The Quantity Channel of Quantitative Easing [†]

Margaret M. Jacobson Arsenios Skaperdas

Preliminary

May 7, 2026

Abstract

This paper presents a new channel through which quantitative easing (QE) can affect the macroeconomy: by altering fiscal behavior. Using standard New Keynesian models, we show that if central bank holdings of government debt are not fully backed by future taxation, output and inflation increase through a wealth effect. The strength of this effect depends on whether the central bank offsets the inflation generated by its own purchases. When interest rate policy accommodates QE inflation, government debt is partially financed through increases in the price level and debt revaluation, significantly reducing households' real tax obligations. When interest rate policy offsets inflation generated by QE, the channel operates primarily by delaying the timing of households' tax obligations. We validate the empirical relevance of the quantity channel using high-frequency identification of QE shocks and daily U.S. data on government tax revenues and debt issuance, indicating a sizeable fiscal response.

JEL Classification: E50, E63, E31, E44

Keywords: *Quantitative easing, fiscal-monetary interactions, central bank asset purchases.*

[†] The views expressed in this paper are solely our own and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System, or of anyone else associated with the Federal Reserve System. We thank Chris Gust for helpful conversations. Jacobson: Board of Governors of the Federal Reserve System, margaret.m.jacobson@frb.gov. Skaperdas: Board of Governors of the Federal Reserve System, arsenios.skaperdas@frb.gov.

1 Introduction

> *"The problem with QE is it works in practice but it doesn't work in theory."*
> *-Ben Bernanke*

Following the global financial crisis (GFC) and the coronavirus pandemic, central banks deployed QE programs of unprecedented scale. Over the course of 2020 alone, the Federal Reserve's asset holdings rose by over \$3 trillion. Yet the channels through which these interventions affect the macroeconomy and the size of their effects remain unsettled. The dominant explanations—signaling about future short-term interest rates and portfolio-balance effects on longer-term yields—operate through asset prices and term premiums. These channels are central to the literature, but often imply effects in macroeconomic models that are modest relative to the scale of interventions.

This paper proposes a new transmission channel of QE—the quantity channel—that has a potentially more powerful macroeconomic effect than the channels emphasized in the existing literature. The key idea is that asset purchases can change not only the composition of private portfolios, but also the fiscal backing of government debt. When the central bank purchases government debt, a smaller share of outstanding government debt is held by the public. If households do not expect the fiscal authority to raise future taxes one-for-one against the central bank's holdings, QE reduces the present value of their perceived tax liabilities or shifts those liabilities further into the future. In economies where Ricardian equivalence fails, this change in the magnitude or timing of expected taxation raises wealth, output, and inflation. Because the mechanism depends on the quantity of debt purchased rather than on movements in interest rates, we refer to it as the quantity channel.

Our first contribution is to formalize this mechanism in a New Keynesian environment where central bank holdings of government debt are not fully backed by future taxation (Jacobson, Leeper, and Preston, 2019; Bianchi, Faccini, and Melosi, 2023). The central bank responds aggressively to ordinary inflationary shocks, but does not fully offset the inflation generated by its own QE. This distinction is natural in the context of QE programs, which are explicitly designed to provide monetary accommodation and are often associated with forward guidance that short-term rates will remain low. Because QE leaves households' nominal wealth holdings unchanged, but reduces households' real tax obligations, QE raises output and inflation through a wealth effect. Monetary policy accommodates the inflation generated by QE and government debt is financed partly through increases in the price level and debt revaluation.

Our second contribution is to show how the quantity channel occurs in a framework where the central bank offsets the macroeconomic effects of its own QE program with the short-term interest rate—a monetary regime. We examine the macroeconomic effects of the channel in a Two-Agent New Keynesian (TANK) framework where Ricardian equivalence is broken through a fraction of households that always consume their income (Galí, López-Salido, and Vallés, 2007). QE leads the fiscal authority to delay the timing of taxation, which shifts consumption toward rule-of-thumb households and therefore raises inflation and aggregate consumption. Because the central bank is bound by the Taylor principle, it raises the policy rate to counteract the effects of QE, mitigating the response of the price level. The TANK setting demonstrates that the quantity channel operates whenever Ricardian equivalence fails, even when government debt remains fully backed by future taxation.

We then turn to U.S. data to test the modeling assumptions necessary for the quantity channel. Following Swanson (2021), we construct a series of exogenous shocks to asset purchases using high-frequency identification of interest rate movements in narrow windows around monetary policy announcements. After extracting the factor corresponding to the effects of QE programs on longer-term yields, we measure the response of daily U.S. tax revenues and government debt issuance to a QE shock. We find that an accommodative shock leads to persistently lower levels of tax revenue and persistently higher levels of government debt—the key assumptions necessary for the quantity channel. We conclude that the effects of central bank asset purchases operate, at least in part, by altering fiscal behavior.

Additional empirical evidence supports the partial fiscal-backing interpretation. The federal funds rate is essentially unchanged following a QE shock, consistent with the idea that the central bank does not offset the inflationary effects of its own QE through conventional policy. The market value of Treasury debt also declines within two years after an accommodative QE shock—the opposite-signed response from the conventional signaling and portfolio-balance channels, which predict that bond prices should rise when yields fall. The evidence therefore points to a fiscal effect on yields that counteracts the direct asset-pricing effects emphasized in standard accounts of QE transmission.

While unfunded fiscal shocks and partial fiscal backing are increasingly examined in the macroeconomics literature, the reasoning for how and why such scenarios may arise remains underexplored. An important contribution of our empirical and theoretical work is therefore to pin down a specific and economically substantial channel through which partial fiscal backing may arise: over a well-defined portion of outstanding debt held by the central bank. Because the central bank purchases this debt with the express aim of increasing inflation and employment, we do not think interest rate policy responds to this specific shock.

While taking a stance on why US fiscal behavior responds empirically to QE is beyond the scope of this work, several plausible explanations exist. Arden, Hauptmeier, and Kamps (2025) show that optimal fiscal policy at the effective lower bound, during which QE largely occurs, entails a larger fiscal expansion than would otherwise be the case. From a macro-finance perspective, QE reduces fiscal interest expense and therefore increases fiscal room for debt issuance (d'Avernas, Hubert de Fraisse, Ning, and Vandeweyer, 2024). Finally, a pre-communicated path of central bank holdings eliminates rollover risk on that portion of the debt for the fiscal authority, potentially encouraging higher levels of borrowing.

The analysis of this paper leads us to three major policy implications. First, QE is potentially a more powerful macroeconomic tool than previously assumed. However, this is a double-edged sword. Because the fiscal response to QE is not under the central bank's control, QE interventions may be harder to calibrate and retain a larger scope for policy errors than standard frameworks would suggest. Coupled with a commitment to keep policy rates low, the inflationary effects of a fiscal response to QE may be difficult for a central bank to reverse. Second, our work provides an additional reason for why monetary policymakers may wish to limit the size of a central bank's balance sheet beyond the usual considerations of market functioning, remittances, or operating frameworks. Central bank holdings of government debt weaken the link between current deficits and future taxation, making inflation or debt revaluation more likely to absorb part of the fiscal burden—a blurring of lines between fiscal and monetary policy that monetary policymakers may wish to avoid. Finally, the effects of QE may be difficult to infer from yield curve movements alone. A small observed response of longer-term yields to QE could reflect a genuinely weak financial market effect, or a large financial market effect offset by a fiscal response working in the opposite direction. These cases are observationally similar in the yield curve, but imply very different paths for output, inflation, and public finances.

Related literature

Our paper relates to several strands of the literature on the macroeconomic effects of QE.[1] Two channels dominate existing work on how large-scale asset purchases (LSAPs) affect activity: signaling about the path of short-term rates and portfolio balance effects on term premiums (Eggertsson and Woodford, 2004; Vissing-Jorgensen and Krishnamurthy, 2011; Bauer and Rudebusch, 2014; Vayanos and Vila, 2021; Sack, Gagnon, Raskin, and Remache, 2011; D'Amico and King, 2013; Gertler and Karadi, 2011). The quantity channel operates instead through the deferral of taxation associated with the portion of government debt held on the central bank's balance sheet. Our finding that the federal funds rate is essentially unchanged in response to asset purchase shocks is consistent with the view that LSAPs partly signal the future policy-rate path (Eggertsson and Woodford, 2004; Bauer and Rudebusch, 2014) and with concerns regarding the ex-post effects of committing to forward guidance (Orphanides, 2023).

