STAFF MEMO

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ØISTEIN RØISLAND,
TOMMY SVEEN AND
RAGNAR TORVIK

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THE INTERPLAY BETWEEN MONETARY AND FISCAL POLICY IN A SMALL OPEN ECONOMY*

Øistein Røisland[†], Tommy Sveen[‡] and Ragnar Torvik[§]

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Abstract: We develop a theory for the optimal interaction between monetary and fiscal policy. While one might initially think that monetary and fiscal policy should pull in the same direction, we show within a simple model that this is not always the case. If there are small costs of changing the interest rate, it is optimal that monetary policy and fiscal policy pull in opposite directions when the economy is hit by an inflation or exchange rate shock. The reason is that monetary policy affects inflation through both the demand channel and the exchange rate channel, while fiscal policy only affects inflation through the demand channel. Therefore, monetary policy has a comparative advantage in stabilizing inflation, while fiscal policy has a comparative advantage in stabilizing output. Only when the costs of changing the interest rate are sufficiently high will it be optimal for monetary and fiscal policy to pull in the same direction. We also analyse how tax deduction for interest payments affects the monetary policy transmission. Such an interest subsidy improves goal achievement in response to inflation and exchange rate shocks, but the opposite is true in response to demand shocks.

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[†]Norges Bank.
[‡]BI Norwegian Business School.
[§]Norwegian University of Science and Technology, and BI Norwegian Business School (CAMP).

1 INTRODUCTION

The division of roles between monetary and fiscal policies has fluctuated over time. In Norway, before the introduction of an inflation target for monetary policy in 2001, the responsibility of monetary policy was to stabilize the exchange rate, while fiscal policy was responsible for managing the business cycle. This division of roles was in line with the recommendation of Mundell (1962); a policy instrument should be assigned to the goal it is more efficient in achieving. Mundell argued that monetary policy was better suited to the goal of external balance, while fiscal policy was best suited to the objective of internal balance.

One motivation for the introduction of inflation targeting was the challenge faced by government in dampening demand through tight fiscal policy, i.e., ensuring internal balance, while simultaneously integrating significant oil revenues into the Norwegian economy. During the 1990s, increased domestic oil revenue spending created upward pressure on the Norwegian krone exchange rate. Consequently, Norges Bank had to maintain relatively low interest rates to achieve the exchange rate target, while latent demand pressure existed due to the integration of oil revenues in the economy. As a result, overall economic policy became procyclical, reinforcing the business cycle.

With the introduction of an inflation target, monetary policy gained an increasing role in stabilizing business cycles. The monetary policy mandate of 2001 stated that "*monetary policy shall underpin fiscal policy by contributing to stable developments in output and employment*." However, shortly after the mandate was implemented, the communication between the government and Norges Bank changed to describe monetary policy as the *first line of defense* in business cycle management. This shift was in line with the division of labour in other countries with inflation targeting.

The view in international academia that monetary policy should have the primary responsibility for business cycle stabilization while fiscal policy should focus on sustainable public finances and efficient public service provision was gradually modified. Two events in particular led to this modification: the global financial crisis in 2007-2008 and the pandemic in 2020-2021. The financial crisis demonstrated that monetary policy is not always able to counter severe downturns because the policy rate is bounded from below.[1] Even though many central banks used alternative measures such as large-scale asset purchases when they reached the policy rate's lower bound, there was still a need for expansionary fiscal policy in many countries.

The pandemic showed that there can be a need for active fiscal policy for reasons other than supporting monetary policy when the lower bound is reached. The public health measures implemented during the pandemic affected different groups and industries very differently. The policy rate has broad effects, primarily on aggregate demand. Fiscal policy measures, however, can directly target specific groups or industries that are particularly hard hit by shocks. The support programs implemented during the pandemic illustrated how fiscal policy can be targeted, which likely reduced the welfare costs of the measures significantly.

[1] The existence of a lower bound for monetary policy was of course well-known before. However, the global financial crisis and its aftermath demonstrated that the lower bound was not just a rare and exceptional case, as previously believed, but something that had to be practically dealt with. The trend towards lower neutral real interest rates has contributed to monetary policy more frequently reaching the lower bound.

The change in the view on the role of fiscal policy is reflected in the fact that the government no longer refers to monetary policy as the ”first line of defense” in business cycle management. Instead of defining which of the two instruments takes the lead, the focus is now on the *interaction* between them. In the 2021 *Financial Market Report*, the Ministry of Finance called for more analysis on the interaction: "*The fiscal policy measures were thoroughly presented in the bank's reports last spring and summer, but the interaction between monetary policy and fiscal policy was little discussed, including how fiscal policy could relieve monetary policy as the initial economic uncertainty of the pandemic gradually subsided.*" (Our translation)

The interaction between monetary and fiscal policy was also mentioned in the 2023 *Financial Market Report*: "*It is important that fiscal and monetary policy do not work against each other. In a situation with few available resources and high demand for goods and services, expansionary fiscal policy would result in higher prices or higher interest rates.*" (Our translation). The focus of this paper is precisely on this interaction. In contrast to the common approach in the literature which examines how the central bank alone can best stabilize the economy, we will look at how a *combination* of monetary and fiscal policy can achieve a stable real economy and stable inflation.

The quotation from the 2023 *Financial Market Report* illustrates some important issues that we will analyze. We will challenge the view that it is crucial for fiscal and monetary policy not to work against each other, a view shared by many, including the Ministry of Finance.[2] That the two policy areas are "not working against each other" usually means that they do not pull in opposite directions. We demonstrate, however, how monetary and fiscal policy leaning in different directions can better achieve objectives in response to inflation shocks or exchange rate shocks. In referring to how expansionary fiscal policy could result in higher inflation or higher interest rates, the Ministry is indirectly suggesting that higher interest rates are undesirable in themselves. Therefore, we will analyse the optimal composition of monetary and fiscal policies when both the central bank and fiscal authorities have a preference for maintaining stable interest rates. This preference may arise because variations in interest rates are perceived to have costs beyond their impact on inflation and employment. Furthermore, we will critically examine to what extent the preference for stable interest rates *should* be a part of the considerations.

The basis of our analysis is that monetary and fiscal policy do not impact inflation in exactly the same way. While both monetary and fiscal policy affect inflation through the demand channel, monetary policy also directly influences inflation through the exchange rate channel. The exchange rate channel is important for a small open economy like Norway because imported goods constitute a considerable proportion of consumer spending. Therefore, by influencing the exchange rate, monetary policy affects inflation through an additional channel alongside the demand channel. As we will demonstrate, this has important implications for the optimal interaction between monetary and fiscal policy, and to our knowledge, this aspect has not been extensively explored in previous literature.

