS}		$-Rev^G_{INS}$		$-Rev^{RW}_{INS}$	0
Rev. Loans		Rev^H_L		Rev^{NFC}_L		$-Rev^{FC}_L$		$-Rev^G_L$		Rev^{RW}_L	0
Rev. Buildings and Dwellings		$-Rev^H_{BD}$		$-Rev^{NFC}_{BD}$		$-Rev^{FC}_{BD}$		$-Rev^G_{BD}$			0
Rev. Equipment		$-Rev^H_E$		$-Rev^{NFC}_E$		$-Rev^{FC}_E$		$-Rev^G_E$			0
Δ Net Worth		$-\Delta W^H_t$		$-\Delta W^{NFC}_t$		$-\Delta W^{FC}_t$		$-\Delta W^G_t$		$\Delta NIIP$	0

Dependent Variable: DLOG(WAGE_DS)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 07/07/22 Time: 11:59
Sample (adjusted): 2006Q4 2020Q1
Included observations: 54 after adjustments
DLOG(WAGE_DS) = P(520) + P(521)*DLOG(WAGE_DS_T) + P(522)
*D(UR(-4)) +P(523)*D(UR(-5)) + P(524)*DLOG(PROD_DS) + P(525)
*LOG(WAGE_DS(-1)) + P(526)*LOG(WAGE_DS_T(-1)) + P(527)
*@TREND + P(528)*D_2008Q2 + P(529)*(D_20091+D_2009Q2) +
P(530)*D_2013Q2 + P(531)*D_2018Q3

	Coefficient	Std. Error	t-Statistic	Prob.
P(520)	0.235657	0.119853	1.966217	0.0559
P(521)	0.774742	0.041136	18.83351	0.0000
P(522)	-0.226715	0.066239	-3.422674	0.0014
P(523)	-0.169983	0.077513	-2.192977	0.0339
P(524)	0.173849	0.032311	5.380581	0.0000
P(525)	-0.173178	0.071257	-2.430327	0.0194
P(526)	0.118387	0.056364	2.100397	0.0417
P(527)	0.000338	0.000159	2.125910	0.0394
P(528)	-0.007856	0.002678	-2.933868	0.0054
P(529)	0.009828	0.002065	4.758291	0.0000
P(530)	0.007606	0.002692	2.825090	0.0072
P(531)	-0.006159	0.002654	-2.320165	0.0253

R-squared	0.974219	Mean dependent var	0.006077
Adjusted R-squared	0.967466	S.D. dependent var	0.013934
S.E. of regression	0.002513	Akaike info criterion	-8.941339
Sum squared resid	0.000265	Schwarz criterion	-8.499342
Log likelihood	253.4161	Hannan-Quinn criter.	-8.770878
F-statistic	144.2806	Durbin-Watson stat	2.459177
Prob(F-statistic)	0.000000		

Dependent Variable: DLOG(PC_DS)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 07/07/22 Time: 11:59
Sample (adjusted): 2006Q3 2020Q1
Included observations: 55 after adjustments
DLOG(PC_DS) = C(21)*DLOG(PC_DS(-1))+ C(22)*DLOG(PC_DS(-2))+
C(23)*DLOG(PC_DS(-3))+ C(24)*DLOG(PC_DS(-4))+ C(25)
*DLOG(WAGE_DS) + C(26)*DLOG(PM_DS) + C(27)
*DLOG(PM_DS(-2)) + C(28)*LOG(PC_DS(-1)) + C(29)
*LOG(WAGE_DS(-1)) + C(30)*LOG(PROD_DS(-1)) + C(31)*
LOG(PM_DS(-1)) + C(32)*D_2007Q3 +C(33)*D_2017Q3 + C(34)
*D_2018Q1 + C(35)*D_2011Q2 +C(36)*D_2013Q1