A growing heterogeneous-agent literature analyzes LSAPs through redistribution and portfolio rebalancing across wealth types (Cui and Sterk, 2021; Sims, Wu, and Zhang, 2022; Kaplan, Nikolakoudis, and Violante, 2023; Cantore and Meichtry, 2024). Seidl and Seyrich (2023) show that fiscal tools can replicate the allocations attainable through monetary instruments. Our paper differs by focusing on a fiscal channel through tax backing rather than cross-household redistribution. The mechanism also relates to a more traditional literature on the role of money: Auerbach and Obstfeld (2005) show that the central bank can raise the price level in a liquidity trap by increasing the money supply through open-market purchases. We obtain similar macroeconomic implications from a permanent increase in reserves which instead works through the timing of households' tax obligation.

Our model structure relates to the fiscal-theory and monetary-fiscal-interaction literature (Leeper, 1991; Davig and Leeper, 2007; Cochrane, 2021). Our work is especially close to the agenda of Cochrane (2014) on inflation determination with interest on reserves and to recent work on partially unfunded debt (Jacobson, Leeper, and Preston, 2019; Bianchi,

---

[1] See Bhattarai and Neely (2022) for a comprehensive overview.

Faccini, and Melosi, 2023). Empirically, Barro and Bianchi (2026) document fiscal contributions to the 2020–2023 inflation episode, and Hazell and Hobler (2024) identify the response of inflation to deficit shocks. In another closely related paper, Billi and Walsh (2025) investigate the implications of breaking Ricardian equivalence for the optimality of passive monetary/active fiscal regimes when short-term interest rates are constrained by the ELB.

A parallel literature studies central-bank solvency and the consolidated government balance sheet: Del Negro and Sims (2015) derives conditions under which the central bank requires fiscal backing, while Hall and Reis (2015, 2017); Reis (2017) analyze remittance rules and the channels through which balance-sheet policies shift the government resource constraint. From a policy-evaluation standpoint, Adrian, Erceg, Kolasa, Lindé, and Zabczyk (2026), Levin, Lu, and Nelson (2022), and d'Avernas, Hubert de Fraisse, Ning, and Vandeweyer (2024) quantify the macroeconomic and fiscal consequences of QE, with Hall and Sargent (2023) drawing a wartime parallel for pandemic-era policies. Our results fit naturally into this consolidated view: when the central bank holds and rolls over a share of debt, future primary surpluses must adjust, providing a concrete mechanism linking purchases to fiscal forces.

The quantity channel also relates to literatures on debt management and on the long-run environment for public debt. The interaction between Treasury issuance and central-bank purchases, including substitution of safe short assets in segmented or currency-union settings, is central to Tischbirek (2018); Greenwood, Hanson, Stein, et al. (2016); Greenwood, Hanson, Rudolph, and Summers (2014, 2015). Kim, Laubach, and Wei (2023) and Swanson (2024) provide recent evidence on sizeable macroeconomic effects of LSAPs through term premium effects. Beyond maturity and term-premium considerations, we show that the quantity of purchases itself matters for the paths of taxation and inflation. Bi, Foerster, and Traum (2024) shows that LSAPs can stabilize markets under sovereign stress. Correia, Farhi, Nicolini, and Teles (2013) show how fiscal tools can replicate monetary allocations at the zero bound. Andrade, Gautier, Mengus, Moench, and Schmidt (2025) provide evidence that household beliefs about fiscal dominance affect inflation expectations. In two final important related papers, Caramp and Silva (2023) show that the economy's response to monetary policy depends on its fiscal backing, while Rachel and Ravn (2025) show that monetary and fiscal policies cannot be considered in isolation in heterogeneous-agent economies with non-Ricardian households. Taken together, our paper thus conforms with a growing body of work indicating that fiscal and monetary policy should be jointly considered when evaluating the effects of monetary policy. For QE, in particular, coordinated fiscal and monetary policy may be necessary to achieve well-calibrated outcomes.

Our paper proceeds as follows: Section 2 presents theory illustrating the quantity channel. Section 3 presents empirical evidence in support of the theoretical predictions. Section 4 concludes.

2 Modeling the Quantity Channel

The economy has four agents: a fiscal authority (F), a central bank (M), and two households. For all financial assets, curly fonts indicate quantity supplied and non-curly quantity demanded. We will illustrate the quantity channel in two models that each break Ricardian equivalence. First, we describe the commonalities between the two models.

The government budget constraint is given as:

$$\mathcal{B}_{t-1} = Q_t \mathcal{B}_t + P_t T_t + P_t \Lambda_t \tag{1}$$

Where the government issues one period debt $\mathcal{B}_t$ at price Q_t, collects taxes from households T_t, and received remittances Λ_t from the central bank. T_t is split between each type of household which will be defined in more detail for each model.

The central bank balance sheet is:

$$Q_t B_t^{CB} - Q_t^M \mathcal{M}_t = B_{t-1}^{CB} - \mathcal{M}_{t-1} - P_t \Lambda_t \tag{2}$$

Where the central bank buys quantity B_t^{CB} of government debt at price Q_t and funds it by issuing reserves $\mathcal{M}_t$ to households at price Q_t^M. To assure that the central bank's balance sheet is bounded and well-defined we assume that their return on asset purchases equals the cost of issuing reserves:

$$Q_t B_t^{CB} - Q_t^M \mathcal{M}_t = 0$$

Asset markets clear such that (1) households and the central bank buy bonds issued by the fiscal authority and (2) households buy reserves issued by the central bank.

$$\mathcal{B}_t = B_t^F + B_t^{CB} \tag{3}$$

$$\mathcal{M}_t = M_t \tag{4}$$

Which household holds which type of asset depends on the different cases of the model (1) partial fiscal theory model and (2) TANK model.

2.1 Partial Fiscal Theory Model

Household F saves in bonds issued by the fiscal authority and household M saves in reserves issued by the central bank (this household could be called a bank). Households have preferences over goods consumption, $\{C_t^F, C_t^M\}$ and financial assets $\{B_t^F/P_t, M_t/P_t^M\}$ as studied by Michaillat and Saez (2021) and Zhao (2023). They supply labor exogenously, each to a separate firm such that they earn $\{Y_t^F, Y_t^M\}$, respectively, and pay lump-sum taxes from the fiscal authority $\{T_t^F, T_t^M\}$. Household F's maximization problem is:

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(C_t^F, B_t^F/P_t)$$

$$\text{subject to} \quad P_t C_t^F + Q_t B_t^F = B_{t-1}^F + P_t Y^F - P_t T_t^F, \tag{5}$$

and that of household M:

$$
\begin{aligned}
&\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(C_t^M, B_t^M/P_t^M) \\
\text{subject to} \quad & P_t^M C_t^M + Q_t^M M_t = M_{t-1} + P_t^M Y^M - P_t^M T_t^M, \qquad (6)
\end{aligned}
$$

where $\beta < 1$ is the households' discount factor, P_t and P_t^M denote the price of consumption goods C_t^F and C_t^M, respectively.

The functional form of utility is standard CRRA preferences in consumption with utility over financial assets:

$$U(C_t^F) = \frac{{C_t^F}^{1-\sigma}}{1-\sigma} + \psi \log(B_t^F/P_t),$$

and

$$U(C_t^M) = \frac{{C_t^M}^{1-\sigma}}{1-\sigma} + \psi \log(M_t/P_t^M),$$

As noted by Michaillat and Saez (2021) and Zhao (2023), utility from financial assets can be interpreted as households valuing status or wealth for hedonic motives. This assumption adds discounting to the consumption Euler equations as noted by McKay et al. (2017), which results in changes in future interest rates having less of an effect on consumption. Let $b_t = b_t^F/P_t$ and $m_t = M_t/P_t^M$.

$$Q_t = \beta \mathbb{E}_t \left[\frac{{C_{t+1}^F}^{-\sigma}}{{C_t^F}^{-\sigma}} \pi_{t+1}^{-1} \right] + \psi \frac{1}{b_t^F {C_t^F}^{-\sigma}} \qquad (7)$$

$$Q_t^M = \beta \mathbb{E}_t \left[\frac{{C_{t+1}^M}^{-\sigma}}{{C_t^M}^{-\sigma}} {\pi_{t+1}^M}^{-1} \right] + \psi \frac{1}{m_t {C_t^M}^{-\sigma}} \qquad (8)$$

Following Leeper (1991) and Galí et al. (2007), net taxes T_t^F and T_t^M follow rules where the parameters $\{\gamma^F, \gamma^M\}$ determine how strongly the government adjusts taxes in response to government debt outstanding. The higher γ^F or γ^M, the more swiftly taxes are adjusted to pay down debt. Let $b_t^{CB} = B_t^{CB}/P_t$.

$$T_t = T_t^M + T_t^F \qquad (9)$$

$$\frac{T_t^F}{T^F} = \left(\frac{b_t^F}{b^F} \right)^{\gamma^F} \qquad (10)$$

$$\frac{T_t^M}{T^M} = \left(\frac{b_t^F}{b^F} \right)^{\gamma^M} \qquad (11)$$

We posit rules where taxes only need to be adjusted to finance debt held by the public $b_t^F = b_t - b_t^{CB}$ and not total debt $b_t = \mathcal{B}_t/P_t$, which includes debt held by the central bank. Importantly, because bonds held by the central bank are rolled over according to the specification of the central bank asset purchase program, no principal payments and therefore no taxation for repayment is collected for the central bank's government debt holdings.

