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Monetary-fiscal interaction and quantitative easing

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Non-technical summary

Research Question

Together with the inception of quantitative easing as an additional monetary policy instrument, a debate has begun about how strongly unconventional monetary policy measures interact with fiscal policy. In this paper, we examine the classical monetary-fiscal interaction (along the lines of Leeper (1991, *Journal of Monetary Economics*)) if the central bank conducts large-scale government bond purchases. In particular, we ask how inflation reacts after an increase in bond purchases especially for the case of fiscal dominance, ie. a situation where monetary policy does not (or cannot) stabilize inflation and fiscal policy does not stabilize government indebtedness.

Contribution

Our contribution is to look at this question through the lens of a dynamic stochastic general equilibrium (DSGE) model featuring a banking sector as the main holder of government bonds and the sole intermediary of funds from households to firms.

Results

We show that under fiscal dominance unconventional monetary policy such as quantitative easing has similar effects as conventional monetary policy such as altering the policy rate. In particular, an expansionary monetary policy shock of both forms, government bond purchases and a cut in the policy rate, exerts downward pressure on inflation. This phenomenon can be explained by wealth effects in the balance sheet of private agents. This means that large-scale asset purchases cause agents to reduce the holdings of these assets which could result in a drop in their financial wealth if they do not invest in other assets accordingly as a consequence from lower overall returns. We can also show that the longer the average maturity of public debt, the more volatile is the transmission of quantitative easing to the real economy in case of fiscal dominance.

Nichttechnische Zusammenfassung

Fragestellung

Seitdem einige Zentralbanken die Quantitative Lockerung (quantitative easing, QE) als zusätzliches geldpolitisches Instrument verwenden, wird die Frage diskutiert, wie stark diese unkonventionelle Geldpolitik mit Fiskalpolitik interagiert. In diesem Papier untersuchen wir die klassische geld- und fiskalpolitische Interaktion (à la Leeper (1991, *Journal of Monetary Economics*)), wenn die Zentralbank Staatsanleihen aufkauft. Insbesondere fragen wir, wie Inflation nach Käufe von Staatsanleihen reagiert und konzentrieren uns hierbei auf den Fall der fiskalischer Dominanz. Dies ist eine Situation, in der die Geldpolitik Inflation über ihre herkömmliche geldpolitische Regel nicht kontrolliert und der öffentliche Sektor nicht seine Verschuldung stabilisiert.

Beitrag

Unser Beitrag ist es, diese Frage anhand eines dynamisch stochastischen Gleichgewichtsmodells (DSGE-Modell) zu beantworten. Im zur Anwendung kommenden Modell spielt ein Bankensektor eine bedeutende Rolle. Dieser ist denjenige Akteur, welcher hauptsächlich Staatsanleihen hält und als Intermediär zwischen Haushalt und Firma fungiert.

Ergebnisse

Wir zeigen, dass unter fiskalischer Dominanz unkonventionelle Geldpolitik - die Käufe von Staatsanleihen - ähnlich wirkt wie konventionelle Geldpolitik, also herkömmliche Variationen des Leitzinses. Im Modell führt eine expansive Maßnahme in beiden Formen, also sowohl Käufe von Staatsanleihen als auch Leitzinssenkungen, zu einem Rückgang der Inflation. Die Ursache ist mit Vermögenseffekten bei den privaten Wirtschaftssubjekten verknüpft. Das bedeutet, dass Käufe von Staatsanleihen die Wirtschaftssubjekte dazu veranlasst, weniger von diesen Vermögenswerten zu halten. Dies geht mit einer Reduzierung ihres Finanzvermögens einher, wenn sie aufgrund von insgesamt niedrigeren Renditen nicht in andere Vermögensanlagen investieren wollen. Es lässt sich hierbei festhalten, dass je länger die durchschnittliche Fälligkeitsstruktur der Staatsanleihen ist, desto volatiler wird die Realwirtschaft bei fiskalischer Dominanz nach den Anleihekäufen.

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Abstract

This paper analyzes the monetary-fiscal interaction if the central bank conducts quantitative easing. Although asset purchases have similar effects on the real economy under monetary and fiscal dominance, wealth effects yield a qualitatively different response on the rate of inflation. Our results show that under fiscal dominance, unconventional monetary policy has similar effects to conventional monetary policy on inflation because these wealth effects exert downward pressure on prices. The longer the average maturity, the more volatile is the transmission of quantitative easing to the real economy.

Keywords: Monetary Policy, Fiscal Policy, Asset Purchase Program
JEL classification: E32, E44, E62.

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1 Introduction

Together with the inception of quantitative easing as an additional monetary policy instrument, a debate has begun about how strongly unconventional monetary policy measures interact with fiscal policy (see Reis (2016), for example). We contribute to this discussion by investigating the classical monetary-fiscal interaction (Leeper and Leith, 2016) if the central bank conducts large-scale government bond purchases.

In a regime of fiscal dominance, i.e. where fiscal policy does not stabilize government debt while the central bank does not sufficiently use the short rate to control inflation (Leeper, 1991), expansive monetary policy shocks can have contractionary effects on the rate of inflation. The reason for this is related to wealth effects. Lower nominal interest rates reduce households' expected financial wealth because of lower interest income (yield effect). This effect constrains consumption by causing expectations about future demand to drop. In a regime of fiscal dominance this occurs because it is not the central bank that controls the path for the nominal interest rate to balance inflation, as it is inflation that is geared towards the stabilization of real debt. Lower interest rates dampen, in turn, the growth in government debt held by the household and lower interest income. Hence, government indebtedness mainly drives inflation via household wealth.

