Comment on "Economic Impact Payments and Household Spending During the Pandemic" Brookings Papers on Economic Activity, Fall 2022

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The last two decades have witnessed a revolution in how macroeconomists model household savings and consumption. Gone is the representative agent, with its infinite horizon and low marginal propensity to consume. In its place, we now have households subject to incomplete markets and credit constraints, with shorter effective horizons and much higher marginal propensities to consume. The macro consequences of this shift are profound: monetary policy works through different channels, and deficit-financed fiscal policy is vastly more powerful.

This revolution has been driven in part by an influential series of empirical papers documenting high marginal propensities to consume out of unexpected income shocks. Chief among these are two papers studying the 2001 and 2008 stimulus payments in the United States, Johnson, Parker and Souleles (2006) and Parker, Souleles, Johnson and McClelland (2013).

The recent pandemic brought similar payments, but at a vastly larger scale: the three Economic Impact Payments (EIPs) in 2020–21 totaled about $800 bilion, whereas the 2008 program paid about $120 billion in 2020 dollars, and the 2001 program was smaller still. In light of the first two papers' influence, it is only natural to pursue a similar study of the new, far larger payments, and I am delighted these authors—two of whom worked on the first two papers—have taken up the challenge.

And it *is* a challenge, because the key source of identification for previous studies—random variation in the timing of disbursement—is now virtually absent. Instead, the authors must rely on variation in the receipt and amount of EIPs, both of which are non-random and determined by variables like income and number of children. If these variables are correlated with fluctuations in consumption that happened for some other reason—quite conceivable in the volatile pandemic environment—then clean identification is in doubt.

The authors, of course, are aware of this challenge, and rise to the occasion. Their major conclusion, which I think is quite credible, is that the short-term spending response to the 2020–21 EIPs was smaller than for the stimulus payments 2001 and 2008.

One notable aberration is that the authors find seemingly no effect for the third EIP: none of the estimates are statistically significant, and the point estimate on the cumulative two-quarter effect on all Consumer Expenditure Survey goods and services (Table 4) is actually negative. I suspect that this strange result stems from the fact that the effects of the second and third EIPs are not separately identified: the two EIPs happened in short succession and had broadly similar eligibility criteria and phase-out rules. Some of the effect of the third EIP, therefore, is likely being assigned to the second EIP instead, which has a rather high point estimate for the two-quarter overall MPC (0.601).

If we adjust for this issue, however, the paper's core message remains intact: MPCs out of the 2020–21 payments, though still far too high to be consistent with a permanent income model, were lower than the corresponding MPCs in 2001 and 2008. In the remainder of this discussion, I will explore the macroeconomic implications of this finding. In particular, I ask: if MPCs out of these payments were lower in the first few quarters, does that mean the payments had a smaller effect on aggregate demand? Or was this effect merely *delayed*? If the latter, perhaps the payments contributed to the surge in excess demand and inflation experienced over the last year and a half.

To help answer these questions, I outline a simple theoretical framework for the dynamics of household consumption following a government transfer. This framework provides several general insights into fiscal transmission—for instance, that "excess savings" following a transfer dissipate more slowly than a partial equilibrium view would imply, leading to a more persistent output effect. I then perform an experiment where I temporarily decrease MPCs following the transfer, consistent with their apparent decline in the data, and show how this results in a *delayed* output effect from the transfer. Finally, I discuss two possible deficiencies in my framework: the lack of long-term savings, and the lack of inelastic asset markets. Accounting for the former might decrease the output effect of a transfer, but the latter works in the opposite direction, introducing a new and potentially powerful channel of transmission to aggregate demand.

Theoretical framework

I now sketch a simple framework for the propagation of fiscal transfers in a population featuring limited heterogeneity, with different household types $i = 1, \dots, N$. This is a discrete-time version of the continuous-time framework in Auclert, Rognlie and Straub (2023), which has many of the same results, along with some extensions. All variables are in level deviations from steady state.

Assume that if household i's cash on hand in period t—including both assets from the previous period and income this period—increases by x_t, then the household will consume an additional $mpc_i x_t$, where $mpc_i \in [0, 1]$ is some type-specific constant.[1] Households are myopic and do not anticipate that future income or taxes will deviate from steady state. The steady-state real interest rate is $r = 0$, and the central bank sets its policy rate to maintain $r_t = r = 0$ in all periods, neither stimulating nor contracting demand.[2] Nominal wages are rigid, production is linear in labor, and at the margin households are forced to supply extra labor hours to fulfill any increase in demand. As a result, if total goods demand increases from steady state by y_t, the income of each household i increases by $\theta_i y_t$, for some $\theta_i > 0$ satisfying $\sum_{i=1}^{N} \theta_i = 1$.

Assume further that household type N is "Ricardian" with $mpc_N = 0$, which is the MPC consistent with a permanent-income household on its Euler equation in the limit $r \to 0$ and $\beta \to 1$. When this household receives additional income, it saves that income forever. All other households, in contrast, are assumed to be "non-Ricardian", with $mpc_i > 0$. The Ricardian household can be interpreted either as a wealthy infinite-horizon household, or as a proxy for other recipients of marginal spending that are unlikely to spend domestically out of their receipts, such as the government or foreigners.