Taken together, the log-linearized optimality and balance sheet conditions from equations (7) and (8) along with those for (1) and (2) and asset market clearing (3) and (4), $\hat{i}_t = -\hat{q}_t$, $\hat{i}^M_t = -\hat{q}^M_t$, and $\phi_t = P^M_t / P_t$.

$$\begin{aligned} \hat{c}^F_t =& \theta^F \mathbb{E}_t[\hat{c}^F_{t+1}] - \theta^F \sigma^{-1}[\hat{i}_{t-1} - \hat{\pi}_{t+1}] + (1-\theta^F)\frac{C^F}{\sigma b^F}\hat{b}^F_t & (12) \\ \hat{c}^M_t =& \theta^M \mathbb{E}_t[\hat{c}^M_{t+1}] - \theta^M \sigma^{-1}[\hat{i}^M_{t-1} - \hat{\pi}^M_{t+1}] + (1-\theta^M)\frac{C^M}{\sigma b^M}\hat{m}_t & (13) \\ \hat{b}_t =& \hat{i}_t + \beta^{-1}\left(\hat{b}_{t-1} - \hat{\pi}_t\right) + \frac{\tau}{b}\hat{\tau}_t - \frac{\Lambda}{b}\hat{\Lambda}_t & (14) \\ \beta\Lambda\hat{\Lambda}_t =& b^{CB}(\hat{b}^{CB}_{t-1} - \hat{\pi}_t) + m\phi(\hat{\phi}_t + \hat{m}_{t-1} - \hat{\pi}^M_t) & (15) \\ \hat{b}_t =& \frac{b^{CB}}{b}\hat{b}^{CB}_t + \left(1 - \frac{b^{CB}}{b}\right)\hat{b}^F_t & (16) \end{aligned}$$

Where $\hat{q}_t + \hat{b}^{CB}_t = \hat{\phi}_t + \hat{m}_t + \hat{q}^r_t$ so that the central bank has zero profits. Let $1-\theta^F = \frac{\psi}{b^F C^{F^{-\sigma}}}$ and $1-\theta^M = \frac{\psi}{m C^{M^{-\sigma}}}$ so that if $\theta^F = 1$ or $\theta^M = 1$ then the log-linearized Euler equations in equations (12) and (13) collapse to standard consumption Euler equations.

The aggregate resource constraint holds such that

$$\frac{c}{y}\left(\hat{c}^F_t + \hat{c}^M_t\right) = \hat{y}^F + \hat{y}^M + \frac{M}{\phi y}\left((1-\phi_t^{-1})(\beta^{-1}(\hat{m}_{t-1} - \hat{\pi}^m_t) - \hat{m}_t)\right)$$

With the budget constraints in equations (5) and (6). Each household supplies labor inelastically to a separate firm. There are two firms because F firms sell at price P_t and M firms sell at price P^M_t. This results in two New Keynesian Phillips curves:

$$\hat{\pi}_t = \beta\mathbb{E}_t[\hat{\pi}_{t+1}] + \kappa\hat{y}^F_t$$
$$\hat{\pi}^M_t = \beta\mathbb{E}_t[\hat{\pi}^M_{t+1}] + \kappa\hat{y}^M_t$$

Tax rules are given as where $\omega = b^{CB}/b$

$$\begin{aligned} \hat{\tau}_t =& \frac{\tau^M}{\tau}\hat{\tau}^M_t + \left(1 - \frac{\tau^M}{\tau}\right)\hat{\tau}^F_t & (17) \\ \hat{\tau}^M_t =& \gamma^M(\hat{b}_{t-1} - \omega\hat{b}^{CB}_{t-1}) & (18) \\ \hat{\tau}^F_t =& \gamma^F(\hat{b}_{t-1} - \omega\hat{b}^{CB}_{t-1}) & (19) \end{aligned}$$

The model is closed by interest rate rules:

$$\begin{aligned} \hat{i}_t =& \phi^F\hat{\pi}_t & (20) \\ \hat{i}^M_t =& \phi^{CB}\hat{\pi}^M_t & (21) \end{aligned}$$

In this framework, the central bank does not respond to any macroeconomic effects of its asset purchases. By setting $\phi^{CB} = 0.5$, the cental bank accommodates any inflation—the only macroeconomic variable in this simple economy—generated from its asset purchases. Otherwise if $\phi^{CB} > 1$, the central bank would be raising interest rates at the same time that it is engaging in asset purchases, which would be counterfactual to what has been observed in practice. On the other hand, $\phi^{F} = 1.5$ such that $\phi > 1$ as in standard frameworks.

The only exogenous shock in the model is one to remittances $\hat{\Lambda}_t$, which evolves according to the rule below.

$$\hat{\Lambda}_t = \gamma^{\Lambda}\hat{m}_{t-1} + \epsilon_t$$

$$\epsilon_t = \rho_{\Lambda}\epsilon_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim \mathcal{N}(0,1)$$

Table 1: Partial FTPL Model Parameters

Parameter	**Value**	**Description**
Household Preferences		
β	0.97	Discount factor
σ	2.0	Risk aversion / IES
ψ	0.001	Portfolio adjustment cost
Production and Price Setting		
κ	0.0202	Calvo price adjustment cost
Monetary Policy		
ϕ^{F}	1.5	Taylor rule coeff., F hh
ϕ^{CB}	0.5	Taylor rule coeff., M hh
Fiscal Policy		
γ_F	1.5	Tax response to debt, F household
γ_M	0.5	Tax response to debt M household
γ_Λ	0.9	Remittances response
b^{target}	0.5	Target debt-to-GDP ratio
Central Bank		
ω	0.2	Central bank share of government debt
ρ_Λ	0.9	Persistence of shock
ϕ_{ss}	1	Steady state price-level ratio
Steady State Values (Derived)		
Y	1.0	Output (each sector)
s	0.5	Total government debt-to-output
τ_M	0.01	Tax revenue, household M