Quantitative easing has the aim to boost aggregate demand and eventually to stimulate inflation. One central channel through which large-scale asset purchase programs work is by causing shifts in agents' portfolios (Krishnamurthy and Vissing-Jorgensen, 2011; D'Amico, English, López-Salido, and Nelson, 2012). Asset purchases reduce the supply of government bonds available to private agents (*free float*) which brings the yields on government bonds down in the presence of limits to arbitrage. Lower yields either stimulate consumption directly (Chen, Cúrdia, and Ferrero, 2012) or create an incentive to invest in other assets supporting investment (Gertler and Karadi, 2013). In these cases, large-scale asset purchases affect the wealth of agents in different ways: on the one hand, lower yields distort desired interest receipts, causing a negative wealth effect via yield effect. On the other hand, rising asset prices stimulate financial wealth of agents through a valuation effect (asset price effect). Large-scale asset purchases, however, cause agents to reduce the holdings of these assets which could result in a drop in their financial wealth if they do not invest in other assets accordingly (quantity effect) as a consequence from lower (expected) overall returns. When agents are faced with a balance sheet constraint, building up net worth can even substitute external funds. Since the latter are eventually provided by households, their financial wealth can also decline via a quantity effect. Thus, it is not clear a priori which channel might dominate under fiscal dominance. Basically, quantitative easing has the potential to boost inflation even further under fiscal dominance if the asset price effect dominates the yield and the quantity effect.

Our contribution is to shed light on these forces by looking at this question through the lens of a dynamic stochastic general equilibrium (DSGE) model featuring a banking sector as the main holder of government bonds and the sole intermediary of funds from households to firms. Hence, banks hold government bonds and the wealth effects following from government bond purchases are transmitted through the banking sector to the households. We show that under fiscal dominance, unconventional monetary policy has similar effects as expansionary conventional monetary policy because wealth effects exert downward pressure on the rate of inflation. However, for government bond purchases, it

is the quantity effect that dominates financial wealth. Although a purchase shock has similar effects on the real economy under monetary and fiscal dominance, these wealth effects yield a qualitatively different response on the rate of inflation. The purpose of this paper is to discuss the monetary policy transmission of quantitative easing to the real economy under fiscal dominance, how it differs to the case of monetary dominance, and how long-term government debt affects this transmission.

2 The framework

2.1 The general setting

In order to investigate the monetary-fiscal interaction if the central bank conducts large-scale asset purchases, we use a New Keynesian DSGE model featuring a banking sector that leans on work by Gertler and Karadi (2013).[1] Banks are the main financial intermediaries that intermediate funds from households to non-financial firms and hold government bonds.[2] Bankers operate these banks, and a moral hazard problem makes it possible for them to default on their debt. As a result, banks combine own net worth with external funds provided by households. The desire of households to place funds with banks is consequently constrained by banks' leverage, and defaults do not occur in equilibrium. Banks invest their funds in purchases of private assets, which are used by the real sector to finance the capital stock, and in purchases of government bonds.

Intermediate goods producers operate under imperfect competition and combine labor supplied by households with capital to produce intermediate goods. They can set the price optimally for their goods every period with a specific probability. In periods when they cannot optimize the prices they index the price to past inflation (Calvo pricing). Final goods producers combine intermediate goods to obtain the final goods bundle which is used for consumption, government expenditures and investment. The capital stock can only be adjusted subject to costs.

2.2 Policy rules for monetary and fiscal policy

In the model, we allow for three different policy rules (all depicted in linear terms). Common to standard DSGE models, our short rate, i_t, is set according to a Taylor rule with interest smoothing, ρ_i. For simplicity, we assume that the central bank solely aims at stabilizing the rate of inflation π_t.

$$i_t = \rho_i i_{t-1} + (1-\rho_i)\phi_\pi(\pi_t - \bar{\pi}) + \epsilon_t^{cmp}$$

The central bank responds to deviations from the inflation target $\bar{\pi}$ by ϕ_π , and the term ϵ_t^{cmp} captures an unexpected (conventional) monetary policy shock. In addition to the policy rate, the central bank can make use of government bond purchases, where the stock

[1] The banking sector is similar to that in Gertler and Karadi (2013). Regarding bankers' optimization problem, we follow Bocola (2016).

[2] From the banks' perspective, private securities and government long-term bonds are perfect substitutes.

held by the central bank CB_t in period t obeys the following structural form

$$CB_t = \rho_{CB} CB_{t-1} + \epsilon_t^{ump}.$$

This reaction function allows for an unexpected (unconventional) monetary policy shock ϵ_t^{ump}, similar to the conventional Taylor rule but without the option for a systematic response on the state of the economy.[3] Furthermore, the stock has an autoregressive part controlled by ρ_{CB}. The fiscal authority aims at stabilizing government debt by varying lump sum taxes T_t, i.e. it raises taxes in excess of steady-state lump sum taxes, T, if government indebtedness B_t exceeds its target $\bar{B}$.

$$T_t - T = \xi_T \left(B_{t-1} - \bar{B} \right) \tag{1}$$

The parameter ξ_T controls the sensitivity to which the fiscal authority reacts to changes in debt to guarantee fiscal solvency. If ξ_T is sufficiently small, the fiscal authority becomes active and does not stabilize debt any longer.[4] The budget constraint of the fiscal authority is given by

$$G_t = T_t + Q_t^B B_t - \left(1 + \rho^B Q_t^B\right) B_{t-1}/\pi_t, \tag{2}$$

where G_t denotes government expenditures, Q_t^B is the price and B_t is the quantity of government bonds. The parameter ρ^B captures the fact that government bonds have a specific maturity.[5]

3 Simulation results

3.1 Monetary policy shocks under fiscal dominance

First, we start with the discussion of the transmission channels of conventional and unconventional monetary policy for fiscal dominance in our benchmark model, i.e. ϕ_π and ξ_T are set to 0.[6] Thus, the central bank does not control inflation and the fiscal authority does not stabilize government indebtedness. In Figure 1, we present the effects of a positive shock to the stock of government bonds held by the central bank (black solid lines), whereas the stock dissipates over time with the speed controlled by the autoregressive parameter, and compare them with a conventional monetary policy shock (blue dashed lines) in the benchmark model.[7] Furthermore, we present the effects of a conventional monetary policy shock in a model without the banking sector, i.e. the model shares the same real sector. This allows us to obtain an understanding of how the banking sector transmits both types of monetary policy impulses through the financial sector to the real

[3] A purchase rule with a target can be found in Gertler and Karadi (2011), for example, who relate the purchases to the credit spread. We leave the exploration of purchase rules for future research.