We will focus on traditional business cycle management through fiscal policy, where fiscal policy can be expansionary or contractionary to varying degrees. We will abstract from disturbances that may require more targeted fiscal policy measures. The reason for excluding these factors is not because we consider them unimportant, but to limit the

[2]Calmfors et al. (2023, p.11) have a similar assessment: *"Fiscal and monetary policy should normally pull in the same direction, i.e. be congruent."* (Our translation)

scope of the analysis.[3] Given the overall tightness/looseness of fiscal policy, there is nothing preventing targeted measures from being implemented through policy changes within a given budget. Therefore, our analysis complements, rather than conflicts with, any potential need for targeted measures beyond the impact of fiscal policy on aggregate demand. We also abstract from factors that may tend to make fiscal policy overly expansionary due to short-term considerations of voter support and various time inconsistency problems.[4] Such underlying and persistent imbalances in fiscal policy should be addressed through targeted institutional reforms, such as the establishment of the Government Pension Fund Global and the fiscal rule for petroleum revenue spending. Therefore, our analysis can be interpreted as stydying how the scope for fiscal stabilization within the framework of the fiscal rule can be best utilized, in coordination with monetary policy. Additionally, our model focuses on a single sector, and does not account for the fact that different sectors may respond differently to both monetary and fiscal policy. Thus, we will limit the analysis to aggregate effects on variables such as unemployment and output.[5] We also assume that the interest rate does not have a lower bound and can thus be set freely, thereby limiting our analysis to studying monetary and fiscal policy in situations where monetary policy is not constrained.[6]

The rest of the paper is structured as follows: First, we will present the model, which is an extension based on the models in Røisland and Sveen (2005 and 2018). Next, we will solve the model in the simplest case where there are no costs associated with changing either fiscal policy or the interest rate. Then, we will examine the case where there are costs associated with using fiscal policy. Finally, we will explore the optimal policy composition in the (perhaps most realistic) scenario where there are costs associated with variations in both fiscal policy and the interest rate.

2 Model of flexible inflation targeting with monetary and fiscal policy

We start with a small open economy that takes global market prices and interest rates as exogenously given. The macroeconomic policy consists of setting the interest rate, which we refer to as monetary policy, and determining the size of public expenditures, which we refer to as fiscal policy.

2.1 The economy

The demand for domestically produced goods and services is given by

$$y = -\alpha_1 r + \alpha_2 e + \alpha_3 g + v, \tag{1}$$

[3] See e.g. Woodford (2001) and Auclert et al. (2023) who develop models that study this topic.

[4] See e.g. Persson and Svensson (1989) and Persson and Tabellini (2000) for different mechanisms that may permanently make fiscal policy too expansionary.

[5] See e.g. Røisland and Torvik (2000, 2004) and Boug et al. (2022) for models that study the interaction between monetary and fiscal policies in economies with non-traded and traded sectors.

[6] See e.g. Gabaix (2020) and Mian et al. (2022) for models that study monetary and fiscal policy with limitations on how low the interest rate can be set.

where y represents the output gap, which is the (logarithmic) deviation between actual output and potential output, and r denotes the real interest rate,[7] measured as the deviation from the long-term neutral real interest rate.[8] The parameter α_1 is assumed to be positive and represents how strongly the interest rate influences demand. Furthermore, e denotes the logarithm of the real exchange rate, which measures the deviation from the equilibrium real exchange rate. The real exchange rate is defined as the price of foreign-produced goods relative to the price of domestically produced goods, measured in the same currency. The parameter α_2 represents the extent to which a real depreciation increases the demand for domestically produced goods. Government demand is denoted by g and is measured as a deviation from neutral fiscal policy. The parameter α_3 represents the strength of fiscal policy's impact on total domestic demand. Lastly, v represents a demand shock. Therefore, the model assumes that demand decreases with the real interest rate, increases with the real exchange rate, and is positively affected by government demand.

Inflation is given by the following Phillips curve:

$$\pi = \pi^e + \gamma_1 y + \gamma_2 e + u, \tag{2}$$

where π^e represents inflation expectations, which are exogenous, and u represents an inflation shock which can, for instance, be caused by exogenous variations in firms' costs (e.g., energy prices) or variations in firms' mark-ups. Consumer price inflation increases with higher economic activity, as measured by the output gap. Additionally, a real depreciation leads to higher prices for imported consumer goods and inputs, which raises consumer prices directly and indirectly, respectively. For a derivation of the consumer price Phillips curve (2) from separate Phillips curves for domestic and imported inflation, see Røisland and Sveen (2018).

The real exchange rate is determined by risk-adjusted uncovered interest rate parity:[9]

$$e = e^e - (r - r^*) + z, \tag{3}$$

where e^e represents the expected real exchange rate, r^* is the foreign real interest rate, and z is a shock to the risk premium. Given the interest rate differential and the expected future exchange rate, an increase in the risk premium leads to an immediate depreciation of the exchange rate. From this weaker level, the exchange rate is expected to gradually reappreciate. The expected appreciation implies an expected excess return that reflects the risk premium. In the absence of risk premium shocks, i.e., when $z = 0$, uncovered interest parity holds.

When we later minimize a loss function with respect to the two policy instruments, it is convenient to first express the output gap and inflation as functions of the policy variables

[7] In the short run, the nominal interest rate, rather than just the real interest rate, can have an impact on demand due to cash flow effects for indebted households. However, we treat inflation expectations as exogenous, so that changes in the nominal interest rate are equivalent to changes in the real interest rate.

[8] In Røisland and Sveen (2018), the variable r is not measured as a deviation from the neutral interest rate. Instead, there is a separate parameter, denoted as ρ, that represents the long-term neutral interest rate. To save notation, and since y and e are measured as deviations from equilibrium, it is useful to define r as deviation from its neutral (equilibrium) level.

[9] Uncovered interest rate parity (UIP) is stated here in real form, but it can be easily shown that real UIP follows from nominal UIP.

r, g, and the exogenous variables. Substituting e from equation (3) into equation (1), we obtain:

$$y = -\left(\alpha_1 + \alpha_2\right) r + \alpha_3 g + \alpha_2 \left(e^e + r^* + z\right) + v. \tag{4}$$

By substituting the expression from equation (1) for y and from equation (3) for e into equation (2), we can write

$$\pi = \pi^e - \left(\gamma_1 \left(\alpha_1 + \alpha_2\right) + \gamma_2\right) r + \gamma_1 \alpha_3 g + \left(\alpha_2 \gamma_1 + \gamma_2\right) \left(e^e + r^* + z\right) + \gamma_1 v + u. \tag{5}$$

We observe that both expansionary monetary policy (lower r) and expansionary fiscal policy (higher g) increase both the level of activity and inflation. However, there is an important difference that is crucial for the optimal interaction: Monetary policy affects inflation through both the demand channel and the exchange rate channel, while fiscal policy only affects inflation through the demand channel.