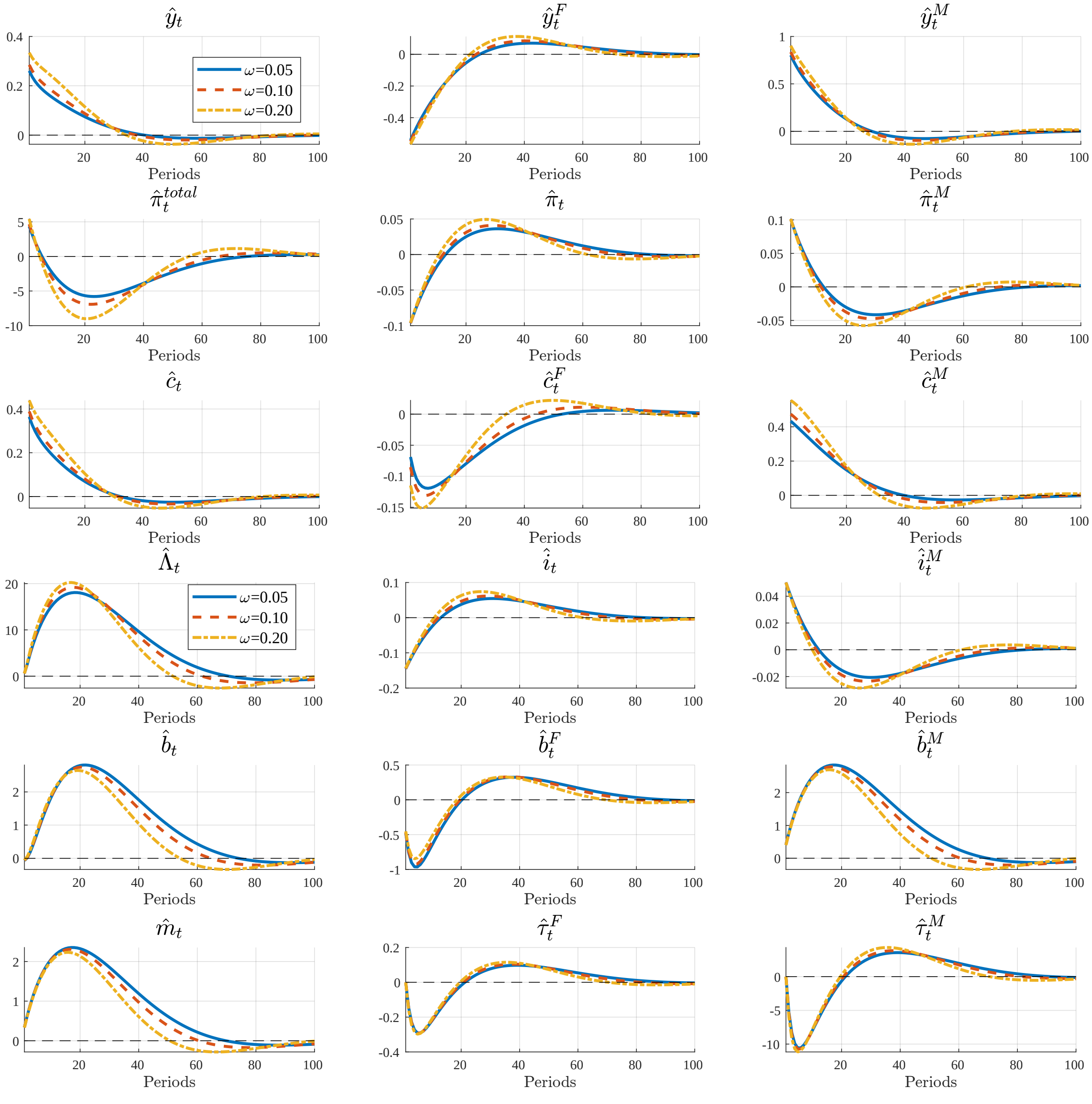


Figure 1: Impulse Response of Partial Fiscal Theory Model to a 1% Shock to Remittances, Λ_t

Figure 1 shows how the increase in remittances from the central bank to the Treasury drives up central bank demand for government debt $\hat{b}_t^M$ on impact. Because supply of debt $\hat{b}_t$ is pinned down by the government budget constraint, which is largely pre-determined, government debt held by households falls, $\hat{b}_t^F$. This drop in financial wealth causes a contraction in the F sector of the economy as shown by column 2 of the figure. On the other hand, the increase in reserves $\hat{m}_t$ leads to a positive wealth effect in the M sector which expands. Because interest rates rise by less than one-for-one in response to inflation, the central bank does not offset the expansionary effects of the asset purchase shock and this dominates the contraction in the F sector, leading to an overall increase in output and consumption.

2.2 TANK Model

Household F saves in bonds issued by the fiscal authority and reserves issued by the central bank. As a result, the other household becomes hand-to-mouth H such that they consumer their income less taxes each period. Household F has preferences over goods consumption C_t^F as well as bonds and reserves B_t^F and M_t, respectively. Each household supplies labor exogenous to one firm and earns Y_t and pays lump-sum taxes $\{T_t^F, T_t^H\}$. The fraction of hand-to-mouth households H are given as $\eta \in [0,1]$. The household maximization problem for type F is:

$$\max \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t U(C_t^F, B_t^F/P_t, M_t/P_t)$$

$$\text{subject to} \quad P_t C_t^F + Q_t B_t^F + Q_t^M M_t = B_{t-1}^F + M_{t-1} + P_t Y_t - P_t T_t^F, \tag{22}$$

With the functional form as in Nagel (2016),

$$U(C_t^F, B_t^F/P_t, M_t/P_t) = \frac{C_t^{1-\sigma}}{1-\sigma} + \psi \log \left[(1-\chi)(B_t^F/P_t)^{\xi} + \chi (M_t/P_t)^{\xi}\right]^{1/\xi}, \qquad 0 < \chi < 1.$$

While the budget constraint of type H is given as:

$$C_t^H = Y_t - T_t^H \tag{23}$$

Aggregate consumption is thus

$$(1-\eta) C_t^F + \eta C_t^H = C_t,$$

Where $\eta \in [0,1]$ is the population weight on the types of households in the economy.

Tax rules for each household are the same as in equations (19) and (11), but the aggregate rule in (10) reflects aggregation weights and is thus:

$$T_t = \eta T_t^H + (1-\eta) T_t^F$$

Market clearing of financial assets is weighted by the share of optimizing households in the economy, $(1-\eta)$:

$$\mathcal{B}_t = (1-\eta)B_t + B^M \tag{24}$$

$$\mathcal{M}_t = (1-\eta)M_t \tag{25}$$

Aggregating and summing across all budget constraints yields the following aggregate resources constraint:

$$\lambda C_t^F + (1-\lambda)C_t^H = Y_t$$

Taken together, the log-linearized optimality and balance sheet conditions from equations (22) and (23) along with those for (1) and (2) and asset market clearing (24) and (25), $\hat{i}_t = -\hat{q}_t$ and $\hat{i}_t^M = \hat{q}_t^M$

$$\hat{c}_t^F = \theta^F \mathbb{E}_t[\hat{c}_{t+1}^F] - \theta^F \sigma^{-1}[Q\hat{i}_t - \hat{\pi}_{t+1}] + \frac{(1-\theta^F)\left((1-\chi)\hat{b}_t^F + \chi\hat{m}_t\right)}{\sigma\left((1-\chi)b^F + \chi m\right)} \tag{26}$$

$$\hat{c}_t^F = \theta^M \mathbb{E}_t[\hat{c}_{t+1}^F] - \theta^M \sigma^{-1}[Q^M\hat{i}_t^M - \hat{\pi}_{t+1}] + \frac{(1-\theta^M)\left((1-\chi)\hat{b}_t^F + \chi\hat{m}_t\right)}{\sigma\left((1-\chi)b^F + \chi m\right)} \tag{27}$$

$$\tilde{c}_t^H = \hat{y}_t^H - \frac{T^H}{Y^{CB}}\hat{\tau}_t^{CB} \tag{28}$$

$$\hat{b}_t = \hat{i}_t + \beta^{-1}\left(\hat{b}_{t-1} - \hat{\pi}_t\right) + \frac{\tau}{s}\hat{\tau}_t - \frac{\Lambda}{s}\hat{\Lambda}_t \tag{29}$$

$$\beta\Lambda\hat{\Lambda}_t = b^{CB}(\hat{b}_{t-1}^{CB} - \hat{\pi}_t) + m(\hat{m}_t - \hat{\pi}_t) \tag{30}$$

$$\hat{b}_t = \frac{b^{CB}}{b}\hat{b}_t^{CB} + \left(1 - \frac{b^{CB}}{b}\right)(1-\eta)\hat{b}_t^F \tag{31}$$

Where $\theta^F = \left(1 - \frac{\psi(1-\chi)(C^F)^{-\sigma}}{(1-\chi)b^F + \chi m}\right)^{-1}$ and $\theta^M = \left(1 - \frac{\psi\chi(C^F)^{-\sigma}}{(1-\chi)b^F + \chi m}\right)^{-1}$

Tax rules are given as before where $\omega = b^{CB}/b$

$$\hat{\tau}_t = \frac{\tau^H}{\tau}\hat{\tau}_t^H + \left(1 - \frac{\tau^H}{\tau}\right)\hat{\tau}_t^F$$

$$\hat{\tau}_t^H = \gamma^H(\hat{b}_{t-1} - \omega\hat{b}_{t-1}^{CB})$$

$$\hat{\tau}_t^F = \gamma^F(\hat{b}_{t-1} - \omega\hat{b}_{t-1}^{CB})$$

The model is closed by the interest rate rule:

$$\hat{i}_t = \phi_\pi\hat{\pi}_t \tag{32}$$

The only exogenous shock in the model is one to central bank asset demand $\hat{b}_t^{CB}$, which evolves according to the rule below.