Finally, coming into period 0, assume that the government makes type-specific transfers ("EIPs"), which effectively increase the initial asset positions $a_{i,-1}$ of each household type. It rolls over the increased debt from these transfers forever at the real interest rate $r = 0$.

[1] This can be microfounded as the first-order solution to a model with concave utility in assets; see Auclert et al. (2023).

[2] These assumptions facilitate a pen-and-paper solution of the model. As Auclert et al. (2023) shows, relaxing them—by introducing rational expectations of income or monetary policy that raises real interest rates in a boom—tends to shrink and shorten the demand effects of a transfer. On the other hand, monetary policy that cuts real interest rates in a boom—for instance, because it is at the ZLB and inflation rises—amplifies the demand effects.

The evolution of this economy away from steady state is summarized by the equations

$$y_t = \sum_i mpc_i(a_{it-1} + \theta_i y_t) \tag{1}$$

$$a_{it} = (1 - mpc_i)(a_{it-1} + \theta_i y_t) \tag{2}$$

where, again, both y_t and a_{it} denote deviations from steady state in levels. The increase in cash on hand—assets and income—for household type i is $a_{it-1} + \theta_i y_t$, of which the household consumes mpc_i. Summing these increments to goods demand across all i gives output y_t in equation (1). Equation (2) then gives the evolution of assets: at the end of period t, household type i saves the unconsumed portion of cash on hand as assets a_{it}.

There are several ways to solve for equilibrium in this model. First, we can solve (1) for each t sequentially, obtaining

$$y_t = (1 - mpc)^{-1} \sum_i mpc_i a_{it-1} \tag{3}$$

where we define $mpc \equiv \sum_i \theta_i mpc_i$ to be the average MPC out of marginal income, and then plug y_t into (2) to obtain assets for the next period. This is a period-by-period Keynesian multiplier, where the impulse $\sum_i mpc_i a_{it-1}$ to spending is amplified by $(1 - mpc)^{-1}$.

Alternatively, we can take $a_{i,-1}$ and the sequence $\{y_t\}$ to be exogenous, iterate on (2) to obtain the implied sequence of assets, and then calculate the implied sequence of consumption $c_{it} = mpc_i(a_{it-1} + \theta_i y_t)$. If there is a shock to income $\theta_i y_s$ at date s, then coming into date t, a fraction $(1 - mpc_i)^{t-s}$ of that income will remain, of which mpc_i will be spent at date t. The matrix $\mathbf{M}_i$ that maps sequences of income $\{\theta_i y_s\}$ to consumption $\{c_{it}\}$ therefore has entries $M_{i,ts} = mpc_i(1 - mpc_i)^{t-s}$ for $t \geq s$ and $M_{i,ts} = 0$ for $t < s$. Aggregating across all households i, the matrix mapping $\{y_s\}$ to $\{c_t\}$ is then $\mathbf{M} \equiv \sum_i \theta_i \mathbf{M}_i$. This is the matrix of *intertemporal MPCs* introduced by Auclert, Rognlie and Straub (2018).

Defining $c_{it}^{PE} \equiv M_{i,t0} a_{i,-1}$ to be household i's "partial equilibrium" consumption response to the fiscal shock—the path of consumption ignoring any changes in aggregate $\{y_t\}$—and aggregating to $c_t^{PE} \equiv \sum_i c_{it}^{PE}$, equilibrium output is characterized by an *intertemporal Keynesian cross*

$$\mathbf{y} = \mathbf{M}\mathbf{y} + \mathbf{c}^{PE} \tag{4}$$

where $\mathbf{y}$ and $\mathbf{c}^{PE}$ are vectors stacking the sequences $\{y_t\}$ and $\{c_t^{PE}\}$. In this case, it turns out that the solution to (4) is given by

$$\mathbf{y} = (\mathbf{I} + \mathbf{M} + \mathbf{M}^2 + \ldots)\mathbf{c}^{PE} \tag{5}$$

where $\mathbf{I}$ is the identity matrix. This is a direct intertemporal generalization of the traditional Keynesian multiplier process, where $1/(1 - mpc)$ is written $1 + mpc + mpc^2 + \ldots$.

Partial sums in (5) can be interpreted as "rounds" of general equilibrium adjustment. $\mathbf{c}^{PE}$ alone is partial equilibrium spending; $(\mathbf{I} + \mathbf{M})\mathbf{c}^{PE}$ takes into account that this spending creates additional income, which is spent; $(\mathbf{I} + \mathbf{M} + \mathbf{M}^2)\mathbf{c}^{PE}$ takes into account the income created by that spending; and so on. After infinitely many rounds, this process converges to the general equilibrium $\mathbf{y}$.[3]

[3]For the general case covered in Auclert et al. (2018), this iterative process does not necessarily converge to a finite time path. Here, however, convergence is easy to prove, because the existence of Ricardian households $\theta_N > 0$ implies that the ℓ^1 norm of $\mathbf{M}$ is strictly less than 1.