[4] See Leeper (1991) for a discussion on these boundaries.

[5] The parameter ρ^B is set to 0.955, reflecting a maturity of approximately 5 years, which is in line with the average maturity in many industrialized countries. The maturity of a portfolio on a quarterly basis is given by $1/\left(1 - \beta\rho^B\right)$ (see Leeper and Leith (2016)).

[6] For the sake of simplicity, we take this polar case.

[7] The autoregressive parameter ρ_{CB} is set to 0.98, implying a half-life for central bank's portfolio of 8.5 years, and ρ_i to 0.6. The size of the program amounts to 7 per cent of annualized output.

economy.[8] Figure 2 provides a deeper insight into the balance sheet composition of banks and plots the responses of private securities held by banks (provision of funds to the real sector), holdings of government bonds, bank equity, and deposits.

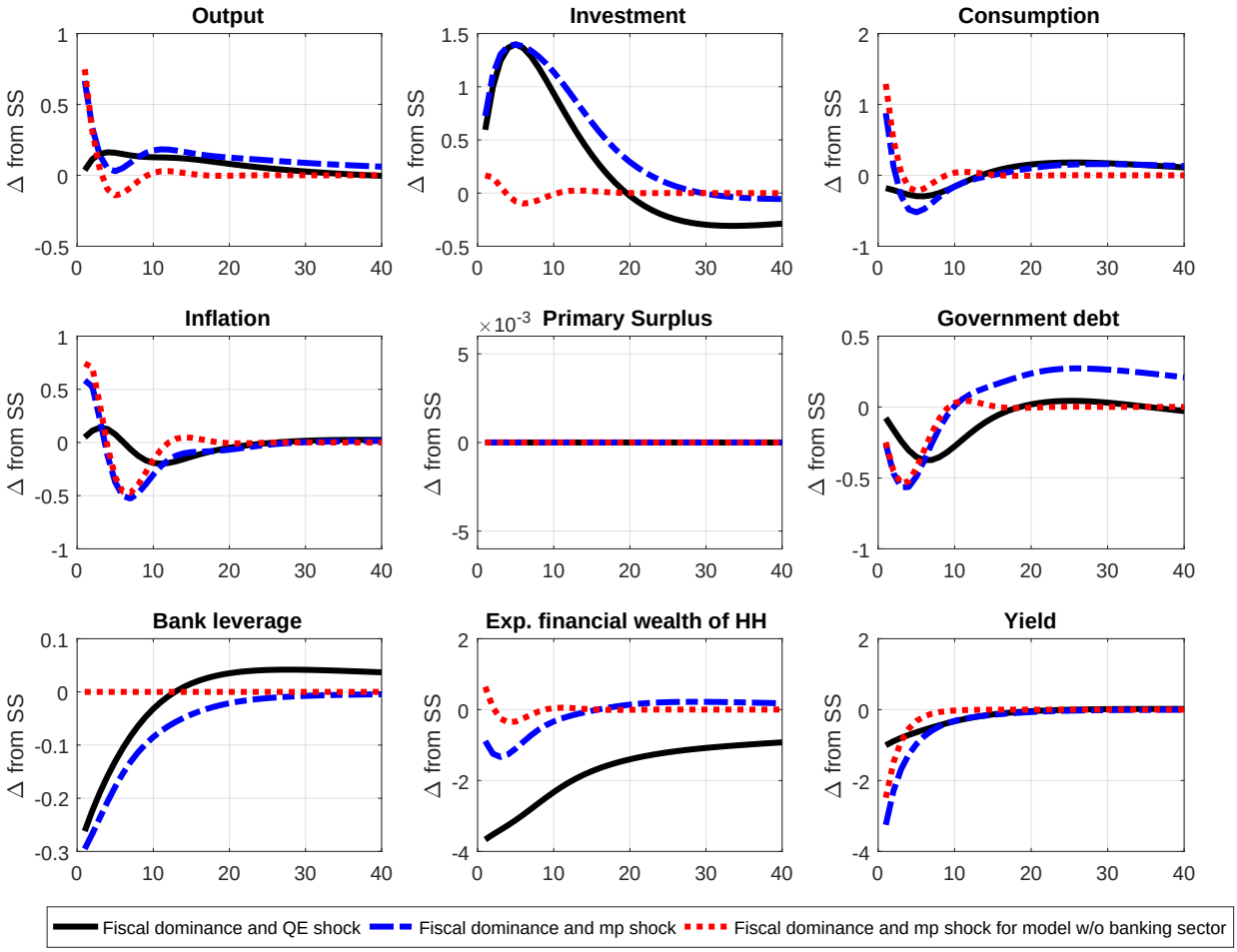

Figure 1: The effects of (a) government bond purchases (black solid lines), of (b) conventional monetary policy under fiscal dominance (blue dashed lines), and of (c) conventional monetary policy under fiscal dominance in a model without banking sector

Note: For output, investment, consumption, primary surplus, government debt, and expected financial wealth of the households, the responses are expressed as deviations from their respective steady state in per cent. Inflation and yields are in percentage points, while bank leverage in absolute terms.