$$\hat{b}_t^{CB} = \gamma^\Lambda\hat{b}_{t-1}^{CB} + \epsilon_t$$

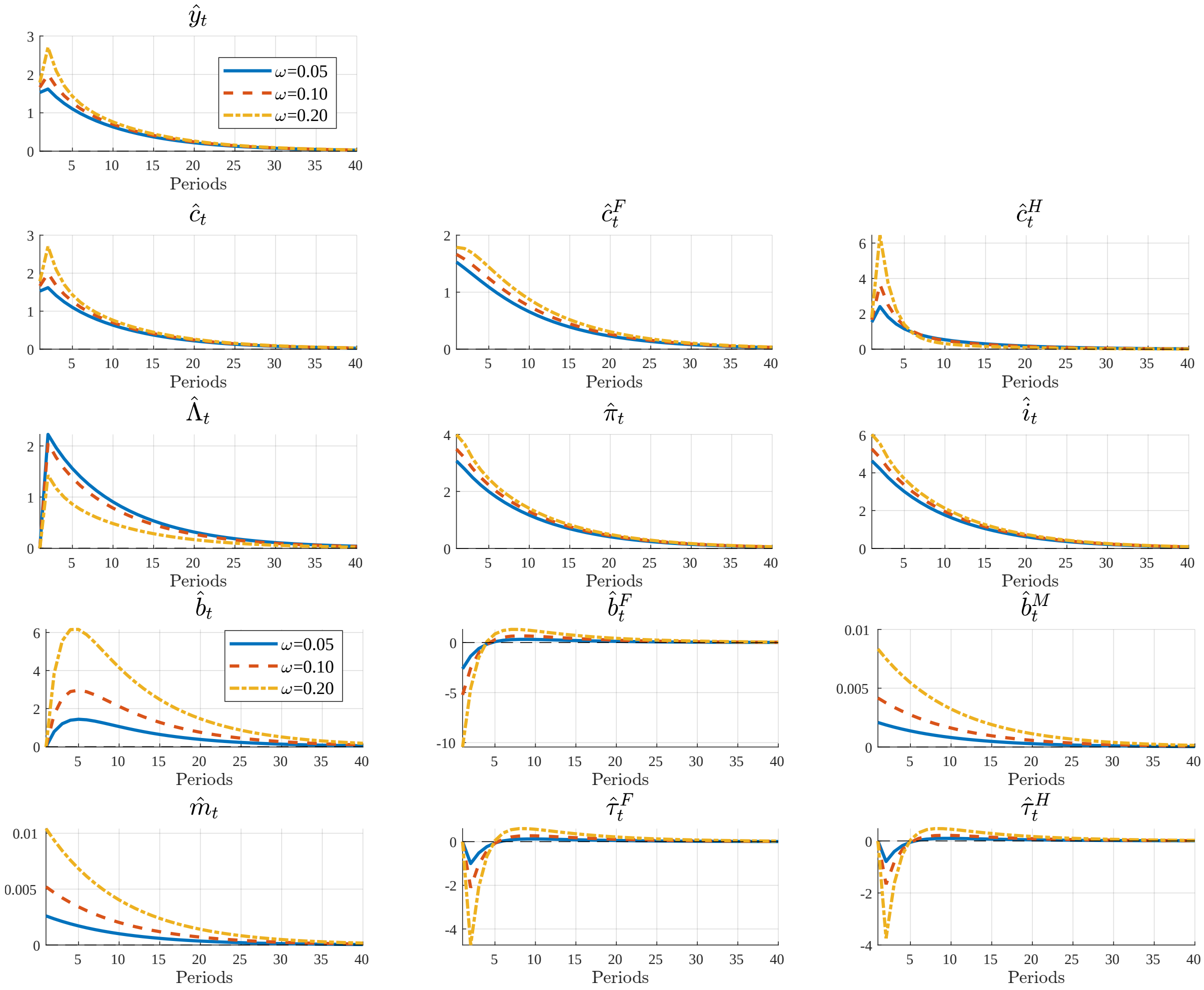


Figure 2: Impulse Response of TANK Model to a 1% Shock to Central Bank Asset Holdings, $\hat{s}_t^M$

$$\epsilon_t = \rho_\Lambda \epsilon_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim \mathcal{N}(0,1)$$

Model parameters are similar to those in the partial FTPL version with the addition of $\eta = 0.23$ as the share of hand-to-mouth households as in Bhattarai et al. (2023), $\chi = 0.75$ as the reserves convenience yield, and $\xi = 1$ as the substitution of reserves and government bonds.

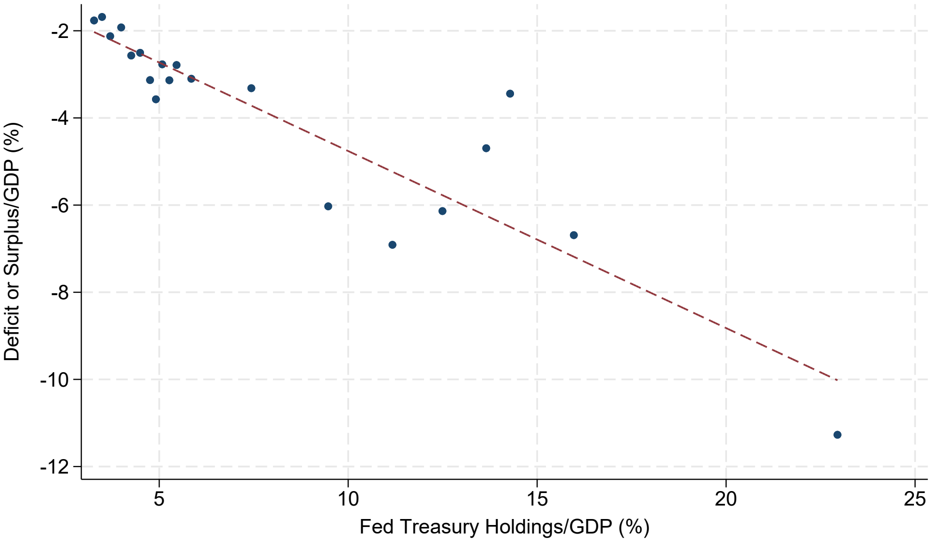
Figure 2 shows that the asset purchase shock is expansionary. As in the partial FTPL model, the increase in government debt demanded by the central bank $\hat{b}_t^{CB}$ leads to decrease in debt held by the public $\hat{b}_t^F$ in the first period. In turn, taxes decrease, which leads to an increase in consumption for the hand-to-mouth households $\hat{c}_t^H$. Rising consumption pushes up aggregate demand, which, in turn, raises prices and leads to an increase in consumption for optimizing households $\hat{c}_t^F$ as well.

3 Empirical Evidence

In order for the quantity channel to be applicable, a key assumption must be satisfied: the share of debt issuance financed by taxation must fall in response to QE. This section provides empirical evidence in support of this behavior. We present correlational evidence and use standard methods from the literature to measure impulse responses to exogenous asset purchase shocks. We find that deficits rise, taxation falls, and debt issuance increases in response to asset purchase shocks. Furthermore, in support of a mixed monetary/fiscal equilibrium, we find that the federal funds rate does not empirically respond to balance sheet actions. In addition, the market value of Treasury debt falls.

3.1 Stylized Facts

Figure 3: Scatter Plot of Surplus/Deficit and Federal Reserve Treasury Holdings



Notes: Figure presents a binned scatter plot of the US Federal Deficit or Surplus against Federal Reserve Treasury holdings, both as fractions of nominal GDP. Variables are in terms of four quarter moving averages and residualized with respect to the four quarter moving average of the unemployment rate. Sample: 1980:Q1-2025:Q4.

Figure 3 presents a binned scatter plot of Federal surpluses/deficits against Federal Reserve Treasury holdings, both scaled by nominal GDP. Higher levels of Treasury holdings are strongly associated with larger fiscal deficits. While both variables respond to the business cycle, this relationship is consistent with the fiscal behavior our mechanism requires.

Table 2 shows that this association is a robust feature of the data. We present OLS estimates of

$$y_t = \alpha + \beta X_t + \epsilon_t, \tag{33}$$

where $y_t$is the annualized dollar fiscal deficit or surplus as a ratio of nominal GDP,$X_t$is a column of covariates of interest, and β is a row of coefficients. Standard errors are Newey-West with a four lag bandwidth to accommodate the MA(4) structure induced by the four-quarter moving averages.

Across specifications, a 10 percentage point increase in Fed holdings is associated with a 2.3 to 4.0 percentage point increase in the annualized deficit-to-GDP ratio. The first row shows that the ratio of the Federal Reserve's securities holdings is strongly correlated with the magnitude of fiscal deficits. Columns (2) and (3) condition on macroeconomic conditions by including the unemployment rate and real GDP growth; notably, the coefficient on Fed holdings is largely unchanged by the inclusion of these cyclical controls, suggesting the association is not driven solely by contemporaneous business-cycle variation. Column (4) controls for the Chicago Fed National Financial Conditions Index. Column (5) restricts the sample to the post-GFC period (2009:Q1 onward) and finds a coefficient of similar magnitude. Columns (6) and (7) show that the association persists when SOMA agency MBS holdings are added to Treasury holdings in the independent variable, though the coefficient attenuates somewhat, consistent with agency MBS purchases having a weaker direct link to Treasury issuance than outright Treasury purchases.

3.2 Causal Evidence

3.2.1 Construction of an Asset Purchase Shock

Following the methodology of Swanson (2021) and Swanson (2024), we decompose interest rate responses to US monetary policy announcements into three factors: a federal funds rate, a forward guidance, and a large-scale asset purchase component. Our first step is to extend the sample of Gurkaynak, Sack, and Swanson (2005) through December 2024 and measure the high frequency responses of the first and third federal funds futures contracts, the second, third, and fourth Eurodollar futures contracts, and the on-the-run 10- and 30-year Treasury yields to monetary policy announcements. As is standard in the literature, we use thirty minute windows to measure the response of interest rates to monetary policy announcements. We normalize all interest rate responses to unit variance and extract the first and second principal components of the interest rate movements. We then rotate these factors into a target rate and forward guidance component. The forward guidance component is identified such that changes in this factor have no effect on the current federal funds rate.

