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Implications of Fiscal-Monetary Interaction from HANK Models

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ABSTRACT

I describe nine implications of the interconnectedness of fiscal and monetary policy that surface in Heterogeneous Agent New Keynesian (HANK) models. Not all are unique to HANK models. (i) Long run fiscal changes force monetary adjustments. (ii) Sustainable permanent deficits are feasible. (iii) Monetary policy leaves fiscal footprints, even with passive fiscal policy. (iv) Fewer controversies around active fiscal policy. (v) Equilibria are unique under a wider class of fiscal and monetary rules. (vi) With short-term debt, raising nominal rates without a fiscal contraction raises inflation. (vii) Unfunded fiscal stimulus is more inflationary. (viii) Even fully funded fiscal stimulus is inflationary. (ix) Fiscal transfers can substitute for monetary policy in the aggregate.

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Introduction

Over the last decade, heterogeneous-agent New Keynesian (HANK) models have emerged as a leading framework for studying monetary and fiscal policy. HANK models are dynamic stochastic general equilibrium (DSGE) models that combine households who face idiosyncratic income risk and incomplete financial markets with firms that face nominal rigidities in the form of sticky prices or wages. Households in HANK models exhibit consumption-saving behavior that matches the empirical evidence far better than in representative-agent New Keynesian (RANK) models. Because of these differences in spending behavior, HANK models often deliver different answers to key questions about monetary and fiscal policy. In the language of Solow (1956), the degree of consumption insurance and household heterogeneity in New Keynesian models is a *crucial assumption*. Altering the assumption of complete markets or a representative household in RANK models to bring it closer to reality leads to different answers to questions the models are designed to address.

One area where these differences surface is in the interactions between fiscal and monetary policy. The interconnectedness of fiscal and monetary policy has a long intellectual history, which in the context of modern macroeconomic models with rational expectations, dates back to Sargent (1981),Sargent and Wallace (1981), Sargent and Wallace (1982) and Wallace (1981).[1] The implications of the government budget constraint for flexible price economies were further developed by Leeper (1991), Sims (1994),Woodford (1995) and Cochrane (1998), and these insights have since been extended to sticky price New Keynesian economies, starting with Davig and Leeper (2007), Sims (2011) and Cochrane (2011).

However, starting in the 1990s, many of the insights in these and related papers were overlooked or ignored by large parts of the policy and research profession, particularly in regard to the study of business cycles and short-run stabilization policy. For a while it seemed like emphasizing interactions between monetary and fiscal policy was confined to corners of the profession. This occurred in part because the version of the RANK model proposed by Woodford (2003) and Galí (2008) became widely adopted as the standard framework for analyzing monetary and fiscal stabilization policy. That version of the RANK model makes a series of crucial assumptions that reduce the importance of the government budget constraint and nullify many of these earlier insights.

However, in recent years a wave of new research has resurrected many of these earlier insights about fiscal-monetary interactions, in part by revisiting similar issues through the lens of HANK models.[2] In this note I describe nine implications of the interconnectedness of fiscal and monetary that surface in HANK models because of the shift from a representative households to heterogenous households. Some are implications for the conduct of policy, such as the effect of funded and unfunded fiscal stimulus, redistributive changes in tax and transfer policy and the effect of changes in interest rates on inflation. Some are theoretical features that affect the robustness of equilibria under particular combinations of fiscal and monetary policies. Some are simply reminders and extensions of issues that were already well understood in the earlier literature cited above, but whose relevance resurfaces when the crucial assumptions in the baseline RANK models

[1] I am purposely light on citations as this is not intended to be a literature review on fiscal-monetary interactions. I refer those interested to Leeper and Leith (2016) and Cochrane (2023) for detailed discussions.

[2] I say "in part" because throughout this time a consistent set of papers has continue to argue for the importance of fiscal-monetary interaction. It is hard to overemphasize the work of Cochrane (2023) in drawing attention to these interactions, which uses RANK models. Important parts of the research I describe do not use HANK models, but rather simpler modifications to RANK models that are intended to replicated features of the consumption behavior of households in HANK models (for example, Aguiar et al. (2023) and Angeletos et al. (2024)), and other ways to depart from Ricardian equivalence (for example, Eusepi and Preston (2018)).

are replaced with more realistic ones. Some implications pertain to the long run and some to the the short run.

In this note I use the acronym HANK to refer to both flexible and sticky price versions of heterogeneous agent models, both for convenience and because the flexible price economy is the limit of the sticky price economy in which pricing frictions vanish. The terminology should be interpreted as reflecting the most recent incarnation of the class of macroeconomic models developed by Bewley (1986), Imrohoroğlu (1989), Huggett (1993) and Aiyagari (1994). I also don't claim that any of the insights that follow are new. The goal is to bring some central implications together in a single place in a way that readers might find useful to understand what HANK models have to say about monetary and fiscal policy. It is far from a comprehensive list.

Three Relevant Differences Between HANK and RANK

HANK and RANK models differ in their assumptions about how households spend and save. Three aspects of these differences are especially relevant for the fiscal-monetary interactions that I discuss.

(A) Heterogeneous marginal propensities to consume (MPCs) Households in HANK models face uninsured idiosyncratic income risk and borrowing constraints, giving rise to a precautionary savings motive. This in turns leads to a consumption policy function that is concave in wealth. Low-wealth households, particularly those close to their borrowing constraint or with temporarily low income, have a high MPC, often near 100%, whereas high-wealth households have a low MPC that is similar in magnitude to the interest rate, as in a representative household model. In two-asset HANK models with both liquid and illiquid assets, it is primarily households' holdings of liquid wealth, rather than their total wealth, that determines their MPC out of small shocks. In equilibrium, this dependence of MPCs on wealth and income gives rise to a distribution of MPCs across the population, and an average MPC between these two extremes.[3]

There is overwhelming empirical evidence for such heterogeneity in MPCs. Studies of fiscal stimulus payments and other income shocks routinely estimate quarterly average MPCs of around 20%-40%, together with substantial heterogeneity that correlates with liquid wealth.[4] The data also reveal that a sizable fraction of households (on the order of one-quarter to one-half) hold near-zero liquid wealth. These "hand-to-mouth" households, most of whom also hold non-trivial amounts of illiquid wealth (the "wealthy hand-to-mouth"), have high MPCs and do not respond much to interest rate changes.

(B) Failure of Ricardian equivalence Because of the precautionary savings motive and heterogeneous MPCs, HANK economies violate Ricardian equivalence. In a RANK model with infinitely lived households, the timing and distribution of lump-sum taxes or transfers does not matter for consumption. The representative household's spending depends only on the present value of net transfers. By contrast, in HANK models the timing and distribution of transfers do matter for spending. The timing of transfers matters because households with low wealth raise their spending in response to a lump sum transfer, even if it is compensated with an equivalent lower transfer in the future. The presence of a borrowing constraint or

[3]See Kaplan and Violante (2022) for an overview of the MPCs in heterogeneous agent economies.

[4]See Havranek and Sokolova (2020) for a meta-analysis of these empirical studies and cites therein.

strong precautionary motive leads these households to act as if they had a shorter horizon than a representative household. The distribution of taxes and transfers matters because of heterogeneity in MPCs. Levying a lump-sum tax on a low-MPC household and transferring the proceeds to a high-MPC household raises aggregate consumption, even though such a policy is budget-neutral. A corollary is that even in the absence of distortionary taxation, the timing of deficits and the allocation of fiscal burdens across households influences aggregate spending.