The economy shows the well-known responses to (unexpected) government bond purchases (see Gertler and Karadi (2013), Sahuc (2016), or Kühl (2018), for example).[9] Yields on government bonds fall, which initiates a portfolio rebalancing in the banking sector. Banks buy more private assets, which are used to finance the capital stock. As a result,

[8]The monetary policy shock is scaled to have the same investment peak effect under both policies. This means that the annualized policy rate drops by about 2.5 percentage points on impact.

[9]The discussion of anticipation effects of a large-scale asset purchase program is beyond the scope of this paper. Sahuc (2016) simulates a purchase program with a second-order autoregressive process and Kühl (2018) with an first-order autoregressive process combined with anticipated shocks. Both approaches are able to capture these anticipation effects. As Kühl (2018) shows anticipated effects do not qualitatively change the effects of the asset purchase program.

the return on capital falls and investment in physical capital is stimulated. The related increases in asset prices of both the private and public sector supports the build-up of bank equity (see eq. (4) in the appendix), which relaxes the balance sheet constraint as can be seen by lower bank leverage. Lower bank leverage, in turn, coincides with lower (expected) financial wealth of households. Banks sell government bonds to the central bank, which leads to a shrinking of banks' balance sheets. The lower need for external funding in the banking sector eventually affects households' financial wealth (see eq. (5) in the appendix). Although consumption drops, output rises through investment. This coincides with a higher rate of inflation before it falls below its steady state in the medium run. Consumption mainly falls on impact because of the negative wealth effect. Government indebtedness falls because lower yields reduce the interest burden. This can be seen by looking at the primary surplus (tax income minus government expenditures), which is unaffected by the purchases. According to Eqs. (1) and (2), variations in government debt occur under fiscal dominance through the debt service.

Regarding household wealth, a quantity effect arises through portfolio rebalancing in conjunction with the evolution of bank equity in the banking sector. While banks buy more securities from the private sector, they reduce the holdings of government bonds. Since bank equity is stimulated on impact through the increase in asset prices (asset price effect) and the reduction in government bonds exceeds the purchases of private securities total assets fall resulting in the lower bank leverage.[10] This means that banks require less external funds. Deposits constitute, however, the financial wealth of households and this quantity effect occurring in the banking sector is transmitted into the household sector where it mainly drives the expected financial wealth of households down as can be seen by looking at eq. (5) in the appendix.

Qualitatively, the effects of a purchase shock share similarities with a conventional monetary policy shock. However, an exogenous drop in the short rate lowers the real interest rate directly, which stimulates consumption and output on impact. As a result, asset prices rise because of a higher demand for capital. Lower funding costs for banks and higher asset prices, in turn, affect bank equity positively and cause a deleveraging while total assets slightly grow and holdings of government bonds remain largely unaffected. Banks' desire to provide more funds to the real sector eventually leads to a strong increase in investment compared to the case in which a banking sector is missing. Thus, the banking sector transmits the impulse of a conventional monetary policy shock more strongly to investment. However, households' (expected) financial wealth falls for the conventional monetary policy shock in the model with banking, while there is a slight increase on impact in the model without a banking setor (see red dotted lines in Figure 1). In the model with a banking sector, wealth effects play an important role with regard to why consumption falls more heavily in the medium run. Output responds more sensitively in the case of the conventional monetary policy shock compared to the unconventional monetary policy shock because consumption increases immediately after the drop in the interest rate. Regarding the financial variables, a conventional monetary policy shock shows similar responses as an unconventional monetary policy shock. Bank leverage drops and helps to stimulate investment. Lower bank leverage, however, also coincides with lower expected household wealth, which is more elaborated for the

[10]Bank equity falls below its steady state in the medium run as a consequence of lower returns on assets. See Kühl (2018) for a deeper discussion.