2.2 The goal of stabilization policy

We assume that the goal of stabilization policy is to achieve as stable inflation as possible around the inflation target and to minimize fluctuations in the output gap around zero. We also assume, as is common in the literature, that it is not possible to achieve sustained higher output and employment through persistent expansionary monetary or fiscal policy.[10] Stabilizing the output gap around zero can be interpreted as stabilizing output and employment around the highest level consistent with stable inflation in the long run.[11] In addition, we include the possibility of welfare costs associated with active use of the two policy instruments. The objectives of stabilization policy are represented by minimizing the following loss function:

$$L = \frac{1}{2} \left[\left(\pi - \pi^*\right)^2 + \lambda y^2 + \theta_g g^2 + \theta_r r^2 \right]. \tag{6}$$

Here, the first two terms inside the brackets on the right-hand side represent the loss associated with deviations from the inflation target and the output target, where λ indicates the relative weight of the output target loss compared with the inflation target loss. The last two terms represent the costs associated with using g and r, respectively. Regarding g, it is evident that there are costs associated with variations in government spending and taxes. As for r, this is not as obvious. Costs associated with variations in the policy rate can arise from uncertainty about the effects of policy rate changes, reluctance to reverse a rate change, consideration of distributional effects of rate changes, or the potential adverse effects of large policy rate movements on financial stability. As we will see, the relative importance of avoiding variations in the interest rate, represented by the parameter θ_r, has important implications for the optimal interaction between monetary and fiscal policy, including whether the policy areas should pull in the same or opposite directions.

[10] This assumption, although not entirely uncontroversial in the academic literature, is made in order to focus on traditional cyclical stabilization policy, and we choose to disregard any measures that could potentially increase employment in the long run. Additionally, we do not consider hysteresis effects, although we acknowledge that such effects may be relevant in practice.

[11] In practice, the precise level of this output is uncertain, but we will disregard this uncertainty in our analysis.

Therefore, in Section 2.5, we will discuss these costs further, and in Section 2.6, we will explore measures that can affect the costs of actively using the interest rate in stabilization policy.

2.3 NO COSTS ASSOCIATED WITH USING g OR r

The case where there are no costs associated with active use of monetary and fiscal policy for stabilization purposes is a useful starting point. First, it shows what can be achieved with unrestricted use of the two policy instruments. Second, this case provides intuition for the mechanisms and results in the more complex, but more realistic, cases with costs associated with the use of the instruments.

In this case, we substitute $\theta_g = \theta_r = 0$ into the loss function (6) before deriving it with respect to r and g, using (4) and (5). The two first-order conditions can be written as:

$$r: \qquad \pi - \pi^* = -\frac{\lambda}{\gamma_1 + \frac{\gamma_2}{\alpha_1+\alpha_2}} y, \tag{7}$$

and

$$g: \qquad \pi - \pi^* = -\frac{\lambda}{\gamma_1} y. \tag{8}$$

In principle, both monetary policy and optimal fiscal policy suggest that the inflation gap (the deviation between actual inflation and the inflation target) and the output gap should have opposite signs.[12] The intuition is as follows: If both gaps are positive, a more contractionary monetary or fiscal policy will reduce both gaps and hence reduce the loss. Therefore, having both gaps positive cannot be consistent with an optimal policy.

Equations (7) and (8) also show that the trade-off between output and inflation is different for optimal monetary policy and optimal fiscal policy. To understand this intuition, let us first consider the effect of changing monetary policy (holding fiscal policy constant). Suppose the interest rate r is increased. This reduces demand through the direct interest rate channel and through the appreciation of the exchange rate, making domestic goods more expensive compared with foreign ones. Lower demand reduces inflation. In addition, inflation is further reduced by the appreciation of the exchange rate, which lowers imported inflation. Now let us consider the effect of changing fiscal policy (holding monetary policy constant). Suppose government spending g is reduced. This reduces demand through the direct demand channel and reduces inflation for the same reason. Nothing happens to the exchange rate. It follows from this that monetary policy has a stronger impact on inflation relative to output compared with fiscal policy. In other words, compared with monetary policy, fiscal policy has a relatively stronger effect on output than it has on inflation. The comparative advantage of monetary policy lies in its ability to influence inflation, while the comparative advantage of fiscal policy lies in its ability to influence output.[13]

[12] Based on Qvigstad (2005), this is sometimes referred to as the "Qvigstad rule".

[13] It is important to note that the central aspect of our analysis is not that fiscal policy cannot influence the exchange rate at a given interest rate. It is possible to consider scenarios where, for example, increased government debt (or a reduced sovereign wealth fund) also affects the exchange rate. Our qualitative conclusions are based on the premise that monetary policy has a stronger impact on inflation relative to output compared with fiscal policy.

In the trade-off between inflation and output, the ratio of the inflation gap to the output gap, i.e., $\frac{\pi-\pi^*}{y}$, should always be smaller in absolute terms if monetary policy is to be used alone compared with when fiscal policy is used alone. This can be observed from equations (7) and (8).

It is useful to compare our results with the results we would have obtained in a closed economy. The exchange rate channel would no longer be relevant, that is, we are in a special case of our model where $\gamma_2 = 0$. The first-order conditions (7) og (8) become identical in this case, meaning the two policies affect the output gap and the inflation gap in the same way. This means that in practice there is only one, and not two, instruments. Therefore, one can only achieve one of the goals according to the Tinbergen rule.[14]

However, in an open economy, monetary and fiscal policy have different effects on the output gap and inflation. Both of the first-order conditions (7) and (8) need to be satisfied, not just one of them. From (7) and (8), we can see that both first-order conditions are satisfied if policy is set such that

$$\pi = \pi^*, \quad y = 0. \tag{9}$$

This is not in itself surprising. The Tinbergen rule states that if we have two policy instruments, r and g, we can achieve two objectives, namely $\pi = \pi^*$ and $y = 0$.

The result also has implications for the possibility of delegation of separate tasks. Here, we have assumed that both policy instruments are used simultaneously to minimize a common loss function. It can easily be shown that the achievement of objectives remains the same if monetary policy is delegated the task of solely stabilizing inflation, while fiscal policy solely focuses on stabilizing the real economy. This is also in line with Mundell's (1962) principle that the division of responsibilities should be determined based on which policy areas have a comparative advantage in influencing specific target variables.