	Coefficient	Std. Error	t-Statistic	Prob.
C(21)	-0.185244	0.069834	-2.652622	0.0115
C(22)	-0.233988	0.074018	-3.161239	0.0030
C(23)	-0.122740	0.072995	-1.681487	0.1007
C(24)	0.425146	0.084633	5.023431	0.0000
C(25)	0.085371	0.037089	2.301796	0.0268
C(26)	0.138642	0.021308	6.506505	0.0000
C(27)	0.038856	0.024613	1.578663	0.1225
C(28)	-0.054760	0.014590	-3.753170	0.0006
C(29)	0.057940	0.026041	2.224959	0.0319
C(30)	-0.049868	0.022671	-2.199667	0.0338
C(31)	0.046239	0.019207	2.407422	0.0209
C(32)	-0.009879	0.002892	-3.416257	0.0015
C(33)	0.009830	0.002825	3.480138	0.0012
C(34)	-0.006175	0.002818	-2.191648	0.0344
C(35)	0.008032	0.002764	2.906272	0.0060
C(36)	-0.007529	0.002788	-2.700569	0.0102

R-squared	0.902024	Mean dependent var	0.003255
Adjusted R-squared	0.864341	S.D. dependent var	0.006858
S.E. of regression	0.002526	Akaike info criterion	-8.886339
Sum squared resid	0.000249	Schwarz criterion	-8.302387
Log likelihood	260.3743	Hannan-Quinn criter.	-8.660520
Durbin-Watson stat	1.274567		

Dependent Variable: DLOG(I_BD_NFC_K_DS/BD_NFC_K(-1))
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 07/07/22 Time: 11:59
Sample (adjusted): 2006Q1 2020Q1
Included observations: 57 after adjustments
DLOG(I_BD_NFC_K_DS/BD_NFC_K(-1)) = P(800) + P(801)
*DLOG(I_BD_NFC_K_DS(-1)/BD_NFC_K(-2)) + P(802)
*DLOG(PS_DS) + P(803) * DLOG(U_DS) + P(804)*
LOG(I_BD_NFC_K_DS(-1)/BD_NFC_K(-2)) + P(805) * LOG(PS_DS(
-1)) + P(806) * LOG(U_DS(-1))+P(892)*DLOG(TOBINQ)+P(893)
*LOG(TOBINQ(-1))

	Coefficient	Std. Error	t-Statistic	Prob.
P(800)	0.375688	0.239130	1.571060	0.1227
P(801)	-0.484892	0.100850	-4.808029	0.0000
P(802)	-0.092887	0.240804	-0.385736	0.7014
P(803)	0.833675	0.396883	2.100553	0.0410
P(804)	-0.373295	0.093988	-3.971737	0.0002
P(805)	0.427841	0.199813	2.141209	0.0374
P(806)	0.958307	0.262226	3.654503	0.0006
P(892)	0.008363	0.070935	0.117902	0.9066
P(893)	0.082759	0.034595	2.392192	0.0207

R-squared	0.644638	Mean dependent var	-0.005002
Adjusted R-squared	0.585411	S.D. dependent var	0.048768
S.E. of regression	0.031401	Akaike info criterion	-3.939996
Sum squared resid	0.047330	Schwarz criterion	-3.617409
Log likelihood	121.2899	Hannan-Quinn criter.	-3.814628
F-statistic	10.88420	Durbin-Watson stat	2.034596
Prob(F-statistic)	0.000000		

Dependent Variable: DLOG(I_EQUIP_NFC_K_DS/EQUIP_NFC_K(-1))
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 07/07/22 Time: 11:59
Sample (adjusted): 2006Q1 2020Q1
Included observations: 57 after adjustments
DLOG(I_EQUIP_NFC_K_DS/EQUIP_NFC_K(-1)) = P(807) + P(808) *
DLOG(I_EQUIP_NFC_K_DS(-1)/EQUIP_NFC_K(-2)) + P(809) *
DLOG(PS_DS) + P(810) * DLOG(U_DS) + P(811) *
LOG(I_EQUIP_NFC_K_DS(-1)/EQUIP_NFC_K(-2)) + P(812) *
LOG(PS_DS(-1)) + P(813) * LOG(U_DS(-1)) + P(814) * DUMMY10 +
P(815) * DUMMY11 + P(890)*DLOG(TOBINQ) + P(891)
*LOG(TOBINQ(-1))