(C) Upward sloping steady-state asset supply curve In RANK models the steady-state asset supply curve is perfectly elastic at $r = \rho + \gamma g$, where ρ is the household discount rate, g is the growth rate of real output, and $\frac{1}{\gamma}$ is the intertemporal elasticity of substitution. Hence the steady-state real interest rate is determined only by these parameters. In HANK models, the steady-state asset supply curve is upward sloping, and so the steady-state real interest rate depends on all the features of the economy that affect asset supply and demand. I denote the steady-state real asset supply curve as $a^S(r)$.[5]

In HANK models, households' willingness to accumulate assets at a given interest rate is driven not only by intertemporal substitution, but also the strength of the precautionary motive. This in turn depends on the degree of uninsured idiosyncratic risk, the tightness of borrowing constraints and their level of wealth. As wealth rises, the precautionary motive becomes weaker, leading to a steady-state asset supply curve that, in typical calibrations, increases smoothly in the interest rate and approaches infinity as the interest rate approaches the rate of time preference. Changes in the economy that affect the degree of uninsured risk or the strength of the precautionary motive change the amount of assets that households are willing to hold at a given interest rate and lead to shifts in the steady-state asset supply curve. The natural interest rate is therefore endogenous and depends on both the features of the economy that affect the degree of precautionary savings, as well as the shape of the asset demand curve, which in the simplest HANK models is determined by fiscal and monetary policy.

None of these features are unique to HANK models. For example, two-agent New Keynesian (TANK) models feature MPC heterogeneity(Galí et al., 2007; Bilbiie, 2008); overlapping generations (OLG) models violate Ricardian equivalence (Aguiar et al., 2023; Angeletos et al., 2024); bonds-in-utility (BIU) models feature an upward sloping steady-state asset supply curve (Kaplan et al., 2023). Other classes of models that exhibit some or all of these features include those with learning (Eusepi and Preston, 2018) and monetarist models (Bassetto and Cui, 2018). The implications of fiscal-monetary interactions each descend from one or more of these features of household consumption behavior and hence many apply to other models beyond HANK models.

An Important Premise: Positive Government Debt

I start with an observation that underlies many of the results that follow: in any empirically plausible HANK model, the level of government debt b is non-zero, $b > 0$. In both HANK and RANK models without capital, the asset market clearing condition equates the real value outstanding government debt to

[5] I refer to this as a "supply" curve, rather than a "demand" curve because that is the tradition following Aiyagari (1994) who modeled households as "supplying" capital and firms "demanding" capital. However, I acknowledge that in a model where households hold government debt, it might be more appropriate to label this as a "demand" curve for government debt. In any case, this is just language with no substantive implications.

the aggregate assets of households,

$$a^s(r) = b. \tag{1}$$

In reality, households *do* hold positive wealth in the aggregate and governments *do* issue a positive amount of debt.

But the fact that government debt and household wealth is non-zero means that the full consequences of the government budget constraint are brought to bare on the economy. One cannot subvert the effects of the government budget constraint by appealing to an economy with zero government debt as is often done in RANK models, or to a version of a HANK model where in equilibrium aggregate wealth is zero (sometimes referred to as a "zero liquidity" limit). While such simplifications are often amenable to analytic results, they are not useful for studying questions whose answers depend on fiscal-monetary interactions. Doing so would constitute another crucial assumption.

In benchmark HANK models it is usually assumed that households hold bonds directly. However, this need not be the case, and it is not in reality. Households hold deposits in financial institutions which use them to issue loans to firms, other households, and the government. Most government bonds are held by financial institutions. As long as it is modeled as being competitive, with a fixed intermediation cost, the financial sector is a veil that one can be safely ignore in the model.[6]

Implication 1: Long-run Fiscal Changes Force Monetary Adjustments

In HANK models, a change in the government's long-run fiscal stance, such as a permanent shift in primary surpluses, requires a change in the long-run monetary stance. This could come from a change in either the inflation target or the long-run nominal rate. In RANK models, no such change is needed. This is because in HANK, the steady-state real interest rate is itself an equilibrium outcome that changes when the level of surpluses change. Fiscal policy cannot alter the steady-state level of debt or surpluses without triggering a change in either steady-state inflation or the policy rate. By contrast, in RANK, the steady-state real rate does not depend on the level of debt or surpluses, and the government can in principle finance any feasible amount of debt without affecting long-run inflation or the nominal rate.

To see why, consider a HANK model without growth ($g = 0$) in which the fiscal authority targets a long-run level of primary surpluses $\bar{s}$. The government budget constraint is

$$\dot{b}_t = r_t b_t - \bar{s}, \tag{2}$$

and hence the steady-state demand for debt is $b^d(r; \bar{s}) = \frac{\bar{s}}{r}$. The asset market clearing condition is

$$a^s(r) = \frac{\bar{s}}{r}. \tag{3}$$

[6] Although households hold many other types of assets besides government bonds, and governments borrow from many other lenders besides domestic households, it happens that the aggregate amount of liquid wealth held by US households is roughly the same as the level of US government debt. Equating the two is not a bad approximation as a calibration of simple one-asset HANK models, justifying the use of the market clearing condition (1). Richer models, however, incorporate many of these other sources of asset demand and supply.

If a steady-state equilibrium exists, then the equilibrium interest rate r^* satisfies equation (3). Since $a^s(r)$ is upward sloping, a permanent reduction in surpluses must result in a lower steady-state real interest rate and a lower level of steady-state debt. But since the real interest rate satisfies a Fisher equation

$$r_t = i_t - \pi_t, \tag{4}$$

either the nominal rate must be lower or inflation must be higher in the new steady-state. With no change in the nominal rate, a permanently lower surplus leads to permanently higher inflation. Alternatively, with no change in the long-run inflation target, lower surpluses would require monetary policy to target a lower neutral rate. No matter the monetary policy framework, if a steady-state equilibrium exists, either or both of the long-run inflation or neutral policy rate must change.

The same equations hold in the corresponding RANK model, but the supply curve $a^s(r)$ is perfectly elastic at $r = \rho$. A reduction in surpluses is accommodated by lower steady state government debt and an unchanged real rate at $r^* = \rho$. Hence no change in monetary policy is required.

Similar types of long run fiscal-monetary interactions arise with other types of fiscal adjustments. For example, if the fiscal authority targets a long-run level of real debt $\bar{b}$, rather than primary surpluses, then a change in the debt target has no implications for the stance of monetary policy in RANK models because no change in the real rate is required. However, in HANK models, an increase in the long-run debt target $\bar{b}$ requires a higher steady-state real rate to satisfy the market clearing condition $a^s(r^*) = \bar{b}$, and hence either a lower inflation target or a higher target policy rate.[7]

HANK models teach us that a fiscal authority cannot permanently change its primary surplus, nor the amount of redistribution and insurance implicit in a given level of surplus, without a corresponding change in either the long-run inflation target or the long-run nominal interest rate.

Implication 2: Sustainable Permanent Deficits are Feasible

HANK models can be used to study economies in which governments run persistent primary deficits. This has arguably been the relevant case for the United States and many other developing countries since the early 2000s. When real output grows at a constant rate $g > 0$ the asset market clearing condition becomes

$$a^s(r) = \frac{s}{r - g}. \tag{5}$$

Since government debt and household savings are both non-negative, the only way for a steady-state equilibrium to exist when the government runs a primary deficit ($s < 0$) is if $r^* < g$. Nothing precludes this as an equilibrium outcome in HANK models, and indeed calibrations of one-asset HANK models to household and aggregate variables in the United States are consistent with this configuration. For example, a primary deficit of of 2.2% of GDP can be sustained with a debt to GDP ratio of 88%, a nominal interest rate of 1.9%, an inflation rate of 2% and a growth rate of 2.4%. Given plausible calibrations of household income risk, tax and transfer policies and discounting, households are willing to hold this level of government debt at these interest rates (Kaplan and Miyahara, 2025).[8]

[7] Examples of papers that have used HANK models to investigate the long-run implications of changes in fiscal policy on monetary policy include Bayer et al. (2023), Kaplan et al. (2023), and Campos et al. (2024).