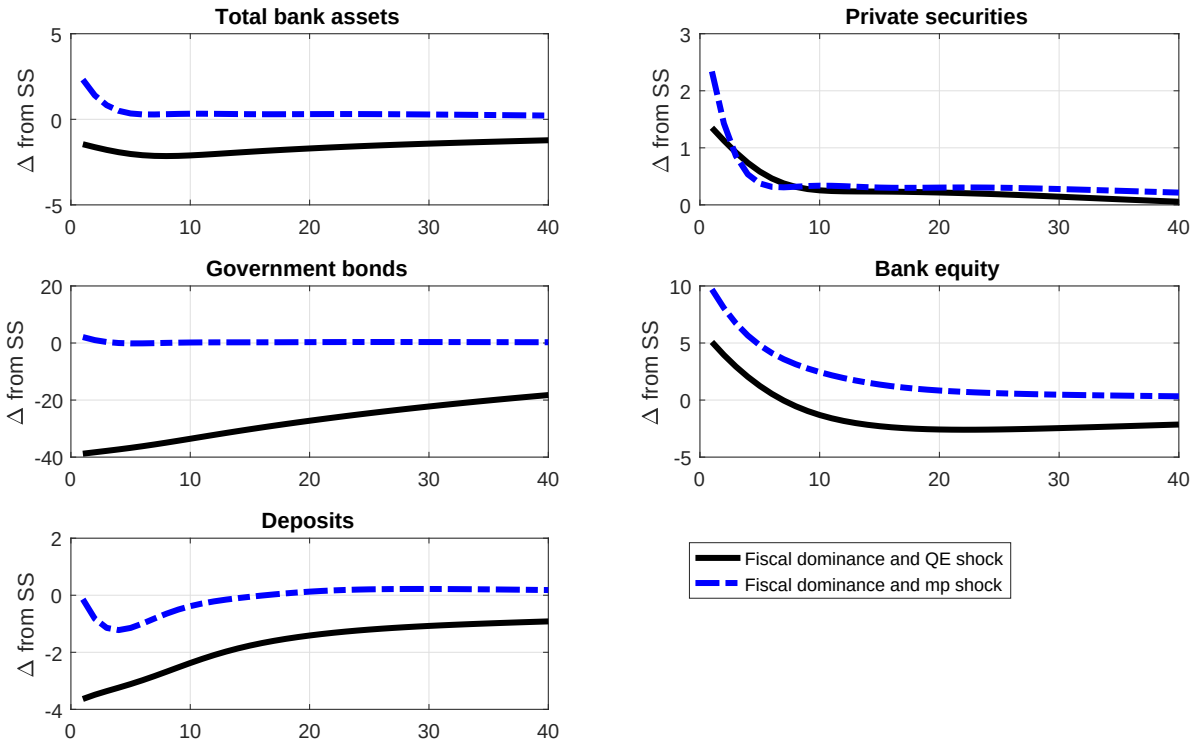

Figure 2: The effects of (a) government bond purchases (black solid lines) and of (b) conventional monetary policy (blue dashed lines) under fiscal dominance in a model with banking sector

Note: The responses are expressed as deviations from their respective steady state in per cent.

unconventional monetary policy shock.

The analysis and the transmission of quantitative easing so far hinges on the presence of a banking sector. However, the responses following a conventional monetary policy shock are nearly the same regardless of whether a banking sector is included or not. The trajectories of inflation, government debt, households' expected financial wealth and consumption are nearly the same.[11] Investment is an exception because in the model with banking it rises by more as a result of the financial accelerator. However, investment does not play an important role for inflation under fiscal dominance. It is mainly households' financial wealth that matters. For the model without banking sector, the wealth effects predominantly stem from lower interest receipts as discussed by Leeper (1991), i.e. it is the yield effect that dominates. The model with banking sector provides the same qualitative conclusions following monetary policy shocks but the quantity effect reduces financial wealth through lower deposits for the unconventional monetary policy. This underpins the role of changes in financial wealth of households even in the presence of a banking sector. In the latter case, these wealth effects are only transmitted through the banking sector.

[11] In the model without a banking sector, households hold all government bonds instead of the banking sector.

3.2 Unconventional monetary policy shocks under fiscal and monetary dominance

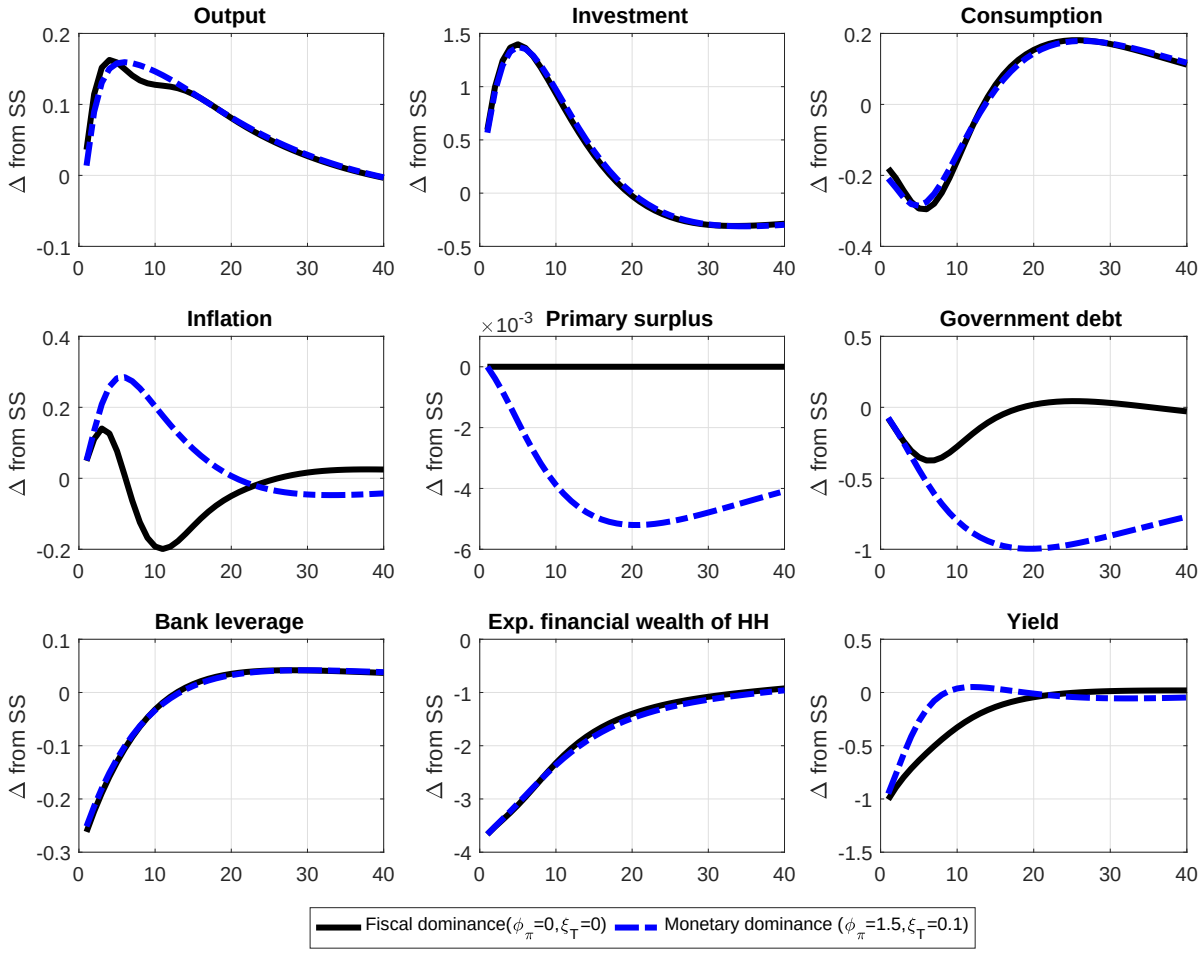

Figure 3: The effects of government bond purchases under (a) monetary dominance (black solid lines) and (b) fiscal dominance (blue dashed lines)

Note: For output, investment, consumption, primary surplus, government debt, and expected financial wealth of the households, the responses are expressed as deviations from their respective steady state in per cent. Inflation and yields are in percentage points, while bank leverage in absolute terms.