We can now find the solution for the interest rate by starting with (2) and substituting $\pi = \pi^*$, $y = 0$, and for e from (3), which, when solved for r, gives:

$$r = \frac{1}{\gamma_2}\left[(\pi^e - \pi^*) + u\right] + (e^e + r^* + z). \tag{10}$$

The solution for fiscal policy is found by starting out with (1), substituting $y = 0$, substituting e from (3), and then substituting r from (10). By solving for g, we obtain:

$$g = -\frac{1}{\alpha_3}v + \frac{\alpha_1 + \alpha_2}{\alpha_3\gamma_2}\left[(\pi^e - \pi^*) + u\right] + \frac{\alpha_1}{\alpha_3}(e^e + r^* + z). \tag{11}$$

Equations (10) and (11) provide us with the optimal monetary as well as fiscal policy. Two characteristics of the optimal interaction are worth mentioning. Firstly, the demand shock v does not appear in the monetary policy reaction function. This means that only fiscal policy is responsible for offsetting demand shocks. The intuition behind this is as follows: If the central bank lowers interest rates in response to a negative demand shock to prevent a reduction in y, inflation will become too high because the exchange rate weakens as a result of the lower interest rates. Therefore, in an open economy, monetary policy cannot simultaneously shield both the real economy and inflation from the effects of a demand

[14]This result is consistent with that obtained in Gabaix (2020) and Wolf (2022), who study monetary and fiscal policy in closed economies.

shock. On the other hand, expansionary fiscal policy can shield both the real economy and inflation from the effects of a demand shock because it does not directly affect the exchange rate. The mechanism is as simple as replacing lower private demand (negative shock) with higher government demand. However, the result that only fiscal policy should respond to a demand shock will be modified if there are costs associated with the use of fiscal policy, as we will show in the next section.

The second characteristic of the optimal interaction is related to the sign of policy responses. Policy areas are termed *congruent* if both instruments are expansionary or contractionary, meaning they pull in the same direction, while they are termed *divergent* if they pull in opposite directions. In the economic debate and in the academic literature, it seems that many have the perception that policy areas should not be divergent. Intuitively, it does not sound favourable for two policy areas to pull in opposite directions, as it seemingly implies a conflict between the two types of policy. However, the relevant question is what leads to the best overall achievement of the policy objectives.

We can see from equations (10) and (11) that in the case where there are no costs associated with using the instruments, monetary and fiscal policy should respond divergently to all shocks except demand shocks (where only fiscal policy should respond). Therefore, the policy instruments should generally pull in opposite directions. Fiscal policy should be expansionary (high g) when monetary policy is contractionary (high r), and vice versa. This is a central result, and the intuition is as follows: Suppose, for example, that inflation increases due to an inflation shock ($u > 0$ in equation (2)). Since both monetary and fiscal policy affect the output gap, there are in principle infinitely many combinations of the two that can keep the output gap unchanged. If both policies are neutral, the output gap remains unchanged, and inflation increases by the magnitude of the shock. However, if the interest rate is increased and fiscal policy is expansionary, the output gap can still remain unchanged, but inflation will be lower because the exchange rate appreciates as a result of the higher interest rate. With an optimal combination of tight monetary policy and expansionary fiscal policy, the increase in inflation can be completely offset by a stronger exchange rate without the need for the output gap to become negative. The divergent policy composition allows the exchange rate channel to be more effectively utilized, enabling the simultaneous achievement of price stability and stability in the real economy.

Equations (10) and (11) show that the more strongly imported inflation affects domestic inflation, i.e., the higher γ_2 is, the less contractionary monetary policy should be, and the less expansionary fiscal policy should be. The intuition behind this is that the more imported inflation affects overall inflation, the less the policy rate needs to increase to bring down inflation, and the less expansionary fiscal policy needs to be to counteract the effect of the monetary policy. Furthermore, we see that fiscal policy must be more expansionary the stronger monetary policy affects output, i.e., the higher $\alpha_1 + \alpha_2$ is. The intuition behind this is that the contractionary effect of a higher policy rate becomes stronger, and fiscal policy needs to be more expansionary to counteract the negative effect of a higher policy rate on the output gap. We also observe that the more strongly fiscal policy affects output, i.e., the larger α_3 is, the less g needs to increase to counteract the contractionary monetary policy.

Assume instead that a risk premium shock or an increase in foreign policy rates occurs, causing the exchange rate to depreciate. We can see from equation (10) that the optimal policy mix implies that the central bank should increase policy rates by the same amount as the increase in the risk premium or foreign policy rates. The exchange rate equation (3) implies that the policy rate is set high enough for the exchange rate to return to its initial level before the shock occurred. However, the increased policy rate, in isolation, would reduce the level of activity. Fiscal policy can counteract this with an expansionary policy. Thus, with the combination of higher interest rates, which counteracts the depreciation of the exchange rate, and expansionary fiscal policy, which neutralizes the effect of increased interest rates on the real economy, both the inflation target and the goal of real economic stability can be achieved.

2.4 COSTS OF USING g

Although the case without costs associated with the use of policy instruments is an interesting starting point, it is unlikely to be very realistic. When it comes to fiscal policy, there are obvious costs associated with active use of policy instruments. Some of these costs can be related to efficiency losses and unpredictability in public service provision, taxes, and transfers. Additionally, there may be costs arising from the fact that fiscal policy decisions are not solely determined by what is economically optimal, but also by what is politically optimal. It can be politically challenging, for example, to fully reverse expansionary policy measures once the conditions that necessitated those measures are no longer present. This could suggest that fiscal authorities should exercise caution in the use of policy instruments, considering not only economic optimality but also political factors.

To account for such costs, we now set $\theta_g > 0$ in the loss function, while keeping $\theta_r = 0$ for now. Again, we differentiate the loss function with respect to r and g. We obtain the same first-order condition for monetary policy as in equation (7), while the first-order condition for fiscal policy now becomes

$$g = -\frac{\gamma_1 \alpha_3}{\theta_g} (\pi - \pi^*) - \frac{\alpha_3 \lambda}{\theta_g} y. \tag{12}$$

The first-order condition (12) resembles a Taylor rule, but for fiscal policy rather than a Taylor rule for monetary policy. If inflation is higher than the target and/or the output gap is positive, fiscal policy should be tight. However, the actual response of fiscal policy to different shocks depends on monetary policy.

When we use the first-order condition (7) for monetary policy and (12) for fiscal policy, substituting y from (4) and π from (5), we obtain two equations in the two endogenous variables r and g. Solving for r and g, we get

$$r = \Omega_{rv} v + \Omega_{ru} [(\pi^e - \pi^*) + u] + \Omega_{rz} (e^e + r^* + z), \tag{13}$$
$$g = \Omega_{gv} v + \Omega_{gu} [(\pi^e - \pi^*) + u] + \Omega_{gz} (e^e + r^* + z), \tag{14}$$

where

$$\begin{aligned}
\Omega_{rv} &= \theta_g \left((\lambda + \gamma_1^2)(\alpha_1 + \alpha_2) + \gamma_1 \gamma_2 \right) / \Omega > 0 \\
\Omega_{ru} &= \left[(\gamma_1 (\alpha_1 + \alpha_2) + \gamma_2) \theta_g + \lambda \alpha_3^2 \gamma_2 \right] / \Omega > 0 \\
\Omega_{rz} &= \left[\theta_g \left[\lambda (\alpha_1 + \alpha_2) \alpha_2 + (\gamma_1 (\alpha_1 + \alpha_2) + \gamma_2) (\alpha_2 \gamma_1 + \gamma_2) \right] + \lambda \alpha_3^2 \gamma_2^2 \right] / \Omega > 0
\end{aligned}$$

$$
\begin{aligned}
\Omega_{gv} &= -\alpha_3\lambda\gamma_2^2/\Omega < 0 \\
\Omega_{gu} &= (\alpha_1+\alpha_2)\,\alpha_3\lambda\gamma_2/\Omega > 0 \\
\Omega_{gz} &= \lambda\alpha_1\alpha_3\gamma_2^2/\Omega > 0 \\
\Omega &= \theta_g\left[\lambda(\alpha_1+\alpha_2)^2+(\gamma_1(\alpha_1+\alpha_2)+\gamma_2)^2\right]+\lambda\alpha_3^2\gamma_2^2 > 0
\end{aligned}
$$