[8] More work needs to be done on calibrating two asset HANK models to better understand whether they are consistent with simultaneously holding risk-free government debt and risky productive capital and equity.

In an analogous RANK model $r* < g$ is not possible as an equilibrium outcome because the asset supply curve is infinitely elastic at $r = \rho + \gamma g$. Since the discount rate is positive $\rho > 0$, it is straightforward to see that if $\gamma \geq 1$ this cannot hold. More generally one can show that if $\rho + (\gamma - 1) g < 0$ (the condition required for $r* < g$), the household's transversality condition will be violated.

The intuition for why HANK models are consistent with permanent deficits comes from the precautionary motive. Households value government debt because it is a safe store of value that allows them to self-insure against idiosyncratic risk. If the precautionary motive is strong enough, households are willing to "pay" the government for the privilege of lending to it in the form of receiving an interest rate below the growth rate. The government uses the flow revenue from the real payments it receives to finance its deficits. The larger is the revenue it receives, the larger is the deficit it can finance.

Importantly, this does not mean that governments can sustain any level of deficits in this way. There is a limit. Higher deficits must be financed by either a lower (more negative) interest rate, or a larger stock of debt (abstracting from growth, in steady state $s = rb$). But as the interest rate falls, so too does the amount of debt that households are willing to finance, generating a Laffer curve for government debt, $s = ra^S(r)$. For large enough deficits there is no combination of a sufficiently low interest rate and sufficiently high quantity of debt that households are willing to supply that generates enough revenue to finance the desired deficit.

The level of this maximum deficit depends on the strength of the precautionary motive. Therefore whether a given level of deficit is sustainable depends on what it is used for. If, for example, a government increases its deficit by spending more on insuring households against low income realizations through social insurance policies, this would reduce the overall precautionary motive and lower the maximum sustainable deficit. On the other hand, if a government increases its deficit by reducing a proportional labor income tax rate, this would increase the overall precautionary motive and raise the maximum sustainable deficit. If the additional deficits are used for government purchases whose utility to households is separable from private consumption, then there is no change in the maximum deficit because the steady-state asset supply curve is not affected.[9]

HANK models teach us that the government can run persistent deficits up to a limit that depends on the degree of redistribution and insurance implicit in the tax and transfer system.

Implication 3: Monetary Policy Leaves Fiscal Footprints, even with Passive Fiscal Policy

A change in the nominal interest rate leaves fiscal footprints. A temporary increase in the nominal interest rate that is successful at raising the real interest rate leads to higher required interest payments on outstanding government debt which the fiscal authority must finance through higher taxes, lower transfers or inflation. These are the fiscal footprints of monetary policy.

In HANK, these fiscal footprints matter even when governments follow passive fiscal rules.[10] An example of such a rule is one in which the fiscal authority sets lump sum taxes to generate a level of surpluses that

[9]Kaplan et al. (2023) estimate that the maximum feasible deficit in the US is 0.2 percentage points higher if deficits are expanded by lowering proportional taxes compared with raising lump-sum transfers.

[10]I use the term passive in the sense of Leeper (1991). Alternatively, I refer to the broader class of Ricardian fiscal rules as defined by Woodford (1995).

stabilize debt at a given target, as in

$$s_t = \bar{s} + \phi\left(b_t - \bar{b}\right) \tag{6}$$

with $\phi > r^*$. I assume that the surplus and debt targets are chosen such that $\bar{b} = a^s\left(\frac{\bar{s}}{\bar{b}}\right)$ so that the desired targets are implemented as a steady-state equilibrium $(s^*, b^*) = \left(\bar{s}, \bar{b}\right)$.

In RANK economies with lump sum taxation, these fiscal footprints have no consequences and can be safely ignored. With a passive fiscal rule such as (6), the higher future taxes that households pay are exactly offset by the higher interest rates they face. The present value of their net income is unaffected by the fiscal adjustment, and because of Ricardian equivalence, there is no change in their consumption. As long as the fiscal rule is passive, the consequences of a monetary contraction can be studied without reference to the specifics of the fiscal response.

In HANK models, these fiscal footprints cannot be ignored. Both the timing and distribution of the fiscal authority's response to the higher interest payments matter significantly for the overall effect of monetary policy. The timing matters because of the failure of Ricardian equivalence. A fiscal response that pushes the required tax increase further in the future would lead to a smaller drop in spending from the rate hike. On the other hand, a fiscal response that immediately raises taxes would lead households to cut spending by more, exacerbating the effects of the rate hike. The distribution matters because of MPC heterogeneity. Even if the government were to perfectly stabilize its debt ($\phi \to \infty$) by immediately raising lump sum taxes or lowering transfers by the amount of the additional interest payments, the incidence of the higher taxes matters for the overall effect. The more it is targeted towards low-wealth, high-MPC households, the larger the fall in aggregate consumption from the increase in real rates.

The size of these fiscal footprints depends on the size and duration of the government balance sheet. As long as the government has some debt ($b > 0$) and its duration is finite, some change in current or future transfers is required to satisfy a passive fiscal rule like (6). But the longer the duration of the debt, the smaller are the required fiscal adjustments. The government effectively has a very long duration asset: a commitment to collect an infinite stream of primary surpluses. So if it is matched with an equally long duration debt a change in the real interest rate would have no effect on the fiscal authority's net equity and no change in taxes or transfers would be required. But even in this case the transmission of monetary policy is still complex, because a change in interest rates redistributes wealth between the subset of households who hold different amounts of the debt. An unexpected rate hike is a capital loss for the households who hold that debt (either directly or via ownership of financial institutions that hold those claims) and so the effect of the policy depends on the MPCs of those households.[11]

HANK models teach us that the the size and duration of the government balance sheet matter for the transmission of monetary policy. The details of these fiscal response to a change in interest rates can be more consequential for the overall effect on the economy than the rate change itself.

[11] Auclert (2019) derive sufficient statistics for the extent of this exposure and applies them to microeconomic data. Kaplan et al. (2018) and Kaplan and Violante (2018) report simulations for the effects of monetary shocks under different assumptions of the size and distribution of fiscal footprints.

Implication 4: Fewer Controversies Around Active Fiscal Policy

Representative agent models with "active", or "non-Ricardian" fiscal rules are commonly referred to as the Fiscal Theory of the Price Level (FTPL).[12] HANK models with these fiscal policies are less conceptually fragile than in RANK models. Because of these subtle theoretical differences, Angeletos et al. (2025) go so far as to advocate for not referring to HANK models with these specifications of policy as FTPL.

To see the essence of their argument, it is useful to recall the dynamic equations of the textbook RANK model with an interest rate peg $i_t = \bar{i}$, and a fixed level of real government surpluses $\bar{s}$.

$$\dot{y}_t = \left(\bar{i} - \pi_t - \rho\right) y_t \tag{7}$$

$$\dot{\pi}_t = \rho \pi_t - \kappa \left(y_t^{1+\sigma} - (y^*)^{1+\sigma} \right) \tag{8}$$

$$\dot{b}_t = \left(\bar{i} - \pi_t\right) b_t - \bar{s} \tag{9}$$

Equation (7) is the household Euler equation with log utility over consumption, combined with the aggregate resource constraint. $c_t = y_t$. The household is assumed to have separable utility over consumption and hours worked with a constant inverse Frisch elasticity of σ. I assume an exogenous upper bound on hours worked which implies that boundedness of output is a necessary condition for an equilibrium. Equation (8) is the New Keynesian Phillips Curve with quadratic price adjustment costs Rotemberg (1982). The constant $\kappa = \frac{\varepsilon \varphi}{\theta} > 0$ depends on the elasticity of substitution across varieties of goods ε, the cost of price adjustment θ and the disutility of labor supply φ. Production is constant returns to scale and uses only labor. Equation (9) is the government budget constraint.