Leeper and Leith (2016) show that the response of inflation under fiscal dominance can be opposed to its reaction under monetary dominance. As can be seen in Figure 3, where we compare the case of fiscal dominance (black solid lines) with the case of monetary dominance (blue dashed lines), i.e. ϕ_π is set to 1.5 and ξ_T to 0.1 such that the central bank responds to inflation by setting the short-term interest rate and the fiscal authority stabilizes real debt. The transmission of an unexpected purchase shock in the benchmark is rather similar under monetary dominance compared to fiscal dominance with the exception of the rate of inflation and government debt. Under fiscal dominance the rate of inflation rises at first, but then falls strongly below its steady state. The reason is related to the changes in households' financial wealth. Inflation increases, *inter alia*, on impact because of the stimulating effects through investment. However, the financial

wealth of households decreases as described above. Lower bank leverage coincides with less external funds and a drop in interest income. Under fiscal dominance this effect negatively affects inflation as a result of lower consumption. Hence, quantitative easing puts the inflation rate in the medium run under pressure in the case of fiscal dominance.

Under monetary dominance, inflation rises more strongly and exceeds its steady-state value more persistently. A necessary precondition for quantitative easing to boost inflation more persistently is therefore a passive fiscal policy and active monetary policy (monetary dominance). Expected household wealth also falls under monetary dominance, but inflation is determined by setting the short-term interest rate and not by stabilizing real debt. Debt falls more strongly under monetary dominance, but this has no effect on inflation because it is monetary policy that controls inflation. The reduction in government debt follows from the response of the fiscal authority on a lower debt burden (see Eq. (1)), resulting from lower long-term interest rates, and the primary surplus deteriorates. This is similar to the conventional monetary policy shock (see the online appendix).

3.3 Effects from maturities

Our model features long-term government bonds and we calibrate the maturity parameter ρ^B to reflect roughly the average maturity in industrial countries. Long-term government debt, however, has a non-trivial role for fiscal policy (see Sims (2011) or Cochrane (2001, 2018), for example). More specifically, Leeper and Leith (2016) show that bond prices affect the monetary and fiscal interaction in the case of fiscal dominance. By starting from a simplified maturity structure, as we do, they argue that the maturity parameter, which controls the average maturity of a bond portfolio, can be interpreted as an additional discount factor. For this reason, bond prices react more sensitively to future than to present inflation developments, the longer the average maturity is. In our case with the banking sector, the prices of government bonds are heavily determined by the leverage constraint of banks and arbitrage to other assets banks hold.

In Figure 4, we present the responses of inflation, government debt, the expected financial wealth of households, and the yield on government bonds following a government purchase shock for different average maturities (y-axis). With longer average maturities, the economy becomes more volatile. Inflation rises more strongly on impact but also falls deeper below its steady state in the medium term. This drop coincides with a fall in government indebtedness. The reason is related to the response of the yield on government bonds, which falls more strongly for longer maturities. With a longer average maturity, the portfolio rebalancing effect in the banking sector following from government bond purchases is more elaborated. For a given volume of purchases, yields must fall more strongly in order to induce banks to sell their government bond holdings. As a consequence, government interest expenses shrink by more and government indebtedness falls to a greater extent. At the same time, household wealth also falls more intensively because the quantity effect is more elaborated as a consequence of the stronger portfolio rebalancing. Banks delever to a larger extent. The impact of maturities on the strength of the transmission for the unconventional monetary policy shock is opposed to a conventional monetary policy shock, where inflation responds more strongly for shorter maturities.[12]

[12]This case is presented in the online appendix.