Not surprisingly, costs associated with the use of fiscal policy lead to a weaker fiscal policy response to different shocks. Apart from that, such costs do not result in substantial changes in the policy interaction, except for the interaction in the case of a demand shock. Since $\Omega_{rv} > 0$, the interest rate should now be increased when the demand shock v is positive. Since $\Omega_{gv} < 0$, public demand should be reduced when the demand shock v is positive. Therefore, monetary policy in the case of a demand shock should be contractionary when fiscal policy is contractionary, and vice versa. The intuition can be easily explained by defining a "net" demand shock, $v' = v + \alpha_3 g$. Since $\alpha_3 g$ is reduced less than v increases due to the costs of using g, $v' > 0$. Thus, monetary policy will face a positive "net" demand shock, and the result found in Røisland and Sveen (2005 and 2018), which states that the interest rate should be increased so that inflation falls slightly below the target and the output gap becomes slightly (less) positive, also holds here. Monetary and fiscal policy should therefore be congruent in the case of a demand shock.

However, for inflation shocks and exchange rate shocks, monetary and fiscal policy should still be divergent. This can be observed by noting that Ω_{ru} and Ω_{gu} have the same sign for inflation shocks, and Ω_{rz} and Ω_{gz} have the same sign for exchange rate shocks. However, because fiscal policy responds less and therefore "counteracts" monetary policy to a lesser extent, the interest rate will also respond less to inflation shocks and exchange rate shocks. When there are higher costs associated with using fiscal policy, monetary policy should have a weaker response.

It is also worth noting that when there are costs associated with the use of fiscal policy, the goals of price stability and stability in the real economy will no longer be fully achieved. This is also in line with the Tinbergen rule. The loss function with $\theta_g > 0$ implies that there are actually three policy goals: $\pi = \pi^*$, $y = 0$, and $g = 0$. It is not possible to fulfill all three goals with only two policy instruments, and generally, an optimal trade-off would imply that none of the goals will be fully met.

2.4.1 AUTOMATIC STABILIZERS

So far, we have not discussed to what extent fiscal policy should be used in a discretionary manner or to what extent it should instead operate through automatic stabilizers. In discretionary fiscal policy, active and ongoing fiscal decisions are made based on the business cycle and shocks. When fiscal policy operates solely through automatic stabilizers, such active and ongoing decisions are not made, but fiscal policy works by automatically becoming expansionary when the level of activity is low and contractionary when the level of activity is high. The reason for this is that public revenues are typically low when the activity level is low (for example because tax revenues decrease), while public expenditures are typically high when the activity level is low (for example, because unemployment benefit payments increase). In other words, with automatic stabilizers, the variable g in our model would be negatively related to the variable y.

The results mentioned above can be used to design discretionary fiscal policy, but an interesting question is whether they also make an argument for the importance of automatic stabilizers. Or more precisely, does the combination of automatic stabilizers and inflation targeting encompass the policy conclusions we have seen above? The answer to this is yes. To see this, let us first consider a demand shock. We saw that the two policy areas should be congruent so that fiscal policy, along with monetary policy, partially offsets the shock. Automatic stabilizers will precisely contribute to making fiscal policy congruent in the case of a demand shock, given that monetary policy is oriented towards an inflation target. Now let us consider a positive inflation shock (or exchange rate shock). In this case, policy areas should be divergent. When monetary policy responds by increasing interest rates, fiscal policy should be expansionary to dampen the downturn in output caused by the interest rate hike. Automatic stabilizers, in the event of an inflation shock, make fiscal policy expansionary when monetary policy is contractionary.

Thus, the analysis above does not necessarily imply that fiscal policy should be discretionary. Fiscal policy responses with the optimal direction of the monetary policy response can be achieved in response to all shocks with the combination of automatic stabilizers and inflation targeting. Therefore, the analysis can also be interpreted as an additional argument that a monetary policy aimed at stable inflation supports the use of automatic stabilizers in fiscal policy. Under inflation targeting, automatic stabilizers ensure that fiscal and monetary policy are congruent in the case of a demand shock but divergent in the case of inflation and exchange rate shocks.

2.5 COSTS OF USING BOTH g AND r

The costs of changing the policy rate are not as apparent as those of changing fiscal policy. The argument for including variations in the policy rate as a separate component in the loss function should therefore be further motivated. There may be several reasons why the central bank is cautious about actively using the policy rate, and we will now discuss the most important ones.

One reason for including the policy rate in the loss function is that the impact of policy rate changes on inflation and the output gap are uncertain. The values of the parameters α_1, α_2, γ_1, and γ_2 are uncertain in practice. Uncertainty about the effect of the policy rate is an example of multiplicative uncertainty, and in such cases, certainty equivalence does not hold, even if the model is otherwise linear-quadratic. As shown in the classic article by William Brainard (1967), uncertainty about the effects of the policy rate implies that one should respond more cautiously to shocks. It is beyond the scope of our analysis to introduce stochastic parameters into the model, but it can be shown that the optimal policy under such uncertainty can be represented by including a quadratic term with the policy rate in the loss function.

Another reason for including the policy rate in the loss function is that there may be other considerations that the central bank prioritizes, beyond what is captured by the terms involving inflation and the output gap. Mitigating financial imbalances can be one such consideration. Large fluctuations in the policy rate and prolonged periods of a very low rate can lead to financial imbalances, which in turn can increase the risk of a severe economic downturn.

More generally, it can be argued that there is a risk associated with overburdening policy areas. Both Bartsch et al. (2020) and Calmfors et al. (2022) emphasize this consideration, which builds on earlier reasoning by Okun, who suggests that policymakers should strive to stay as much as possible "in the middle of the road" in their use of policy instruments. This view is likely an important reason why Bartsch et al. and Calmfors et al. seem to start from the premise that monetary and fiscal policy should not be divergent.[15] But, as we will demonstrate, the argument for policy areas to stay as much as possible "in the middle of the road" does not necessarily imply that they should be on the same side of the road's midline. The argument is against excessively aggressive use of policy instruments, but not necessarily against the instruments being divergent.