The most important feature to notice is that the dynamics of government debt in (9) are decoupled from the dynamics of output and inflation in (7) and (8) in the sense that, given initial conditions (y_0, π_0) for output and inflation, one can determine the dynamics of output and inflation without reference to the dynamics of debt.

Once can show that there are multiple bounded solutions to (7) and (8), which can be indexed by the initial value of inflation π_0. Each such path of (y_t, π_t) implies a different path of real interest rates and hence a different path of government debt from (9). One can also show that only one of these paths for debt satisfies the household's transversality condition, $\lim_{t\to\infty} e^{-\rho t} \frac{1}{c_t} b_t = 0$. According to the FTPL, this is the unique equilibrium of the model.[13]

This equilibrium is sometimes criticized on the basis that it uses the household transversality condition to select among multiple equilibria. Strictly speaking this is not correct - the transversality condition is itself a necessary equilibrium condition so there is indeed a unique equilibrium. However, what is true is that there are multiple paths of output and inflation that satisfy all the equilibrium conditions apart from the transversality condition. The government budget constraint is then used to select the unique one of these paths that implies a path for debt that does not violate the transversality condition. It is this reliance on the household transversality condition that leaves the FTPL fragile to modifications of the environment that weaken the importance of the transversality condition, and is why researchers have been able to construct modified versions of the RANK model that change its equations in seemingly inconsequential ways, but prevent the FTPL from delivering uniqueness. These include, for example, adding small amounts of error to

[12] I use the term active in the sense of Leeper (1991). Woodford (1995) introduced the label Fiscal Theory of the Price Level to refer to economies in which fiscal policy is part of a broader class of rules that he refers to a non-Ricardian fiscal .

[13] Cochrane (2023) refers to this sticky price version of the FTPL as a fiscal theory of inflation, since it is the path of inflation, not the initial price level that is determined in equilibrium. SeeKaplan (2025) for details of these claims.

beliefs about outcomes far in the future (Angeletos and Lian, 2023), or allowing for a finite but arbitrarily long horizon, instead of an infinite horizon (Angeletos et al., 2025).

It is because the dynamics of output and inflation decouple from the dynamics of debt in the system (7)-(9) that equilibrium uniqueness in RANK models with active fiscal policy is fragile to these modifications. The reason for the decoupling is Ricardian equivalence: the representative household makes the same choices of consumption and labor supply regardless of the path of its assets, so long as the present value of the net transfers from the government is unchanged. But since the model has a unique steady-state level of real assets, any two paths of debt that converge to steady-state must imply the same present value of net transfers and hence the same household decisions. It follows that in RANK models, the only way for fiscal policy to affect household decisions is if it were to imply a path for household assets that grows too fast to satisfy the transversality condition.

HANK models do not suffer from this fragility because the dynamics of government debt do not decouple from the dynamics of output and inflation. Since households are non-Ricardian, different paths of household asset holdings that all converge to the same steady state and have the same present value of net transfers coincide with different optimal consumption and work decisions. This is enough to ensure that the transversality condition is not required for uniqueness. With passive monetary policy and active fiscal policy, the condition that output remains bounded is on its own enough to guarantee a unique equilibrium. To be clear, in the resulting equilibrium the transversality condition of course holds, it is just that without this condition there would still be a unique allocation that satisfies the remaining equilibrium conditions, which is not the case in RANK models. As such, applying the types of modifications described above to HANK models do not prevent uniqueness.[14]

Since HANK models have a much higher dimension than RANK models one cannot express their dynamics in a simple low dimensional system of ODEs as in (7)-(9). But an intuitive way to understand the difference is to examine the dynamics in other simple models in which Ricardian equivalence does not hold and the steady-state asset supply curve is upward sloping. For example RANK models with either bonds-in-utility (BIU) or overlapping generations models (OLG) can be expressed as the system

$$\dot{y}_t = \left(\bar{i} - \pi_t - \rho\right) y_t + g\left(b_t, y_t\right) \tag{10}$$

$$\dot{\pi}_t = \rho\pi_t - \kappa\left(y_t^{1+\sigma} - \left(y^*\right)^{1+\sigma}\right) \tag{11}$$

$$\dot{b}_t = \left(\bar{i} - \pi_t\right) b_t - \bar{s} \tag{12}$$

The only difference between this system and the RANK model is the presence of the term $g\left(b_t, y_t\right)$ in the equation for the dynamics of output. This term breaks the decoupling of debt from the dynamics of output and inflation. The economics underlying these dynamics stem from the presence of a wealth effect on household spending that is a hallmark of optimal consumption decisions for non-Ricardian households: they choose different paths for consumption when their assets follow different paths, even if the present value of their net income is the same. In the RANK-BIU model this is because the household's asset holdings directly impact its marginal value of saving. In HANK models it is because the precautionary motive leads households to choose consumption functions that are concave in their own wealth.

HANK models teach us that with active fiscal policy and passive monetary policy, uniqueness of equilibrium does not rely on the household transversality condition and so is more robust than in HANK models. This matters because there are important questions for which it is useful to study outcomes under the

[14]See Kaplan (2025) for further details.

assumption of active fiscal and passive monetary policy, including the effects of interest rate hikes without a coordinated fiscal response (Implication 6), and unbacked fiscal expansions (Implication 7).

Implication 5: Equilibria are Unique Under a Wider Class of Fiscal and Monetary Rules

There are fiscal and monetary rules under which the price level and inflation are uniquely determined in HANK models, but are not in RANK models. Hagedorn (2021) emphasizes a series of examples that build on Bewley (1986) and leverage the upward sloping steady-state asset supply curve in HANK models. Consider a fiscal rule in which the fiscal authority commits to a particular path for nominal debt B_t, and passively raises whatever real transfers are required to satisfy its budget constraint at the prevailing price level. This is an example of a Ricardian fiscal policy in the language of Woodford (1995), and so falls outside of the FTPL. This fiscal rule leads to multiple equilibria in RANK models but a unique equilibrium in HANK models. To understand the source of the difference it is simplest to consider a flexible price endowment economy in which the monetary authority pegs the nominal rate at $\bar{i}$ and the fiscal authority commits to a constant growth rate of nominal debt $g_B = \frac{\dot{B}_t}{B_t}$.

Consider first a representative agent economy. In any equilibrium the real rate is equal to the household discount factor $r_t^* = \rho$ at all times, so the inflation rate is constant and uniquely determined as $\pi^* = \bar{i} - \rho$. A steady-state for real government debt requires that $\frac{\dot{b}}{b} = g_B - \pi^* = 0$ and so the only fiscal rule for which a steady-state equilibrium can exist is one in which $g_B = \pi^* = \bar{i} - \rho$. Hence there is a joint constraint on fiscal and monetary policy: only combinations of $(g_B, \bar{i})$ that satisfy $g_B = \bar{i} - \rho$ are consistent with a stationary equilibrium. Moreover even if monetary and fiscal policy coordinate in this way, the initial price level P_0 in the resulting equilibrium is not uniquely determined because the steady-state government budget constraint (2) restricts only that $s^* = \rho b^*$. There are a continuum of different levels of steady-state surpluses s^* and real debt b^* that are consistent with equilibrium. The initial nominal debt B_0 is pre-determined, but the initial price level P_0 is not determined because different initial price levels are associated with different levels of real debt.