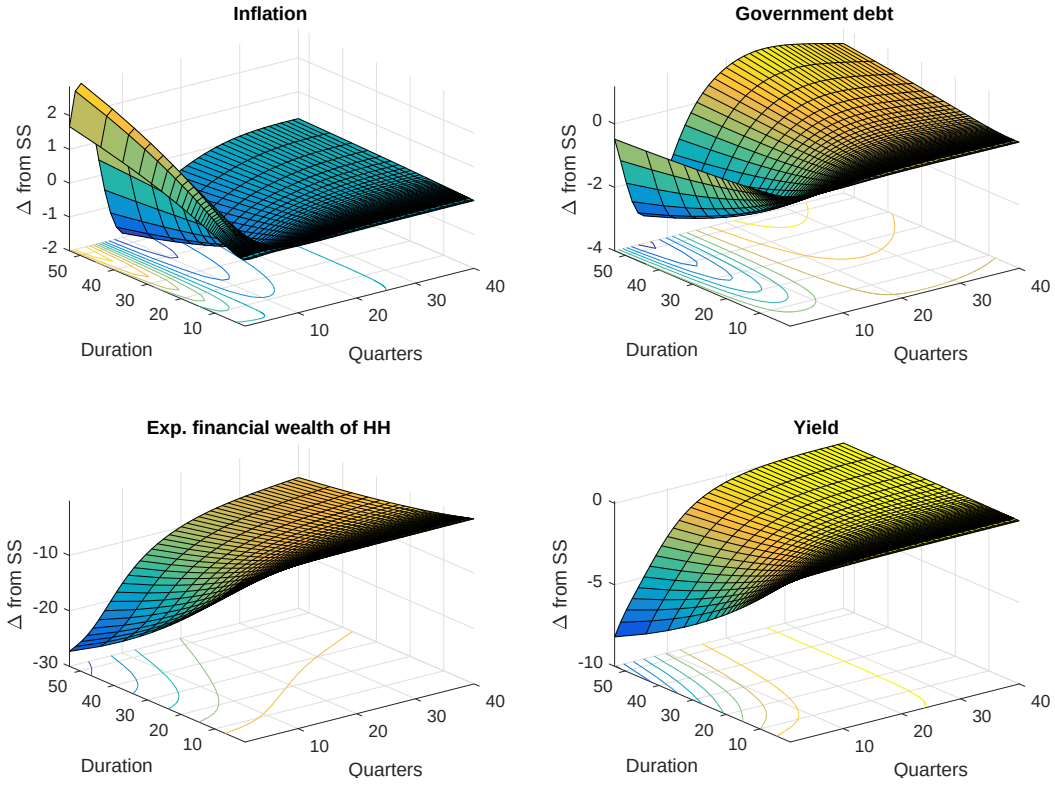

Figure 4: The effects of an unconventional monetary policy shock under fiscal dominance for different average maturities of government bonds' portfolio.
Note: Debt and expected financial wealth of the households, the responses are expressed as deviations from their respective steady state in per cent. Inflation and yields are in percentage points.

4 Conclusion

This paper has analyzed the monetary-fiscal interaction if the central bank conducts quantitative easing. Unconventional monetary policy is transmitted similarly to conventional monetary policy under fiscal dominance. Consistent with the literature, wealth effects yield downward pressure on the rate of inflation. The expected financial wealth of households deteriorates after an unconventional monetary policy shock. Banks need less external funds which is directly translated into a fall in the financial wealth of households. Government indebtedness falls because lower short-term interest rates and the portfolio rebalancing in the banking sector reduce long-term interest rates, which lower government interest expenses. Asset purchases have similar effects on the real economy under monetary and fiscal dominance. The wealth effects in the household sector, however, mainly affect the response on the rate of inflation.

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Appendix

A The role of financial wealth in the model

Since financial wealth is central to the results, this subsection will briefly summarize the financial linkages in the model. Banks hold securities issued by the non-financial real sector S_t, which are traded at market price Q_t, and government bonds, BB_t, which are traded at price Q_t^B.[13] Total assets, A_t^B, are financed by bank equity, N_t^B, and external funds. External funds are considered to be deposits, D_t, provided by households. Thus, the balance sheet constraint of banks becomes

$$A_t^B = Q_t S_t + Q_t^B BB_t = D_t + N_t^B. \tag{3}$$

Bank equity is solely built up by retained earnings, for which reason its law of motion can be formalized as

$$N_t^B = R_t^k Q_{t-1} S_{t-1} + R_t^B Q_t^B BB_{t-1} - R_{t-1} D_{t-1}, \tag{4}$$

where R_t^k denote the return on securities and R_t^B is the yield-to-maturity of government bonds. R_t represents the costs for external funds and is simply equal to the short-term interest rate. Bank equity can be built up through higher asset prices (asset price effect).

Households can only save by using the banking sector, i.e. deposits are their sole financial asset. Financial wealth consequently arises as

$$D_t = R_{t-1} D_{t-1} + \Theta_t - C_t, \tag{5}$$

with C_t as consumption expenditures and Θ_t as further income from labor supply and profits from intermediate goods producers after taxes and transfers.

The quantity of government bonds, B_t, is allocated to banks and the central bank, with holdings denoted by CB_t. The free float available to banks arise as

$$BB_t = B_t - CB_t. \tag{6}$$

Thus, asset purchases by the central bank reduces the amount available for private agents and cause non-negative effects on yields in the presence of limits to arbitrage which initiates portfolio rebalancing.

B Calibration strategy and steady state values

Regarding the calibration we take conventional values for the steady state and the deep parameters as can be found in the literature. The model is calibrated on a quarterly basis. The values for the deep parameters which we set freely or are pinned down by the steady state can be found in Table 1.

[13] These securities are backed by physical capital and therefore finance the capital stock.

Table 1: Calibration of parameters

Description	Value
Discount rate	0.9953
Inverse Frisch elasticity of labor supply	2.5
Steady state hours worked	1/3
Effective capital share	0.3
Investment adjustment costs	6.9
Calvo parameter, probability of keeping goods prices fixed	0.8
Diversion share	0.4115
Survival probability of banks	0.975
Steady state leverage ratio of banks	4
Maturity parameter of long-term bonds	0.955
Depreciation rate of capital	0.025
Steady state rate of inflation, per cent	1.8
Steady state spreads, annualized in basis points	100
Steady state proportion of government expenditures	0.2

C Additional figures

Figure 5 presents the responses of inflation and debt to the conventional monetary policy shock for different average maturities (y-axis). Government debt falls more strongly for shorter average maturities and the undershooting of inflation is more elaborated in these cases. The reduction in interest expenses on government debt is stronger for shorter maturities.