Taking into consideration the asymmetric effects of the policy rate can also motivate a less aggressive approach to policy rate setting. Recent developments in the literature have focused more on heterogeneity and imperfect risk sharing among households, often implying that the distribution of income and wealth is relevant to welfare, as measured by the overall utility of all households. In such models, distributional concerns can be incorporated into the relevant welfare loss function for monetary policy, and this may imply a more cautious approach to policy rate setting in cases where households are heterogeneous, as opposed to models with homogeneous households.[16]

There can also be other motivations for cautious interest rate setting that are not directly tied to welfare losses. For example, central banks may have a tendency to avoid policy reversals, which means avoiding a rate cut following a rate hike (or vice versa).[17] Good macroeconomists understand that economic developments are uncertain, and therefore, policy reversals can be appropriate. As Keynes purportedly said: "*When facts change, I change my mind. What do you do?*". However, for the general public, policy reversals can appear as if decision-makers are not competent. Despite central banks having significant independence, it is a strong assumption to assume that policymakers are completely immune to public criticism, and even if they were, they are still concerned about maintaining public trust in the central bank as an institution. The "policy error" of lowering the policy rate too little and subsequently having to lower it further at the next policy meeting is unlikely to generate as much criticism as the opposite "policy error" of lowering the rate too much and subsequently having to raise it. There is an asymmetry in the "costs" (criticism and reduced trust) associated with doing too much versus doing too little. This asymmetry can lead to a bias towards central banks making policy rate changes more gradually than the actual welfare costs of policy rate adjustments alone would suggest.

With the policy rate level included in the loss function, the first-order condition for monetary policy can be written as follows:

$$r = \frac{\gamma_1 (\alpha_1 + \alpha_2) + \gamma_2}{\theta_r} (\pi - \pi^*) + \frac{\lambda (\alpha_1 + \alpha_2)}{\theta_r} y. \tag{15}$$

The first-order condition can be written as a Taylor rule, where the magnitudes of the coefficients on inflation and the output gap are negatively dependent on the costs, θ_r, associated with changing the policy rate. We can find the solutions for monetary and fiscal

[15] They acknowledge the possibility that divergence in certain situations can be beneficial. For example, Bartsch et al. (2020) state that "*the desirable M-F mix depends on circumstances, and there is a priori no universal ranking according to which a congruent mix would be always and everywhere better than a divergent mix or vice versa*." However, in their empirical analysis, it appears that they consider it unfavourable for monetary and fiscal policy to be divergent, as in Calmfors et al. (2022).

[16] See Acharya et al. (2023).

[17] See Hasui et al. (2021) for an analysis of the implications of aversion to policy reversal.

policy by substituting equations (4) and (5) into equations (12) and (17), solving for r and g, which yields:

$$\begin{aligned} r &= \Lambda_{rv} v + \Lambda_{ru}\left[(\pi^e - \pi^*) + u\right] + \Lambda_{rz}\left(e^e + r^* + z\right), \\ g &= \Lambda_{gv} v + \Lambda_{gu}\left[(\pi^e - \pi^*) + u\right] + \Lambda_{gz}\left(e^e + r^* + z\right), \end{aligned}$$

where

$$\begin{aligned} \Lambda_{rv} &= \theta_g\left[\lambda\left(\alpha_1+\alpha_2\right) + \left(\gamma_1\left(\alpha_1+\alpha_2\right)+\gamma_2\right)\gamma_1\right]/\Lambda > 0 \\ \Lambda_{ru} &= \left[\left(\gamma_1\left(\alpha_1+\alpha_2\right)+\gamma_2\right)\theta_g + \lambda\alpha_3^2\gamma_2\right]/\Lambda > 0 \\ \Lambda_{rz} &= \left[\theta_g\left[\lambda\left(\alpha_1+\alpha_2\right)\alpha_2 + \left(\gamma_1\left(\alpha_1+\alpha_2\right)+\gamma_2\right)\left(\alpha_2\gamma_1+\gamma_2\right)\right] + \lambda\alpha_3^2\gamma_2^2\right]/\Lambda > 0 \\ \Lambda_{gv} &= -\left[\theta_r\left(\lambda+\gamma_1^2\right)+\lambda\gamma_2^2\right]\alpha_3/\Lambda < 0 \\ \Lambda_{gu} &= \alpha_3\left[\left(\alpha_1+\alpha_2\right)\lambda\gamma_2 - \gamma_1\theta_r\right]/\Lambda? \\ \Lambda_{gz} &= \alpha_3\left[\alpha_1\lambda\gamma_2^2 - \theta_r\left(\alpha_2\left(\lambda+\gamma_1^2\right)+\gamma_1\gamma_2\right)\right]/\Lambda? \\ \Lambda &= \theta_g\left[\lambda\left(\alpha_1+\alpha_2\right)^2 + \left(\gamma_1\left(\alpha_1+\alpha_2\right)+\gamma_2\right)^2 + \theta_r\right] + \lambda\alpha_3^2\gamma_2^2 + \alpha_3^2\theta_r\left(\lambda+\gamma_1^2\right) > 0 \end{aligned}$$

We observe that the result that monetary and fiscal policy should be congruent in the case of a demand shock still holds, as Λ_{rv} and Λ_{gv} have opposite signs.

Whether monetary and fiscal policy should be congruent or divergent in the case of inflation shocks and exchange rate shocks is no longer unambiguous. Let us first consider a positive inflation shock, i.e., $u > 0$. Since $\Lambda_{ru} > 0$, the policy rate should still be increased in response to a positive inflation shock. However, since the sign of Λ_{gu} is unclear, it is no longer clear whether fiscal policy should be expansionary. The sign of Λ_{gu} determines the condition for divergence versus congruence in the case of inflation shocks, which is as follows:

$$\begin{aligned} \text{Divergent} &: \quad \theta_r < \lambda\left(\alpha_1+\alpha_2\right)\gamma_2/\gamma_1 \\ \text{Congruent} &: \quad \theta_r > \lambda\left(\alpha_1+\alpha_2\right)\gamma_2/\gamma_1 \end{aligned}$$

As we can see, monetary and fiscal policy will still be divergent if the costs of interest rate changes, θ_r, are zero, as we would then revert back to the model from the previous section. However, if the costs of policy rate changes are sufficiently large, we see that the results are reversed, and the policies should pull in the same direction.