In a heterogenous agent economy with the same fiscal and monetary rules, not only can the two authorities independently set the growth rate of nominal debt g_B and the nominal interest rate $\bar{i}$, but for any such specification of policies, the initial price level is uniquely pinned down. The steady-state of the government budget constraint still implies that in a steady-state equilibrium the inflation rate is determined by the growth rate of nominal debt $\pi^* = g^B$. For a given nominal interest rate $\bar{i}$, the asset market clearing condition (1) then requires that

$$a^s\left(\bar{i} - g_B\right) = \frac{s^*}{\bar{i} - g_B}. \tag{13}$$

This uniquely determines the steady-state level of real surplus s^* as the level needed to finance the interest payments on government debt implied by the level of debt households are willing to hold at the interest rate $r^* = \bar{i} - g_B$. This level of debt $b^* = a^s\left(\bar{i} - g_B\right)$ is pinned down by the strength of households' precautionary savings motives, whereas it is indeterminate in a representative agent model. Given initial nominal debt B_0, this uniquely determines the initial price level P_0. The same logic can be readily extended to determine inflation in sticky price economies with production and more general fiscal and monetary rules. This approach has been used, for example, by Hagedorn et al. (2019b) to study forward guidance, and Hagedorn et al. (2019a) to study the size of government spending multipliers.

There are also other fiscal rules for which the uniqueness properties differ between HANK and RANK models, including ones in which the fiscal rule involves only real variables. These leverage the failure of Ricardian equivalence among households. Consider, for example a monetary rule that sets a nominal peg, and a fiscal authority that commits to a fixed level of surpluses $\bar{s}$, but only as long as real government debt does not deviate too far from a target level $\bar{b}$. If debt does deviate too far, then the government commits to bring debt back to its steady-state level via appropriate adjustment of surpluses using a rule like (6).[15] Such a fiscal policy is Ricardian in the sense of Woodford (1995) and implies that debt always remains bounded. In a RANK model, the dynamics of government debt decouple from the dynamics of output and inflation as described in the previous section, and since the household transversality condition holds for all paths of inflation (assets are bounded), there are multiple equilibria, including multiple equilibria that are local to the steady-state. FTPL does not apply. However, in a HANK model, the equilibrium is locally unique because the dynamic system remains fully coupled. There is a unique path of inflation, output and debt in the neighborhood of the steady-state that is consistent with equilibrium.[16]

HANK models teach us that there are plausible configurations of monetary and fiscal policies which deliver a unique equilibrium in HANK models but not in RANK models.

Implication 6: With Short-Term Debt, Raising Nominal Rates Without a Fiscal Contraction Raises Inflation

In the absence of a fiscal contraction, a temporary increase in the nominal interest rate cannot persistently lower inflation. And in an economy in which the government issues short-term debt, a temporary increase in the nominal interest rate without a fiscal contraction must *raise* inflation, not lower it. With long-term debt inflation can fall, but only temporarily, and eventually must rise above its initial level. This is the phenomenon that Sims (2011) calls "stepping on a rake" and Cochrane (2024) calls "unpleasant interest rate arithmetic".

This point is not about HANK models *per se*. It holds also in RANK models and has been clearly articulated by Sims (2011) and Cochrane (2024). Nonetheless because of its profound importance for our understanding of monetary policy and inflation, I feel compelled to include it. Moreover, two features of the argument make it more difficult to avoid in a heterogeneous agent economy than in a representative agent economy. First, it relies on a non-zero level of steady-state government debt $b^* > 0$, and a unique steady-state equilibrium to which the economy returns after a temporary shock. Second, the thought experiments underlying this insight are most easily articulated in the context of an active fiscal and passive monetary regime and so even though this point does not depend on the FTPL, it has become associated with FTPL and consequently ignored by those who find FTPL controversial. However, as I explained in Implication 4, those controversies are largely avoided in HANK models; and the assumption of a unique, positive steady-state level of real debt falls naturally from the economic environment. In HANK models, Sims' and Cochrane's arguments are even harder to avoid.

[15] The fiscal rule I have described is not recursive in current real variables because surpluses depend on the history of government debt, in particular whether it has previously exited the specified interval around $\bar{b}$.

[16] Establishing global uniqueness is more involved and whether it holds depends on other properties of the economy. My point is simply that the different economic forces in HANK and RANK can lead to different implications of certain fiscal and monetary rules for the nature and set of equilibria.

The result follows from the government budget constraint. Integrating the government budget constraint (2) forward from a steady-state at $b_0 = b^*$ and imposing that the economy eventually returns to the same steady-state $\lim_{t\to\infty} b_t = b^*$ delivers an integral restriction on the joint time path of inflation, nominal rates and primary surpluses that must hold in any equilibrium

$$\int_{t=0}^{\infty} r^* e^{-r^* t} e^{-\int_{\tau=0}^{t}\left(\hat{i}_\tau - \hat{\pi}_\tau\right)d\tau} \frac{s_t}{s^*} dt = 1, \tag{14}$$

where $\hat{i}_t$ and $\hat{\pi}_t$ are paths of deviations of nominal interest rates and inflation from steady-state. This equation holds in *any* equilibrium in which the economy starts at a steady-state with a non-zero level of real government debt and returns to the same steady-state, regardless of what type of fiscal and monetary rules are used to implement the equilibrium. This is why the point does not rely the FTPL, nor active vs passive fiscal rules, but rather on the fact that $b^* > 0$ and is unique. Note that term $r^* e^{-r^* t} = \omega(t) > 0$ is a non-negative weighting function that integrates to 1.

Now consider a temporary increase in the nominal rate that decreases smoothly and returns to steady-state, so that $\hat{i}_t > 0$ and for some $T > 0$, $\hat{i}_t = 0\ \forall t \geq T$. Assume there is no change in fiscal policy so that $s_t = s^*$. The integral condition reduces to a restriction on a weighted average of cumulative gross real rates,

$$\int_{t=0}^{\infty} \omega(t)\, e^{-\int_{\tau=0}^{t}\left(\hat{i}_\tau - \hat{\pi}_\tau\right)d\tau} dt = 1. \tag{15}$$