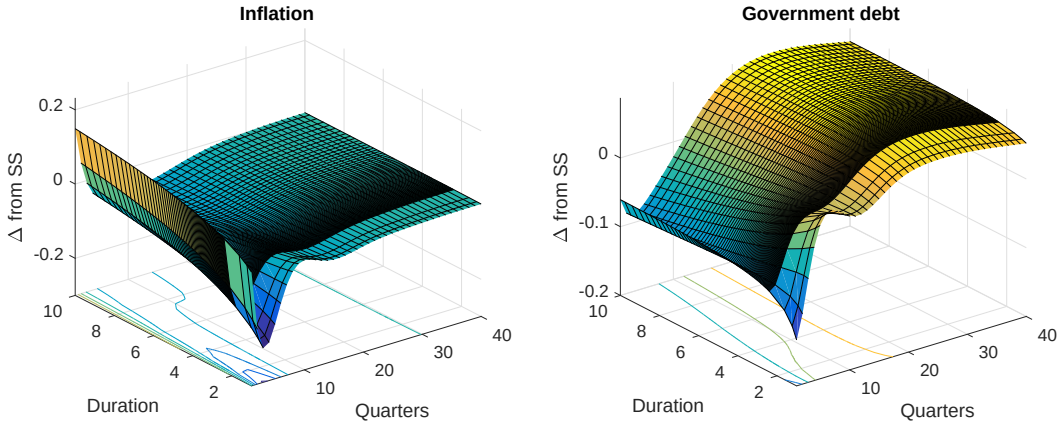

Figure 5: The effects of a conventional monetary policy shock under fiscal dominance for different average maturities of government bonds' portfolio.
Note: Inflation and yields are deviations from their respective steady state in percentage points.

The figure shows unconventional and conventional monetary policy.

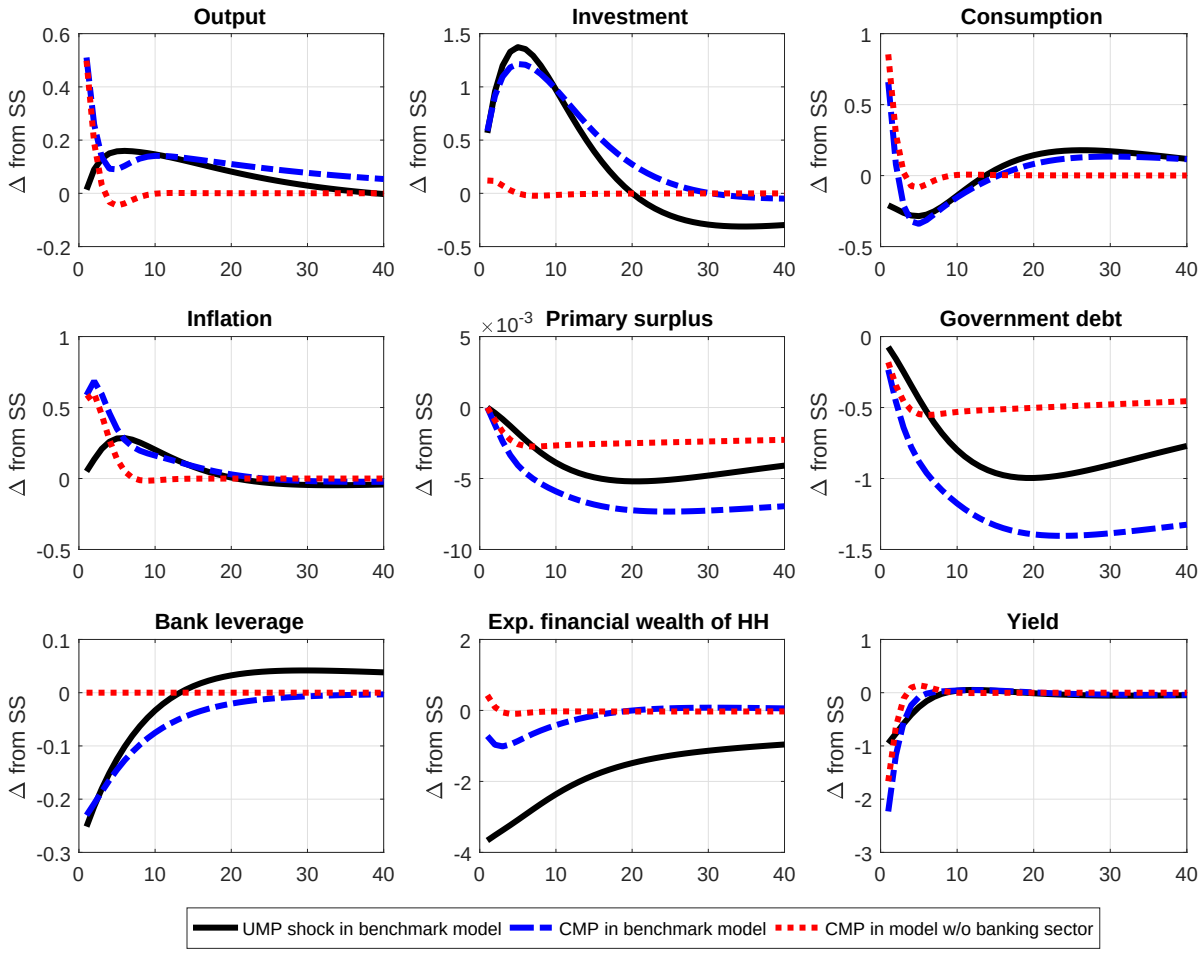

Figure 6: The effects of (a) a government purchase shock (black solid lines) and (b) a conventional monetary policy shock under monetary dominance (blue dashed lines) and (c) a monetary policy shock under monetary dominance in a model without banking sector under monetary dominance (ϕ_π=1.5 and $\xi_T = 0.01$)

Note: For output, investment, consumption, primary surplus, debt, and expected financial wealth of the households, the responses are expressed as deviations from their respective steady state in per cent. Inflation and yields are in percentage points, while bank leverage in absolute terms.