	Coefficient	Std. Error	t-Statistic	Prob.
P(807)	-0.028415	0.321979	-0.088252	0.9301
P(808)	-0.173276	0.101450	-1.708001	0.0944
P(809)	0.007892	0.281146	0.028070	0.9777
P(810)	0.311660	0.462101	0.674441	0.5034
P(811)	-0.405579	0.096349	-4.209494	0.0001
P(812)	0.447956	0.215213	2.081452	0.0430
P(813)	0.466029	0.148125	3.146192	0.0029
P(814)	0.179386	0.029619	6.056350	0.0000
P(815)	-0.133241	0.022974	-5.799777	0.0000
P(890)	-0.240539	0.082133	-2.928654	0.0053
P(891)	0.064135	0.033854	1.894471	0.0645

R-squared	0.762238	Mean dependent var	-0.001262
Adjusted R-squared	0.710550	S.D. dependent var	0.066459
S.E. of regression	0.035755	Akaike info criterion	-3.652681
Sum squared resid	0.058808	Schwarz criterion	-3.258408
Log likelihood	115.1014	Hannan-Quinn criter.	-3.499453
F-statistic	14.74705	Durbin-Watson stat	2.114532
Prob(F-statistic)	0.000000		

Dependent Variable: D(LOG(PCONK_DS))
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 07/07/22 Time: 11:59
Sample (adjusted): 2006Q2 2020Q1
Included observations: 56 after adjustments
D(LOG(PCONK_DS)) = C(1) + C(2)*LOG(PCONK_DS(-1)) + C(3)*LOG(YD1_HK_DS(-1)) + C(4)*LOG(YD2A_HK_DS(-1) + YD2B_HK(-1)) + C(5)*LOG(FNW_HK(-2)) + C(6)*DLOG(PCONK_DS(-2)) + C(7)*DLOG(PCONK_DS(-3)) + C(8)*DLOG(YD1_HK_DS) + C(9)*DLOG(YD2A_HK_DS+YD2B_HK) + C(10)*D_2008Q4 + C(11)*D_2018Q2 + C(12)*D_2020Q1 + C(13)*@TREND

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.755048	0.682748	1.105895	0.2749
C(2)	-0.262291	0.077232	-3.396158	0.0015
C(3)	0.139485	0.061798	2.257126	0.0291
C(4)	0.005167	0.016358	0.315864	0.7536
C(5)	0.051058	0.014996	3.404828	0.0014
C(6)	-0.389709	0.109408	-3.561975	0.0009
C(7)	-0.188797	0.114955	-1.642361	0.1078
C(8)	0.120766	0.044337	2.723801	0.0093
C(9)	0.036293	0.012121	2.994155	0.0045
C(10)	-0.020838	0.010033	-2.076968	0.0438
C(11)	0.019234	0.009230	2.083871	0.0431
C(12)	-0.036898	0.009255	-3.986948	0.0003
C(13)	-0.000540	0.000218	-2.478421	0.0172

R-squared	0.688203	Mean dependent var	0.001912
Adjusted R-squared	0.601190	S.D. dependent var	0.013207
S.E. of regression	0.008341	Akaike info criterion	-6.535207
Sum squared resid	0.002991	Schwarz criterion	-6.065036
Log likelihood	195.9858	Hannan-Quinn criter.	-6.352923
F-statistic	7.909189	Durbin-Watson stat	2.558570
Prob(F-statistic)	0.000000		