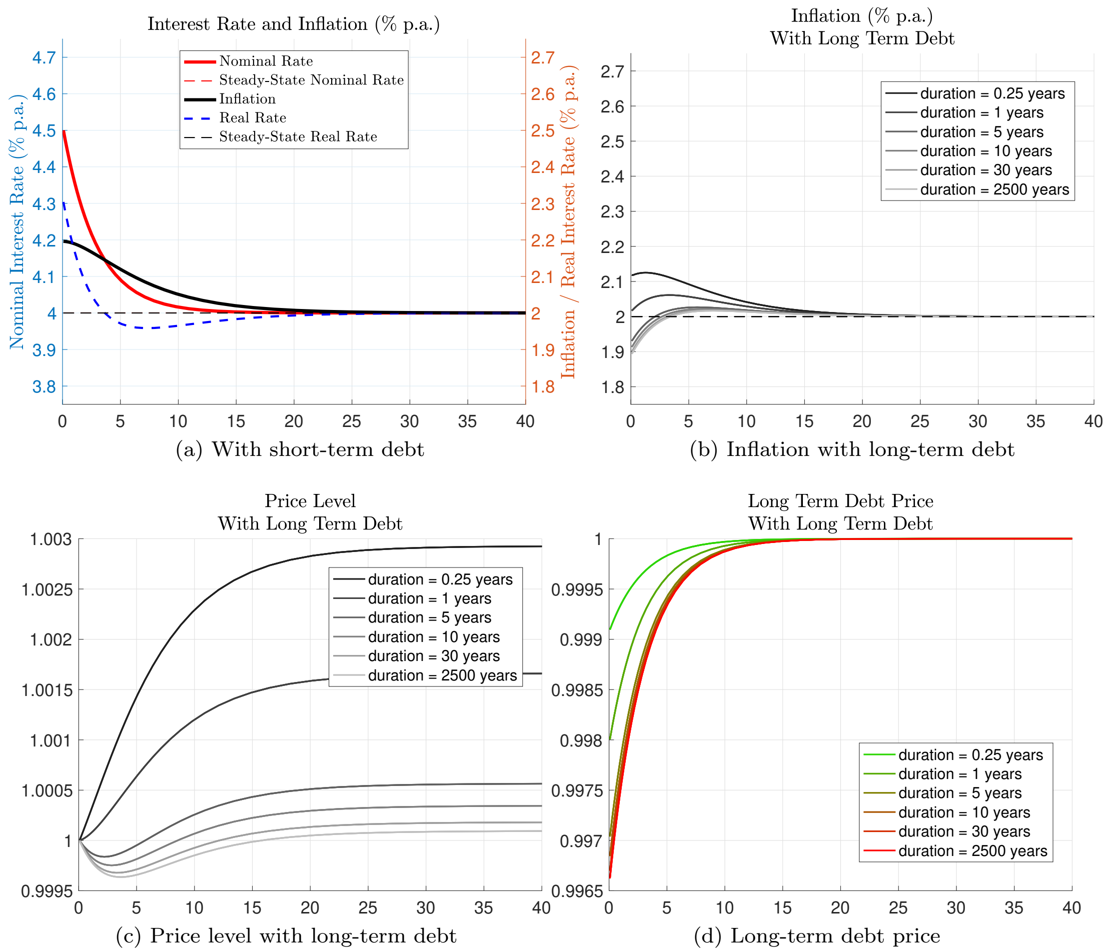
A consequence of (15) is that the price level cannot remain below its steady-state level indefinitely. Eventually, the price level must be at least as high as it would have been absent the rate hike. Formally, there is some time $\hat{t} > 0$ such $0 < \int_{\tau=0}^{\hat{t}} \hat{i}_\tau d\tau \leq \int_{\tau=0}^{\hat{t}} \hat{\pi}_\tau d\tau$. To see why, assume this were not the case. Then the cumulative deviation in real rates would have to be positive at all horizons $\int_{\tau=0}^{t}\left(\hat{i}_\tau - \hat{\pi}_\tau\right)d\tau > 0\ \forall t$, and hence $e^{-\int_{\tau=0}^{t}\left(\hat{i}_t - \hat{\pi}_t\right)d\tau} > 1$ for all t. But then it would not be possible that a weighted average over time is equal to 1, which is a contradiction. So temporarily raising nominal rates cannot persistently lower inflation.

The difficulty in generating a a persistent fall in inflation can be seen more starkly in an approximation to the government budget constraint for small deviations in nominal rates and inflation. In this case the restriction on the path of real rates in (14) implies that a weighted average of real rate deviations must must be zero (see Cochrane (2024)),

$$\int_{t=0}^{\infty} \omega(t) \left(\hat{i}_t - \hat{\pi}_t\right) dt = 0. \tag{16}$$

Since the weighting function $\omega(t)$ declines exponentially fast, and since $\hat{i}_t$ is positive and declining, a negative inflation deviation early on would need to be offset by even larger and more persistent positive inflation deviations later on. The simplest way for this restriction to hold is for inflation to rise on impact, but less than the increase in nominal rates, so that the real rate initially rises, and then returns to steady-state more slowly than the nominal rate so that the real rate then falls below steady-state. Indeed, this is what happens in every simulation I have encountered and I am not aware of any simulations from a RANK or HANK model with (non-zero) short-term debt in which inflation falls on impact of temporary nominal rate hike, absent a fiscal contraction.

The top left panel of Figure 1, taken from Cochrane et al. (2025), illustrates these effects. It shows the



(a) With short-term debt

(b) Inflation with long-term debt

(c) Price level with long-term debt

(d) Long-term debt price

Figure 1: Example of 50bp p.a. increase in nominal rate with no change in surpluses in HANK model. From Cochrane et al. (2025).

impulse response to a temporary 50 basis point leaving fiscal surpluses unchanged from a standard one-asset HANK model. On impact, the real rate rises by around 30 basis points and inflation by around 20 basis points.

What goes wrong with the usual intuition from New Keynesian models that a temporary rate hike lowers inflation by raising real rates and depressing household spending? That intuition comes from a thought experiment involving an innovation to a Taylor rule for monetary policy and a passive fiscal policy rule of the type in (6). On impact of the shock, the real interest rate indeed rises, but that causes real debt to rise above its steady-state level. The fiscal authority responds to this increase in debt by raising primary surpluses. It is this fiscal contraction that causes inflation to fall, not the rise in nominal rates. Moreover, the fiscal contraction needed for inflation to fall is large, much more than is needed to meet the additional interest payments on outstanding debt from higher rates. In Cochrane et al. (2025) we report simulations for various types of monetary and fiscal rules to illustrate these effects. Even for fiscal rules that stabilize real debt but adjust surpluses to meet the higher interest payments, inflation rises substantially on impact. It is only because in the standard New Keynesian experiment, primary surpluses rise by much more than this, that inflation falls. Indeed, in the presence of such a fiscal contraction, the rate hike itself does nothing to lower inflation, and inflation would be lower without the rate hike.

Sims (2011) and Cochrane (2023) point out that if the government issues long-term debt then it may be possible for a rate hike to lower inflation without a fiscal contraction, but only temporarily and only at the expense of higher inflation later on, such that eventually the price level is permanently higher than it would otherwise be. To see how this works, assume that the government issues a long-term nominal bond, rather than a short term bond, with a geometric maturity structure whose rate of maturity is δ. I continue to denote the real value of outstanding government debt by b_t but now denote the real price of these bonds (i.e. the price in terms of goods) as Q_t^δ and the quantity of outstanding bonds as B_t^δ. The integrated government budget constraint becomes

$$\int_{t=0}^{\infty} \omega(t)\, e^{-\int_{\tau=0}^{t}\left(\hat{i}_t-\hat{\pi}_t\right)d\tau} dt = \frac{Q_0^\delta}{Q^*}. \tag{17}$$

An increase in the nominal rate as described above leads to an immediate fall in the price of long-term bonds Q_0^δ, the size of which depends only on the path of nominal rate. Because the right hand side of (17) is less than one, the argument given above for short term debt does not hold. It is possible that inflation may fall on impact, and indeed it typically does for long maturity debt. To see why, it is easiest to consider a flexible price representative agent model. The present value of government debt is

$$\frac{Q_0^\delta B_0^\delta}{P_0} = \frac{\bar{s}}{\rho},$$

With no change in surpluses, this value is unchanged by a period of higher nominal rates. With short-term debt, there is no change in Q_0^δ and so no change in the initial price level P_0, but subsequent inflation is higher since $\pi_t = i_t - \rho$. With long-term debt, the price of bonds Q_0^δ falls on impact and so the price level P_0 must also fall on impact to keep the real value of debt unchanged. With sticky prices, this initial fall in the price level manifests as a period of disinflation before which higher inflation eventually takes over.