It turns out that the condition for congruence/divergence is related to the sign of the effect on inflation of an exogenous increase in g. The effect on inflation is the sum of the direct effect and the indirect effect, which operates through the impact of increased g on r. From equation (5), we have that

$$\frac{d\pi}{dg} = \gamma_1\alpha_3 - \left(\gamma_1(\alpha_1+\alpha_2)+\gamma_2\right)\frac{dr}{dg},$$

where the first term represents the positive direct effect of increased g on π, and the second term represents the negative indirect effect through the higher g leading to an increased interest rate r, which in turn lowers inflation. To find $\frac{dr}{dg}$, we can substitute equations (4) and (5) into equation (15), solve for r, and differentiate with respect to g. Substituting this into the equation above yields that the overall effect on inflation of an exogenous increase in g is given by

$$\frac{d\pi}{dg} = \frac{(\theta_r\gamma_1 - \lambda(\alpha_1 + \alpha_2)\gamma_2)\alpha_3}{\theta_r + \gamma_2^2 + 2\gamma_1\gamma_2(\alpha_1 + \alpha_2)^2}.$$

If the overall effect (general equilibrium effect) of increased g is that inflation increases, it is optimal for monetary and fiscal policy to pull in the same direction, whereas they should pull in opposite directions if the general equilibrium effect is that inflation decreases.

The intuition behind why the impact of fiscal policy on inflation determines whether monetary and fiscal policy should pull in the same or opposite direction in the event of an inflation shock can be described as follows: Assume that the costs of policy rate changes are relatively small. Monetary policy then responds relatively strongly to an increase in g, so that the policy rate is raised so much by increased g that the general equilibrium effect of expansionary fiscal policy on inflation is negative. In this case, an expansionary fiscal policy in response to an inflation shock will contribute to both bringing inflation down and making the output gap less negative. The benefits of better target attainment for inflation and the output gap through expansionary fiscal policy exceeds the costs of an increased policy rate with increased g. It is therefore optimal to have an expansionary fiscal policy combined with a contractionary monetary policy. If, on the other hand, the costs of policy rate changes are relatively high, so that increased g results in higher inflation, contractionary fiscal policy is optimal in order to support monetary policy in reducing inflation. The costs of tight fiscal policy are that the output gap becomes more negative, but the gains in the form of lower inflation and a lower policy rate exceed these costs.

In economic policy debates, it has often been argued that more expansionary fiscal policy would lead to higher inflation or an increased policy rate (as mentioned in the quote from the *Financial Market Report* in the introduction). Although the partial equilibrium effect suggests increased inflation, it is not obvious that the general equilibrium effect of increased g implies higher inflation. This depends on the extent to which the policy rate increases and the extent to which the exchange rate strengthens as a result of increased r. It is primarily an empirical question, and the empirical results do not provide a clear answer. Calculations in Statistics Norway's model KVARTS, as presented in *Economic Survey* 3/2022 (Box 1), indicate that expansionary fiscal policy either leads to slightly lower inflation or approximately unchanged inflation, depending on the type of public expenditure. However, calculations in the Ministry of Finance's NORA model suggest that increased g leads to higher inflation.[18] The international research literature on the effect of expansionary fiscal policy on inflation yields different conclusions regarding the direction of the effect.[19]

In the case of an exchange rate shock (e^e, r^*, and z), the answer to the question of whether monetary and fiscal policy should be congruent or divergent is determined by

[18] See Aursland et al. (2020). In the NORA model, the exchange rate will strengthen less because the risk premium on the currency increases when g increases, partially offsetting the effect of increased policy rate differential. However, the endogenous risk premium in this type of DSGE models primarily serves to "close" the model, ensuring that temporary shocks do not have permanent effects.

[19] See Table 1 in Jørgensen and Ravn (2022).

the costs of policy rate changes. We observe that since $\Lambda_{rz} > 0$, the policy rate should be increased in response to such a shock. However, from Λ_{gz}, it is unclear in which direction fiscal policy should be adjusted. From the expression for Λ_{gz}, the conditions are as follows:

$$\begin{aligned} \text{Divergent} &: \quad \theta_r < \left[\left(\lambda + \gamma_1^2\right) \alpha_2 + \gamma_1 \gamma_2\right] / \lambda \alpha_1 \gamma_2^2 \\ \text{Congruent} &: \quad \theta_r > \left[\left(\lambda + \gamma_1^2\right) \alpha_2 + \gamma_1 \gamma_2\right] / \lambda \alpha_1 \gamma_2^2 \end{aligned}$$

The intuition behind this is as follows: Suppose there are extremely high costs associated with raising the policy rate. In this case, the policy rate increases only slightly in response to a risk premium shock, and as a result, inflation is significantly above the target when fiscal policy in unchanged. With extremely high costs of raising the policy rate, output will also exceed its target level. This is because the expansionary effect of depreciation outweighs the (minimal) contractionary effect of an increased policy rate. Since monetary policy responds so minimally, both inflation and output will be above their targets (for unchanged fiscal policy). It means that reducing g in this case brings both inflation and output closer to their targets. In this scenario, it is evident that fiscal policy should support monetary policy. Monetary and fiscal policy should be congruent.

If the costs of changing the policy rate are very low, we are back to case 2. In this scenario, monetary and fiscal policy should be divergent. It follows that there is a threshold for the costs of policy rate changes such that policy areas are congruent if the costs are higher than this threshold, and divergent if they are lower.

Finally, it is also worth noting that the costs of fiscal policy, θ_g, are irrelevant for determining whether monetary and fiscal policy should be congruent or divergent. θ_g determines the level of activity of fiscal policy but not its direction. To determine the latter, the costs of policy rate changes, θ_r, are the relevant factor.

3 INTEREST SUBSIDY

An argument often used against tight monetary policy is that a higher policy rate has adverse distributional consequences. We will now study a case where fiscal policy is designed to mitigate these consequences by providing interest rate subsidy - that is, households receive support that increases with their interest expenses. There are different forms of interest rate subsidies, but the most general form is the tax deduction for interest expenses, which means that borrowers in Norway effectively only have to pay 78 percent of their interest expenses (and depositors receive 78 percent of their interest income) given the current tax rate. Therefore, we now assume that households only pay a fraction $(1-t)$ of their interest expenses, and the remaining portion is provided as public support. We will examine the implications of this type of fiscal policy for monetary policy.

To isolate the effect of interest subsidy, we will keep the type of fiscal policy we examined earlier - fiscal policy (g) - exogenous. Therefore, we assume that interest subsidy does not affect the overall level of government spending, meaning that changes in government revenue resulting from changes in interest rates or changes in the rate of interest rate support are offset by reallocations within the budget framework. In other words, we focus solely on the substitution effect of the interest subsidy.