Dependent Variable: DLOG(MK_DS)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 07/07/22 Time: 11:59
Sample (adjusted): 2006Q2 2020Q1
Included observations: 56 after adjustments
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)
DLOG(MK_DS) = P(661) + P(662)*DLOG(MK_DS(-2)) + P(663)*DLOG(RER(-1)) + P(664)*DLOG(RER(-3)) + P(665)*DLOG(YK_DS) + P(666)*LOG(MK_DS(-1)) + P(667)*LOG(YK_DS(-1)) + P(668)*D_20091 + P(669)*D_2009Q4

	Coefficient	Std. Error	t-Statistic	Prob.
P(661)	-3.755903	0.760866	-4.936351	0.0000
P(662)	-0.126920	0.064662	-1.962821	0.0556
P(663)	0.281269	0.225315	1.248336	0.2181
P(664)	0.383758	0.214693	1.787470	0.0803
P(665)	1.222592	0.215897	5.662851	0.0000
P(666)	-0.301646	0.054907	-5.493820	0.0000
P(667)	0.572442	0.105101	5.446613	0.0000
P(668)	-0.078825	0.005265	-14.97190	0.0000
P(669)	-0.069792	0.006134	-11.37826	0.0000

R-squared	0.662568	Mean dependent var	0.006830
Adjusted R-squared	0.605133	S.D. dependent var	0.030491
S.E. of regression	0.019160	Akaike info criterion	-4.925773
Sum squared resid	0.017254	Schwarz criterion	-4.600270
Log likelihood	146.9217	Hannan-Quinn criter.	-4.799577
F-statistic	11.53594	Durbin-Watson stat	2.530920
Prob(F-statistic)	0.000000	Wald F-statistic	5.87E+10
Prob(Wald F-statistic)	0.000000		

Dependent Variable: DLOG(XK_DS)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 07/07/22 Time: 11:59
Sample (adjusted): 2006Q3 2020Q1
Included observations: 55 after adjustments
DLOG(XK_DS) = P(651)*@TREND + P(652)*DLOG(GDP_TP(-4)) + P(653)*DLOG(RER) + P(654)*LOG(XK_DS(-1)) + P(655)*LOG(RER(-2)) + P(656)*LOG(GDP_TP(-1)) + P(657)*D_2008Q2+ P(658)*D_2018Q1 + P(659)*D_2019Q3

	Coefficient	Std. Error	t-Statistic	Prob.
P(651)	-0.001641	0.000709	-2.313558	0.0252
P(652)	1.304913	0.500121	2.609193	0.0122
P(653)	-0.630544	0.268125	-2.351684	0.0230
P(654)	-0.619366	0.112066	-5.526774	0.0000
P(655)	-0.249551	0.158004	-1.579397	0.1211
P(656)	0.615028	0.115880	5.307472	0.0000
P(657)	0.056446	0.019648	2.872905	0.0061
P(658)	-0.018258	0.019584	-0.932280	0.3561
P(659)	0.034417	0.021070	1.633494	0.1092

R-squared	0.490289	Mean dependent var	0.005666
Adjusted R-squared	0.401644	S.D. dependent var	0.024440
S.E. of regression	0.018905	Akaike info criterion	-4.950175
Sum squared resid	0.016441	Schwarz criterion	-4.621702
Log likelihood	145.1298	Hannan-Quinn criter.	-4.823152
Durbin-Watson stat	1.902709		

Scenario 2: An increase in autonomous nominal wage rate: nominal wage rate increases by 6 percent

We create this scenario for two reasons. To isolate how domestic cost push inflation affects the economy. And at the same time, we can also assess whether the Danish economy can be classified as wage-led or profit-led.

Increase the autonomous component of nominal wage. The shock implies a 6 percent increase in the nominal wage rate compared to the baseline. Here, we can see that even though consumption goes up, output declines for two reasons. investment goes down because of a fall in investment as a result of falling profit shares: ii) Exports fall strongly as a result of real exchange rate appreciation.