Even with long-term debt, eventually inflation must rise back above steady-state and the ultimate rise in the price level will be above, not below steady-state. This is why Sims (2011) calls this mechanism "stepping on a rake". One way to see why this must happen is to consider the analogous integral restriction to 16 for the case with long-term debt (see Cochrane (2024)),

$$\int_{t=0}^{\infty} \omega(t) \left(\left(1-e^{-\delta t}\right)\hat{i}_t - \hat{\pi}_t \right) dt = 0. \tag{18}$$

With short term debt ($\delta \to \infty$), this collapses to (16). With perpetual debt ($\delta = 0$), the restriction imposes that the weighted average inflation deviations must be zero $\int_{t=0}^{\infty} \omega(t)\, \hat{\pi}_t dt = 0$. Therefore in both cases, and any in between, lower inflation early on must be compensated for with higher inflation later.

The remaining panels of 1 illustrate these effects. They show impulse responses to the same path of nominal rates under different assumptions about the duration of government debt. With durations of a year or more, inflation falls on impact, but then rises above its steady-state level and the cumulative effect on the price level leaves it higher than before the rate hike.

HANK models teach us that the insights from Sims (2011) and Cochrane (2024) on the effects of nominal interest rates on inflation are not a curiosity associated with FTPL, but instead are a robust feature of any reasonable model with government debt. Without a fiscal contraction, interest rate policy can at best change the timing of inflation, via its effects on the market value of government bonds, and a rate hike cannot persistently lower inflation.

Implication 7: Unfunded Fiscal Stimulus is More Inflationary in HANK

Unfunded fiscal stimulus, such as a fiscal helicopter drop or a temporary reduction in primary surpluses, is more inflationary in HANK than in RANK.

To understand why, it is useful to recap the effects of unbacked fiscal expansion in a flexible price endowment economy. Consider a policy in which the government issues an amount of new nominal debt equivalent in value to a fraction Δ of its outstanding debt, and uses the proceeds to make a one-time lump sum transfer to households. Importantly, the government commits to not increasing future surpluses. The amount of debt immediately after the policy is $B_0 = B^* (1 + \Delta)$. In a representative agent economy, the present value government budget constraint before and after the change is

$$\frac{B^*}{P^*} = \frac{\bar{s}}{\rho} = \frac{B^* (1 + \Delta)}{P_0}$$

The effect of the stimulus is an immediate jump in the price level of an amount of Δ so that $P_0 = P^* (1 + \Delta)$, with no change in any real variables or inflation. In sticky-price models this manifests as an inflationary boom in which inflation temporarily rises above its steady state level and the cumulative increase in the price level in the new steady state is exactly Δ.

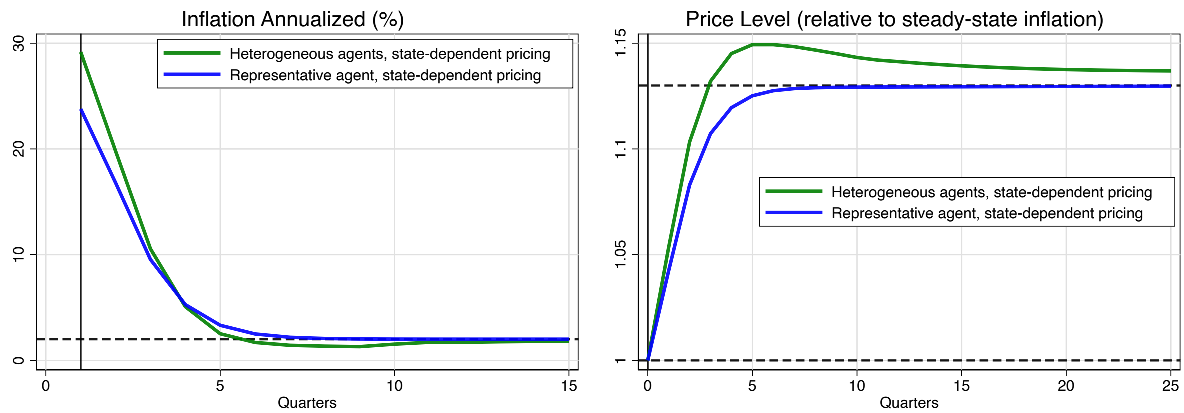
In HANK models there is an additional force that leads to more short-run inflation and a larger cumulative increase in the price level that arises because of MPC heterogeneity and real redistribution. The fiscal helicopter drop gives each household an additional amount of nominal resources ΔB^*. If the price level were to immediately jump to $P_0 = P^* (1 + \Delta)$, the net change in real resources for a household j would be

$$b_{j,0} - b_j^* = -\frac{\Delta}{1 + \Delta} \left(b_j^* - b^* \right).$$

Households with higher initial wealth than the average ($b_j^* > b^*$) would suffer a fall in real wealth, and vice-versa. Intuitively, the fiscal helicopter drop gives real resources to households in an additive way, but the rise in the price level takes real resources away from households in a multiplicative way. A household with the average wealth in the economy would be unaffected for the same reason that the representative agent is unaffected by the same experiment in a RANK model.

The net result would be real redistribution from high-wealth households to low-wealth households. But because low-wealth households have higher MPCs than high-wealth households, overall spending would increase. This puts additional upward pressure on the price level. For the goods market to clear, a period of higher real interest rates is required to offset this additional spending pressure. With no change in the nominal rate the higher real rate means lower future inflation, implying that the price level must jump higher on impact than in the representative agent economy. With sticky prices the higher initial price jump manifests as an overshooting of inflation in the immediate wake of the stimulus, followed by lower subsequent inflation.

Figure (2), from Kaplan and Miyahara (2025), illustrates these different dynamics in response to a temporary increase in uniform lump-sum transfers in RANK and HANK economies. The left panel shows that inflation is initially substantially higher in the HANK economy but then drops below the RANK economy. The right panel shows that the lower future inflation is not enough to offset the higher inflation



(a) GDP, Heterogeneous Agents

(b) Inflation, Heterogeneous Agents

Figure 2: From Kaplan and Miyahara (2025). Impulse response to an increase in uniform lump-sum transfers, equivalent to 13% of outstanding government debt.

early on and the cumulative increase in the price level is larger in the HANK economy.[17]

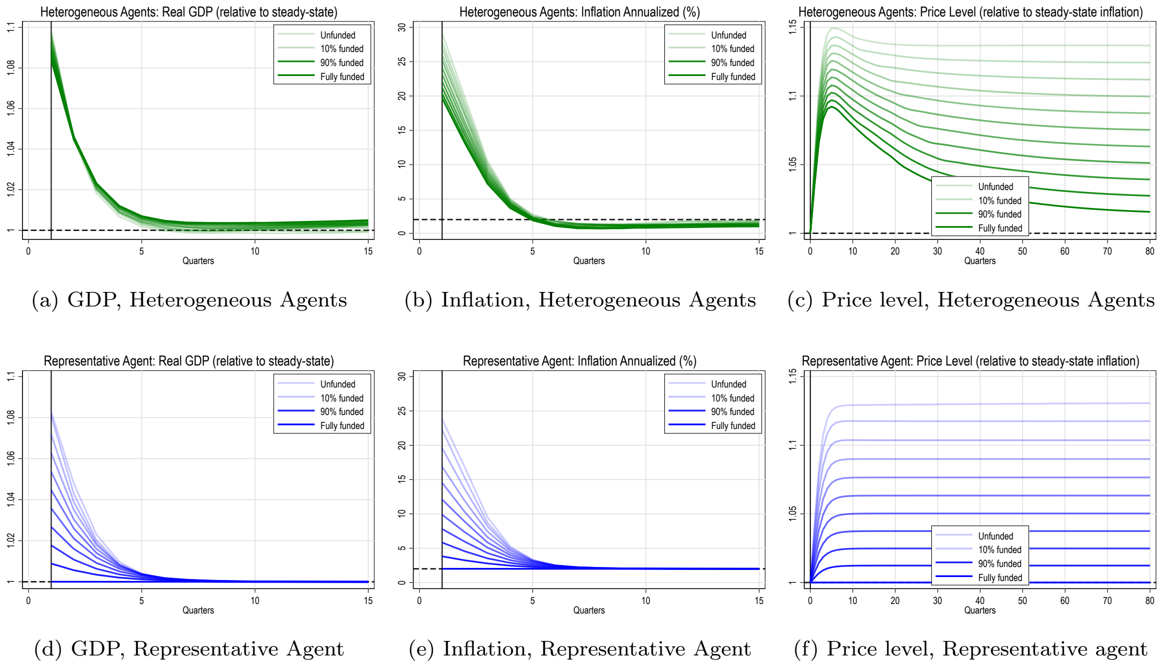
A corollary is that the specifics of how unfunded fiscal stimulus is targeted matters for the short-run inflation (and hence output) response in HANK. The more targeted are the transfers to households with high MPCs, the stronger is the additional upward pressure on spending and the more inflation and output rise in the short term. Taking the logic one step further, even purely redistributive shocks that entail no change in debt or surpluses affect inflation.