Following Swanson and Jayawickrema (2023), LSAP shocks are defined to be zero through 2008. From 2009 onwards, the LSAP factor is defined as the the movement of the average of the 10- and 30- year Treasury yields that is orthogonal to the target and forward guidance factors. As a last step in the shock construction, we orthogonalize the LSAP factor to its own two lags in order to account for the "Fed Response to News" channel documented by Swanson (2024) . We normalize the factor so that a 1 unit increase has a negative 10 basis point effect on 10-year Treasury yields at the daily level.

Because market participants do not systematically receive any other information over the narrow windows around monetary policy announcements, the change in interest rates

Table 2: Annualized Surplus/Deficit and Fed Securities Holdings

Dependent Variable:	Annualized Federal Surplus/Deficit over GDP						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Fed Holdings/GDP	-0.31***	-0.40***	-0.40***	-0.39***	-0.47***	-0.23***	-0.41**
	(0.10)	(0.08)	(0.08)	(0.07)	(0.16)	(0.05)	(0.16)
Unemployment Rate		-1.21***	-1.18***	-1.21***	-1.09***	-1.22***	-1.33***
		(0.20)	(0.20)	(0.20)	(0.31)	(0.20)	(0.40)
GDP Growth			0.98*	1.13**	1.09	1.11*	1.54
			(0.58)	(0.57)	(1.14)	(0.67)	(1.32)
Financial Conditions				0.29	-2.44**	0.36	-2.59*
				(0.43)	(1.20)	(0.43)	(1.31)
Constant	-1.51*	6.56***	5.70***	5.80***	5.16	5.24***	8.31
	(0.84)	(1.49)	(1.45)	(1.52)	(3.39)	(1.49)	(5.02)
Full Sample	✓	✓	✓	✓	Post-GFC	✓	Post-GFC
MBS Included	×	×	×	×	✓	×	✓
Observations	181	181	181	181	68	181	68
R-squared	0.25	0.62	0.64	0.65	0.53	0.63	0.51

Notes: Newey-west standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Samples: 1980:Q4-2025:Q4 for full sample and 2009:Q1-2025:Q4 for “Post-GFC”. “MBS Included” indicates that the independent variable, “Fed Holdings/GDP,” includes SOMA agency securities holdings in addition to SOMA Treasury securities. All variables are in terms of four-quarter moving averages.

over that time reflects the surprise component of monetary policy. The LSAP factor, which loads on longer-term yields and is orthogonal to the pre-2009 monetary policy toolkit, measures exogenous changes to market expectations of balance sheet policy.

3.3 Empirical Specification

We use daily data from the US Treasury on tax revenues and Treasury debt issuance to measure the fiscal response to asset purchase shocks.[2] We employ local projections at each daily horizon h (Jordà, 2005). For debt outstanding, a stock variable, we estimate:

$$y_{t+h} = \alpha_h + \theta_h s_t + \sum_{j=1}^{60} \rho_{h,j}\, y_{t-j} + \delta_m + \varepsilon_{t+h}, \quad h = 0, \ldots, H; \tag{34}$$

where y_{t+h} is 100 times the log of a 22-day backward moving average of debt outstanding at horizon h, and the coefficients $\rho_{h,j}$ capture the effects of past realizations of the dependent variable. We include monthly indicators δ_m for the months of the coronavirus pandemic from March through August 2020. The coefficients of interest, θ_h, measure the percentage change in the moving average of debt outstanding at horizon h following an asset purchase shock s_t.

Because tax revenues are a flow rather than a stock variable, we specify a local projection to obtain the cumulative impulse response:

$$y^c_{t,t+h} = \alpha_h + \theta_h s_t + \sum_{j=1}^{60} \rho_{h,j}\, x_{t-j} + \delta_d + \delta_m + \varepsilon_{t+h}, \quad h = 0, \ldots, H; \tag{35}$$

where $y^c_{t,t+h} = 100 \times \log\left(\sum_{\ell=0}^{h} \text{tax}_{t+\ell}\right)$ is 100 times the log of cumulative daily tax revenues from day t to day $t+h$ in terms of a 60-day backwards moving average. The lagged controls x_{t-j} are the logs of a 60-day backward moving average of tax revenues, corresponding approximately to the number of business days in a quarter and thus capturing that important tax inflow dates occur on a quarterly basis. We include fixed effects δ_d for each calendar day of the year to account for significant predictable daily variation in tax receipts, and we include monthly indicators δ_m for the months of the coronavirus pandemic from March through August 2020. The local projection specifications measure cumulative percentage changes in total taxes collected and total debt outstanding, respectively, following an asset purchase shock.

Identification: The asset purchase shocks s_t are assumed to satisfy the restriction such that

$$\mathrm{E}[s_t \epsilon_{t+h}] = 0, \quad h = 0, 1, \ldots, H, \tag{36}$$

as the interest rate movements underlying the LSAP shocks are unexpected by market participants and are orthogonal to information up to five minutes before each monetary

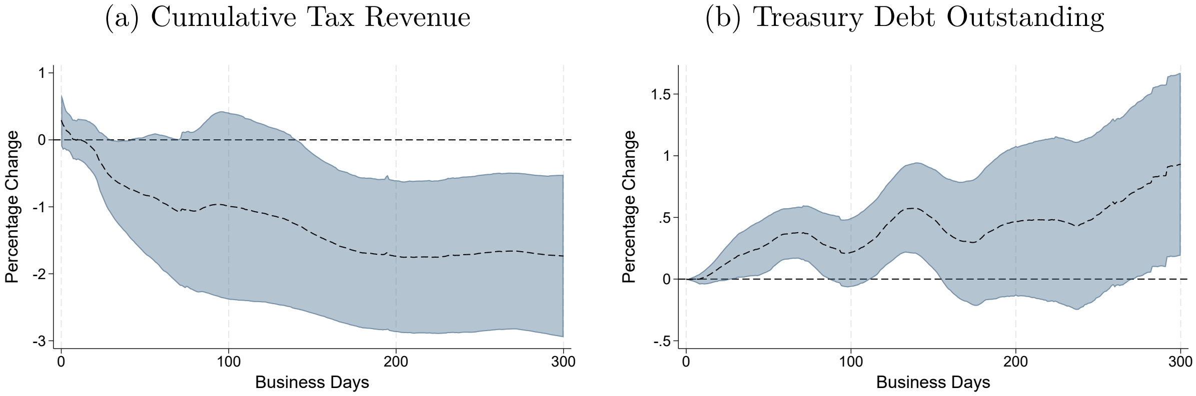
---

[2] Daily debt outstanding is obtained from the Treasury's "Debt to the Penny" release. Total daily tax collection is from Haver Analytics and available under the series name TDA@DAILY.

policy announcement. In addition, the daily frequency of the dependent variables makes it unlikely that an omitted variable could bias the impulse responses. Regarding the statistical relevance of the LSAP shocks, we replicate the financial market analysis of Swanson (2021) in the appendix and confirm that an accommodative asset purchase shock leads to a statistically significant reduction in the 10-year Treasury yield at the daily frequency.

3.4 Results

Figure 4: Fiscal Impulse Responses to an Accommodative Asset Purchase Shock


(a) Cumulative Tax Revenue

(b) Treasury Debt Outstanding

Notes: Panel (a) plots the response of the log of cumulative tax revenues to an accommodative QE shock. Panel (b) plots the response of the log of Treasury debt outstanding to an accommodative QE shock. Sample periods: January 1, 2008—May 22, 2024. 90% confidence intervals constructed with heteroskedasticity-robust standard errors.

3.4.1 Taxation and Debt Issuance

Figures 4a and 4b present the responses of tax revenues and debt issuance, respectively. The empirical responses align closely with the theoretical impulse responses in Section 2. The decline in tax revenue confirms that QE operates, at least in part, by relaxing the timing of households' tax obligations relative to their outstanding nominal wealth in government bonds—which is also measured to increase in response to asset purchase shocks.[3]

Because the asset purchase shock is measured from yield changes around monetary policy announcements, it does not contain information about the expected size of purchases. However, we can gauge the extent of this response using evidence from the fiscal literature for the effects of Treasury supply on yields. Using elasticities for the effects of

---

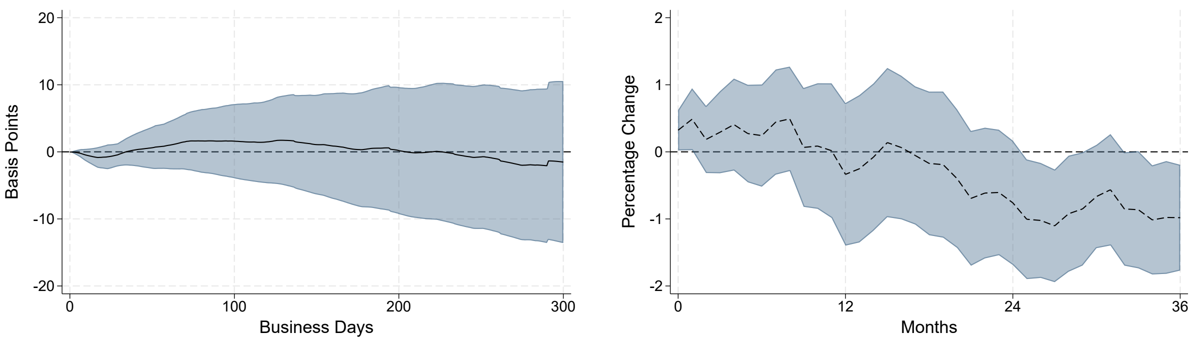
[3] Impulse responses at the monthly frequency, available in the appendix, yield less statistically precise but similar impulse responses.