The interest subsidy has implications for the monetary policy transmission mechanism. The reason is that such support weakens the strength of the demand channel of a change in the policy rate *relative* to the exchange rate channel. With interest deductions, the central bank needs to increase interest rates more than otherwise to achieve a given dampening effect on demand. However, the exchange rate is not affected by such interest rate support or deductions. The reason for this is that the exchange rate is a relative price determined by the return on domestic currency relative to the return on foreign currency. For a domestic investor deciding whether to invest in domestic currency or foreign currency, the tax rate or interest rate support is the same for both investments. Similarly, for a foreign investor, the tax rate or interest rate support in their home country is the same for investments in Norwegian kroner or other currencies. The level of the tax rate or whether it differs for domestic and foreign investors is thus irrelevant for the effect of the policy rate on the exchange rate. Therefore, the tax rate is not included in the UIP equation.[20]

Taking into account the interest subsidy, equation (1) will be modified to

$$y = -\alpha_1(1-t)r + \alpha_2 e + \alpha_3 g + v, \tag{16}$$

where t is the tax rate. We observe that the interest subsidy is equivalent to a lower coefficient α_1 for the effect of the interest rate. This section is therefore an extension of the model in Røisland and Sveen (2005 and 2018). Since the interest subsidy weakens the demand channel relative to the exchange rate channel, such interest deductions have implications for the optimal monetary policy and the achievement of objectives under different shocks. We will not present the solution for the monetary policy response with and without interest subsidy, as this follows directly from the expressions in Røisland and Sveen (2005 and 2018), where the case of interest subsidy is equivalent to a lower coefficient α_1, as seen in (16). It can also be analytically shown that achievement of the policy goal improves in the case of interest subsidy when there are inflation shocks and exchange rate shocks (e^e, r^*, and z), and it worsens in the case of demand shocks. Instead of repeating the analytical expressions from Røisland and Sveen (2005 and 2018), we will use logical reasoning here to clarify the intuition.

First, assume that we have an inflation shock. As shown in Røisland and Sveen (2005 and 2018), the optimal policy implies that the central bank increases the policy rate so that inflation becomes lower than without a response, but still higher than the target. The output gap becomes negative as a result of the policy rate increase. Now, suppose that an interest subsidy is introduced, reducing the impact of the policy rate on demand. Initially, assume that the central bank increases the policy rate such that the output gap becomes exactly as negative as in the case without an interest subsidy. In this scenario, the demand channel for inflation remains unchanged. However, since the central bank needs to raise the policy rate more when there is an interest subsidy to achieve the same negative output gap, the exchange rate will appreciate more compared with the case without an interest subsidy. As a result, inflation will be lower for the given level of the output gap. Therefore, policy goal achievement improves. However, because the central bank weighs inflation against the output gap, it is optimal to increase the policy rate slightly less in the case of an interest subsidy, leading to a slightly less negative output gap compared with the case without interest subsidy. This further enhances goal achievement compared with a situation where the output gap is as negative as without an interest subsidy.

[20] Interest income is typically subject to ongoing taxation, while currency gains are typically taxed upon realization. If the tax system is what is known as periodization-neutral, meaning that the timing of taxation does not affect the expected return differences between domestic and foreign currency investments, taxation will not affect the UIP equation.

The reasoning will be similar in the case of a shock to the exchange rate, such as an increase in foreign policy rates. It is optimal to increase the policy rate, but not one-to-one with foreign interest rates, as that would result in an unchanged exchange rate but a negative output gap, causing inflation to fall below the target. The optimal response in this case also implies that inflation will be higher than the target (due to a weaker exchange rate) and the output gap will be negative. If an interest subsidy is introduced, the interest rate can be increased more for a given effect on the output gap. Therefore, the exchange rate may become less weak without the need for the output gap to become more negative. With the interest subsidy, the policy rate is increased in a way that makes the output gap less negative than without interest subsidy, bringing inflation closer to the target.

We can see that factors that weaken the strength of the demand channel relative to the exchange rate channel improve the achievement of policy goals in response to inflation and exchange rate shocks. This makes the task of the central bank easier in the sense that the trade-offs in monetary policy are less demanding. Conversely, factors that strengthen the policy rate channel relative to the exchange rate channel make the trade-offs more challenging. An example of this could be a high share of floating-rate mortgage loans. If this makes the policy rate channel strong relative to the exchange rate channel, the central bank faces more difficult trade-offs when the economy is hit by inflation or exchange rate shocks.

Let us assume a negative demand shock to demonstrate that interest rate support leads to worse policy outcomes. It is easiest to start from the opposite end, assuming that there is an interest subsidy initially and that it is removed. As shown in Røisland and Sveen (2005 and 2018), a negative demand shock leads to the central bank lowering the policy rate, resulting in a less negative output gap compared with a situation without the policy rate cut, while inflation exceeds the target due to the depreciation of the exchange rate resulting from the policy rate cut. Assume then that the interest subsidy is removed. In this case, the central bank can theoretically achieve the same negative value for the output gap by lowering the policy rate to a lesser extent. However, a smaller policy rate cut leads to a smaller depreciation of the exchange rate, causing inflation to not exceed the target by as much as with interest rate support. Therefore, policy outcomes become worse with interest subsidy compared with a situation without it.

An interesting question is how interest subsidy affects the costs, represented by θ_r, of policy rate changes. This depends on the reasons for why the policy rate is included in the loss function. If there is uncertainty about the effects of policy rate changes on demand or undesired distributional effects, it is natural to assume that changes in the after-tax interest rate are the relevant cost. In that case, the policy rate term in the loss function (6) would be $\theta_r((1-t)r)^2 = \theta_r(1-t)^2 r^2$, which is equivalent to a lower weight on the policy rate in the loss function. In a closed economy, an interest subsidy would have no effect since a lower effective weight on policy rate changes would be fully offset by the need to change the policy rate more when shocks occur. In an open economy, however, an interest subsidy does not have a neutral stabilization effect as the relative importance of the exchange rate channel increases.

4 Conclusion

We have extended a simple model of inflation targeting to also discuss fiscal policy. The optimal interaction between monetary and fiscal policy in the simplest model implies that (i) both the inflation target and the output target can always be achieved, (ii) fiscal policy responds to demand shocks while monetary policy does not, and (iii) both monetary and fiscal policy should respond and be divergent to other shocks. The latter implies, for example, that in the case of positive inflation shocks or shocks that weaken the currency, monetary policy should be contractionary while fiscal policy should be expansionary. This ensures that the difference in the functioning of monetary and fiscal policy is optimally utilized.

Furthermore, we have shown that when there are costs associated with changing fiscal policy, (iv) monetary policy should also respond to demand shocks, and in that case, (v) monetary and fiscal policy should support each other, i.e., be congruent. However, with other types of shocks such as inflation shocks or exchange rate shocks, (vi) monetary and fiscal policy should still be divergent. We have also demonstrated that (vii) automatic stabilizers in fiscal policy combined with an inflation target are consistent with monetary and fiscal policy being congruent in response to demand shocks and divergent in response to inflation shocks or exchange rate shocks.

If there are also costs associated with using the policy rate, (viii) the result that monetary and fiscal policy should be divergent during inflation shocks or exchange rate shocks can be reversed if these costs are significant.

We have also discussed an interest subsidy (which can alternatively be interpreted as tax deductions for interest payments or a low share of variable-rate mortgage loans) and shown how this (ix) strengthens the exchange rate channel relative to the demand channel of a policy rate change. This implies that (x) policy outcomes improve when the economy faces inflation and exchange rate shocks, while they (xi) worsen when the economy faces demand shocks.

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