HANK models teach us that the real redistribution caused by unfunded fiscal stimulus is an important additional source of inflation, even when stimulus payments are distributed equally to all households. Both the short and long run effects on prices are larger when fiscal stimulus is targeted towards households with high MPCs.

Implication 8: Even Fully Funded Fiscal Stimulus is Inflationary

In RANK models, fiscal stimulus payments that the government commits to eventually repay with higher non-distortionary taxes or lower transfers have no effect on either inflation or the real economy. This is a well-known implication of Ricardian equivalence. In plausibly calibrated HANK models, departures from Ricardian equivalence are large, and the same policy can have substantial short-run effects on both inflation and the real economy. The further in the future are the required fiscal adjustments, the stronger are the short-run effects on output and inflation. For a fiscal rule with a sufficiently delayed increase in taxes, the short run effects of fully-funded stimulus approach those of unfunded stimulus. It follows that in HANK economies, very little can be learned from the short run response of output and inflation about the extent to which households and firms expect the government to eventually raise future surpluses versus allowing the additional debt to be inflated away.

[17] The reason why the price level increases by more than Δ in the long run is that it is the present value of future inflation that must integrate to Δ (see equation (14)). Since inflation rises more early on in the HANK economy the cumulative increase in the price level is larger.



(a) GDP, Heterogeneous Agents (b) Inflation, Heterogeneous Agents (c) Price level, Heterogeneous Agents

(d) GDP, Representative Agent (e) Inflation, Representative Agent (f) Price level, Representative agent

Figure 3: From Kaplan and Miyahara (2025). Impulse response to an increase in uniform lump-sum transfers, equivalent to 13% of outstanding government debt, for different degrees of funding in 10% increments from unfunded to fully funding. Funding is implemented by reductions in lump-sum transfers commencing after 5 years. Model includes state-dependent pricing.

Figure 3, taken from Kaplan and Miyahara (2025), shows the output and inflation response to a uniform increase in lump-sum transfers equivalent to 13% of steady-state debt under different assumptions about the fraction of the stimulus that the fiscal authority intends to repay. The funded component is repaid by a reduction in lump-sum transfers that starts 5 years after the initial shock, and follows the surplus rule in (6). The figures show that even for fully funded stimulus programs there is a large short run effect on output and inflation in the HANK model, whereas there is no effect at all in the RANK model. However, the figures also reveal the effect of the stimulus is temporary and is followed by a prolonged period of disinflation, as well as a recession when the debt starts being repaid. The long run effect on the price level is much smaller than the initial surge in inflation although there is a permanent effect on prices. It remains the case that the most important factor determining the long run impact of the fiscal stimulus on the on the price level is the extent to which it is funded.

HANK models teach us that fiscal stimulus payments can generate substantial short-run inflation even when fully funded by higher future surpluses. By changing nominal interest rates, monetary policy can affect the timing of this inflation. But ultimately, the cumulative impact on prices is determined by the extent of financing via higher real surpluses.

Implication 9: Fiscal Transfers Can Substitute for Monetary Policy in the Aggregate

In HANK models, fiscal transfers can be used to replicate monetary policy in ways it cannot in RANK models. Wolf (2024) shows that "any path of inflation and output that is implementable via interest rate policy is also implementable through time-varying uniform transfers". Previous work by Correia et al. (2013) has shown in RANK economies that time-varying paths of proportional taxes on consumption and labor can be used to replicate the effects of paths of interest rates, thereby circumventing constraints on monetary policy from the zero lower bound. Such results apply in HANK economies too, but Wolf (2024) shows that in HANK the same equivalence can be achieved with an even simpler set of fiscal policies that entail only lump sum transfers.

The result relies on the failure of Ricardian equivalence. The idea is to define a time-varying an aggregate consumption function $\mathcal{C}_t(\mathbf{i}, \tau, \mathbf{y}, \pi)$ that takes as its input a path of nominal interest rates $\mathbf{i} = \{i_t\}$, a path of fiscal transfers, $\tau = \{\tau_t\}$, a path of inflation $\pi = \{\pi_t\}$ and a path of aggregate output $\mathbf{y} = \{y_t\}$ by aggregating the consumption decisions of individual households. Inflation enters because together with nominal interest rates it determines the real rates that households face. Aggregate output enters because the economy is constructed so that the path of output determines the stochastic process for labor income that households face.

In an economy without investment, the aggregate resource constraint implies that $\mathcal{C}_t(\mathbf{i}, \tau, \mathbf{y}, \pi) = y_t$. Wolf (2024) provides conditions, which he refers to as “strong Ricardian nonequivalence” such that the set of paths for aggregate inflation and output consistent with this equation that are spanned by interest rate paths, is the same as that spanned by paths of budget feasible fiscal transfers. This is not possible in RANK models because of Ricardian equivalence. The analogous consumption function in RANK depends only on the present value of transfers implied by τ, and not on the individual elements of the time path of transfers.[18]

One important caveat is that the equivalence between fiscal stimulus policy and monetary policy extends only to aggregate outcomes. The distributional, and hence welfare, implications of the two types of policies are potentially very different. Seidl and Seyrich (2023) go a step further and show that with a different set of fiscal instruments - time-varying consumption and labor taxes, and government debt - fiscal policy can be a perfect substitute for monetary policy not just in the aggregate, but household by household. The idea builds off the results in Correia et al. (2008) and Correia et al. (2013) who show that in RANK models, consumption and labor taxes can substitute for interest rate policy. However, in HANK models, the required tax policies induces a different pattern of redistribution relative to the interest rate policy. Seidl and Seyrich (2023) show that by simultaneously changing the time path of government debt, this redistribution can be undone and the two policies made equivalent. The fact that changes in the path of government debt can be used to affect real allocations relies on the failure of Ricardian equivalence.

HANK teaches us that time-varying fiscal policies are an alternate set of policy tools to influence aggregate and distributional outcomes that can overcome the constraints on monetary policy imposed by the zero lower bound.

[18] In economies with investment, stimulus payments need to be complemented with other policies that influence the time path of investment in order to replicate the effects of interest rate policy.

Conclusion

The interconnectedness of monetary and fiscal policies is an inescapable feature of macroeconomic models that has profound importance for how we design and implement these polices in the real world. I have illustrated nine implications of these interactions that are particularly salient in HANK models, although many are features of other models as well.

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