Treasury supply (Bhatt, Diercks, Eyal, and Skaperdas, 2026; Wiegand, 2025), a 10 basis point reduction in the 10-year Treasury yield from our normalized 1 unit accommodative LSAP shock corresponds to an effective reduction in Treasuries outstanding in the range of 3-4 percentage points of debt to nominal GDP . The impulse response in Figure 4b therefore suggests a sizeable fiscal response: for each 3-4 percentage point effective reduction in the public's holdings as a share of GDP from central bank actions, the Treasury increases debt supply by about 1 percentage point at a 300 day horizon.

3.4.2 Evidence for a Mixed Monetary/Fiscal Equilibrium

We additionally test for the additional assumption necessary for a mixed monetary/fiscal equilibrium in the US: that the federal funds rate does not increase in response to the Federal Reserve's QE. We present estimates from specification (35) using the 22 day moving average of the federal funds rate as the dependent variable of interest and include monthly pandemic indicators. Figure 5a confirms the federal funds rate response is statistically insignificant from zero and remains within its 25 basis point target range.

Figure 5: Impulse Responses to an Accommodative Asset Purchase Shock



(a) Effective Federal Funds Rate

(b) Market Value of Privately-Held Treasury Securities

Notes: Panel (a) plots the daily response of a 22-day moving average of the effective federal funds rate to an accommodative QE shock. Includes 22 lags of the dependent variable. Sample period: January 1, 2008—May 22, 2024. Panel (b) plots the monthly response of the log of market value of privately held Treasury debt to an accommodative QE shock. Includes 12 lags of the dependent variable, the unemployment rate, the change in the Chicago National Financial Conditions Index, and monthly indicators for March-August 2020. Sample: February, 1972—June, 2024. 90% confidence intervals constructed with heteroskedasticity-robust standard errors.

In order to examine the market value of Treasury debt, we obtain publicly-available estimates from the Federal Reserve Bank of Dallas. Because these data are monthly, we present impulse responses at the monthly frequency using 12 lags of the dependent variable with the LSAP shocks summed within each month. Figure 5b shows that an expected balance-sheet expansion initially increases the real market value of privately-held Treasuries. However, the response is negative within two years, consistent with a partial FTPL equilibrium that erodes the value of government debt. In sum, the empirical evidence confirms the model assumptions necessary for the quantity channel, as the key assumption that the federal funds rate does not respond to QE is satisfied.

4 Conclusion

This paper presents the quantity channel as a new channel that has a potentially more powerful macroeconomic effect than transmission channels previously studied, which largely focus on the effects of QE on medium- and longer-term interest rates. In standard New Keynesian models, we assume that an increase in the central bank's holdings of government debt leads to a suspension of principal payments by the fiscal authority on an equivalent amount of securities holdings. The reduction in principal payments, in turn, implies that household's tax obligations are smaller or later arriving than would otherwise be the case. Under any macroeconomic framework that breaks Ricardian equivalence, QE will therefore have an accommodative effect on economic activity. These findings are confirmed empirically with identified high-frequency QE shocks and daily fiscal variables.

References

Adrian, T., C. Erceg, M. Kolasa, J. Lindé, and P. Zabczyk (2026). Macroeconomic and fiscal consequences of quantitative easing. Working Paper.

Andrade, P., E. Gautier, E. Mengus, E. Moench, and T. Schmidt (2025). Household beliefs about fiscal dominance.

Arden, L., S. Hauptmeier, and C. Kamps (2025). Inflation-stabilizing monetary and fiscal policy rules at and away from the lower bound. *Journal of Monetary Economics*, 103857.

Auerbach, A. J. and M. Obstfeld (2005). The case for open-market purchases in a liquidity trap. *American Economic Review 95*(1), 110–137.

Barro, R. J. and F. Bianchi (2026). Fiscal influences on inflation in oecd countries, 2020–2023. *The Economic Journal 136*(674), 626–654.

Bauer, M. D. and G. D. Rudebusch (2014). The signaling channel for federal reserve bond purchases. *36th issue (September 2014) of the International Journal of Central Banking*.

Bhatt, A., A. Diercks, B. Eyal, and A. Skaperdas (2026). The causal effect of debt on interest rates. *Available at SSRN 6169128*.

Bhattarai, S., J. W. Lee, and C. Yang (2023). Redistribution and the monetary-fiscal policy mix. *Quantitative Economics 14*(3), 817–853.

Bhattarai, S. and C. J. Neely (2022). An analysis of the literature on international unconventional monetary policy. *Journal of Economic Literature 60*(2), 527–597.

Bi, H., A. T. Foerster, and N. Traum (2024). Asset purchases in a monetary union with default and liquidity risks. *Federal Reserve Bank of Kansas City Working Paper No. RWP24-13*.

Bianchi, F., R. Faccini, and L. Melosi (2023, 05). A fiscal theory of persistent inflation. *The Quarterly Journal of Economics 138*(4), 2127–2179.

Billi, R. M. and C. E. Walsh (2025, January). Inflation, fiscal rules and cognitive discounting. Working paper, revised January 2025.

Cantore, C. and P. s. Meichtry (2024). Unwinding quantitative easing: state dependency and household heterogeneity. *European Economic Review 170*, 104865.

Caramp, N. and D. H. Silva (2023). Fiscal policy and the monetary transmission mechanism. *Review of Economic Dynamics 51*, 716–746.

Cochrane, J. H. (2014). Monetary policy with interest on reserves. *Journal of Economic Dynamics and Control 49*, 74–108.

Cochrane, J. H. (2021). The fiscal theory of the price level: An introduction and overview. *Journal of Economic Perspectives*.

Correia, I., E. Farhi, J. P. Nicolini, and P. Teles (2013). Unconventional fiscal policy at the zero bound. *American Economic Review 103*(4), 1172–1211.

Cui, W. and V. Sterk (2021). Quantitative easing with heterogeneous agents. *Journal of Monetary Economics 123*, 68–90.

d'Avernas, A., A. Hubert de Fraisse, L. Ning, and Q. Vandeweyer (2024). How large is too large? a risk-benefit framework for quantitative easing. *A Risk-Benefit Framework for Quantitative Easing (October 31, 2024). Chicago Booth Research Paper*, 24–27.

Davig, T. and E. M. Leeper (2007). Generalizing the taylor principle. *American Economic Review 97*(3), 607–635.

Del Negro, M. and C. A. Sims (2015). When does a central bank's balance sheet require fiscal support? *Journal of Monetary Economics 73*, 1–19.

D'Amico, S. and T. B. King (2013). Flow and stock effects of large-scale treasury purchases: Evidence on the importance of local supply. *Journal of financial economics 108*(2), 425–448.

Eggertsson, G. B. and M. Woodford (2004). Policy options in a liquidity trap. *American Economic Review 94*(2), 76–79.

Galí, J., J. D. López-Salido, and J. Vallés (2007). Understanding the effects of government spending on consumption. *Journal of the european economic association 5*(1), 227–270.

Gertler, M. and P. Karadi (2011). A model of unconventional monetary policy. *Journal of monetary Economics 58*(1), 17–34.

Greenwood, R., S. Hanson, J. S. Rudolph, and L. H. Summers (2014). Government debt management at the zero lower bound.

Greenwood, R., S. G. Hanson, J. S. Rudolph, and L. H. Summers (2015). The optimal maturity of government debt. Book chapter, Brookings Institution Press.

Greenwood, R., S. G. Hanson, J. C. Stein, et al. (2016). The federal reserve's balance sheet as a financial-stability tool. *Innovative Federal Reserve Policies During the Great Financial Crisis*, 63–124.

Gurkaynak, R. S., B. Sack, and E. T. Swanson (2005). Do actions speak louder than words? the response of asset prices to monetary policy actions and statements.

Hall, G. J. and T. J. Sargent (2023). Fiscal consequences of the us war on covid. *World War II 30*(46.0), 10–1.

Hall, R. E. and R. Reis (2015). Maintaining central-bank financial stability under new-style central banking. Technical report, National Bureau of Economic Research.

Hall, R. E. and R. Reis (2017). Acheiving price stability by manipulating the central bank's payment on reserves. NBER Working Paper 22761.

Hazell, J. and S. Hobler (2024). Do deficits cause inflation? a high frequency narrative approach. Technical report, Technical report.

Jacobson, M. M., E. M. Leeper, and B. Preston (2019). Recovery of 1933. Technical report, National Bureau of Economic Research.

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American economic review 95*(1), 161–182.

Kaplan, G., G. Nikolakoudis, and G. L. Violante (2023). Price level and inflation dynamics in heterogeneous agent economies. Technical report, National Bureau of Economic Research.

Kim, K., T. Laubach, and M. Wei (2023). Macroeconomic effects of large-scale asset purchases: New evidence.

Leeper, E. M. (1991). Equilibria under active and passive monetary and fiscal policies. *Journal of monetary Economics 27*(1), 129–147.

Levin, A. T., B. L. Lu, and W. R. Nelson (2022). Quantifying the costs and benefits of quantitative easing. Technical report, National Bureau of Economic Research.

McKay, A., E. Nakamura, and J. Steinsson (2017). The discounted euler equation: A note. *Economica 84*(336), 820–831.

Michaillat, P. and E. Saez (2021, 05). Resolving new keynesian anomalies with wealth in the utility function. *The Review of Economics and Statistics 103*(2), 197–215.

Nagel, S. (2016). The liquidity premium of near-money assets. *The Quarterly Journal of Economics 131*(4), 1927–1971.

Orphanides, A. (2023). The forward guidance trap. Technical report, IMFS Working Paper Series.

Rachel, L. and M. O. Ravn (2025). Brothers in arms: Monetary-fiscal interactions without ricardian equivalence.

Reis, R. (2017). Can the central bank alleviate fiscal burdens? Technical report, National Bureau of Economic Research.

Sack, B., J. Gagnon, M. Raskin, and J. Remache (2011). The financial market effects of the federal reserve's large-scale asset purchases.

Seidl, H. and F. Seyrich (2023). Unconventional fiscal policy in a heterogeneous-agent new keynesian model. *Journal of Political Economy Macroeconomics 1*(4), 633–664.

Sims, E. R., J. C. Wu, and J. Zhang (2022). Unconventional monetary policy according to hank. *PBCSF-NIFR Research Paper Forthcoming*.

Swanson, E. and V. Jayawickrema (2023). Speeches by the fed chair are more important than fomc announcements: An improved high-frequency measure of us monetary policy shocks. *Unpublished Manuscript*.

Swanson, E. T. (2021). Measuring the effects of federal reserve forward guidance and asset purchases on financial markets. *Journal of Monetary Economics 118*, 32–53.

Swanson, E. T. (2024). The macroeconomic effects of the federal reserve's conventional and unconventional monetary policies. *IMF Economic Review 72*(3), 1152–1184.

Tischbirek, A. (2018). Large-scale bond purchases in a currency union with segmentation in the market for government debt. *Journal of Economic Dynamics and Control 95*, 37–69.

Vayanos, D. and J.-L. Vila (2021). A preferred-habitat model of the term structure of interest rates. *Econometrica 89*(1), 77–112.

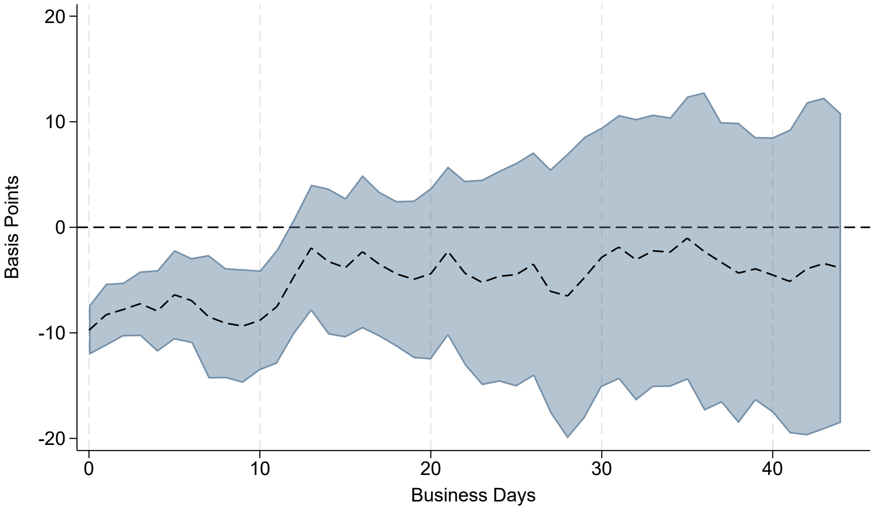
Vissing-Jorgensen, A. and A. Krishnamurthy (2011). The effects of quantitative easing on interest rates: Channels and implications for policy. *Brookings Papers on Economic Activity 43*(2), 215–287.

Wiegand, C. (2025). The effect of fiscal policy shocks on asset prices. *Available at SSRN 5269517*.

Zhao, J. (2023). Wealth in utility, the taylor principle and determinacy. *Journal of Macroeconomics 76*, 103525.

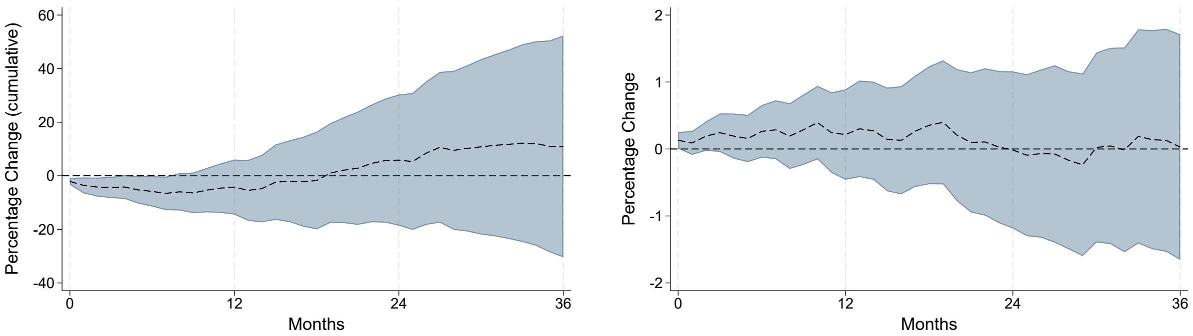
Appendix

Figure 1: Impulse Response of the 10-Year Treasury Yield to an Accommodative Asset Purchase Shock



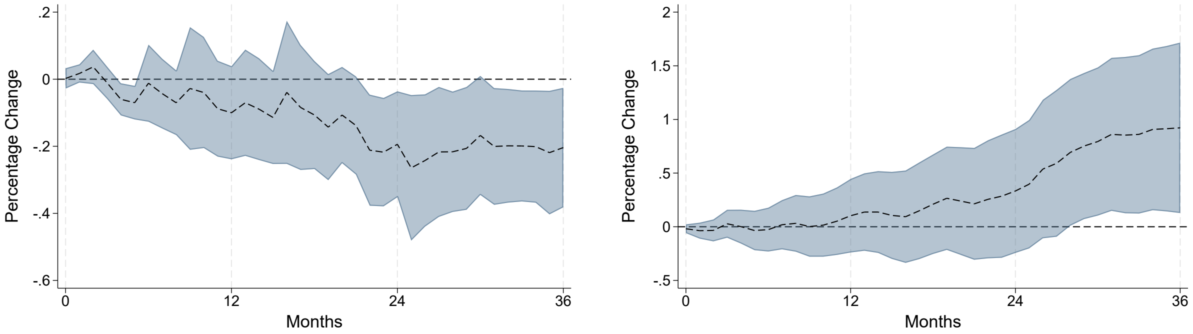
Notes: Figure plots the daily response of the market yield on US Treasury securities at 10-Year constant maturity (DGS10 from FRED). Sample: January 1, 2008- May 22, 2024. Local projection includes 5 lags of the dependent variable. 90% confidence interval constructed with heteroskedasticity-robust standard errors.

Figure 2: Monthly Impulse Responses to an Accommodative Asset Purchase Shock



(a) Cumulative Tax Revenue

(b) Outstanding Treasury Debt



(c) Unemployment Rate

(d) CPI Inflation

Notes: Panel (a) plots the response of the log of cumulative tax revenue. Panel (b) plots the response of the log of total public debt outstanding. Panel (c) plots the response of the unemployment rate; Panel (d) plots the response of the CPI price level. All IRFs include 12 lags of the dependent variable, 12 lags of the change in the Chicago National Financial Conditions Index, and monthly indicators for March through August 2020. Sample: October 1980–April 2024. The start date of the sample corresponds to the first month for which all variables are available. 90% confidence intervals constructed with heteroskedasticity-robust standard errors.