Results about equilibrium. We can quickly derive several features of equilibrium, summarized below:

- *Result 1:* in the long run, the Ricardian household owns all the additional assets.
- *Result 2:* general equilibrium output $\mathbf{y}$ is greater than partial equilibrium spending $\mathbf{c}^{PE}$, and in the long run y_t decays at a slower rate than c_t^{PE}.
- *Result 3:* the cumulative output effect of the transfer is given by the simple formula:

$$\sum_{t=0}^{\infty} y_t = \theta_N^{-1} \sum_{i=1}^{N-1} a_{i,-1} \tag{6}$$

How do we derive these results? Result 1 follows from (3), which implies that y_t is bounded from below by $(1-mpc)^{-1}\left(\min_{i<N} mpc_i\right)\sum_{i<N} a_{it-1}$. Hence, given total non-Ricardian assets $\sum_{i<N} a_{it-1}$ coming into period t, y_t will be a strictly positive multiple of that, and a share $\theta_R y_t$ will be received by the Ricardian household and immobilized. Over time, this implies an exponential decline in total non-Ricardian assets, which "trickle up" (Auclert et al., 2023) to the zero-MPC Ricardian household. This is in line with empirical evidence showing that poorer households deplete their transfers more quickly than wealthy ones.

The first part of result 2, that $\mathbf{y}$ is larger than $\mathbf{c}^{PE}$, follows directly from (5). To understand the second part, note that if all households receive transfers coming into date 0, then c_t^{PE} asymptotically decays at a rate of $1-\min_{i<N} mpc_i$, corresponding to the non-Ricardian household with the lowest MPC. But in general equilibrium, this household will receive back the income from some of its own spending, and its assets will not decay as quickly.[4] This leads to a more persistent output effect.

Finally, result 3 comes from the fact that all assets transferred to non-Ricardian households must eventually end in the hands of the Ricardian household. In general equilibrium, this happens via increases in output, but only a fraction θ_N of increased output is earned by the Ricardian household, and hence cumulatively, output needs to increase by θ_N^{-1} times the extra assets held by non-Ricardian households.[5] Remarkably, (6) makes no reference to the MPCs of the non-Ricardian agents: all that matters for the *cumulative* output effect is that these MPCs are positive, so that any cash received is eventually spent.[6]

Applying the framework

Calibration. Now that the theoretical framework has been established, I will discuss quantification. I consider a case where there are only three household types. First, type 1 is "hand to mouth", with $mpc_1 = 1$. Second, type 2 has an intermediate $mpc_2 = 0.2$, and I call it a "target" household since it reverts to its steady-state asset target at a rate of 0.2 per quarter. Finally, type 3 is Ricardian, with $mpc_3 = 0$.

[4] Formally, we can condense (2)–(3) to get a law of motion $\mathbf{a}_t = (\mathbf{I} - \text{diag}(\mathbf{mpc}))(\mathbf{I} + (1-mpc)^{-1}\boldsymbol{\theta}\mathbf{mpc}')\mathbf{a}_{t-1}$, where we stack non-Ricardian households $i = 1,\ldots,N-1$ in bolded vectors. Perron-Frobenius implies that the matrix mapping $\mathbf{a}_{t-1}$ to $\mathbf{a}_t$ has a unique leading positive eigenvalue λ with positive eigenvector $\mathbf{v}$, which governs asymptotic decay. We can write the equation for this eigenvector as $(\lambda - (1-mpc_i))v_i = \frac{1-mpc_i}{1-mpc}\theta_i \sum_j mpc_j v_j$, and from positivity of $\mathbf{v}$ it follows that $\lambda \geq 1 - mpc_i$ for all i, and indeed that strictly $\lambda > 1 - mpc_i$ if there is any non-Ricardian agent with $mpc_i < 1$.

[5] Another interpretation is provided by the formula (5). Multiplying a sequence by the row vector of all ones, $\mathbf{1}'$, takes its sum. One can show that $\mathbf{1}'\mathbf{M}$ equals $(1-\theta_N)\mathbf{1}'$, since the entire income share $1-\theta_N$ received by non-Ricardian households is *eventually* spent. Multiplying (5) on the left by $\mathbf{1}'$, it becomes $\mathbf{1}'\mathbf{y} = (1 + (1-\theta_N) + (1-\theta_N)^2 + \ldots)\mathbf{1}'\mathbf{c}^{PE} = \theta_N^{-1}\mathbf{1}'\mathbf{c}^{PE}$. It is easy to show that $\mathbf{1}'\mathbf{c}^{PE} = \sum_{i=1}^{N} a_{i,-1}$, since the cumulative partial equilibrium increase in consumption equals the initial excess assets.

[6] Importantly, however, this result is sensitive to the assumption that the central bank holds the real rate r_t fixed. A rise in r_t provides another mechanism for moving assets from the non-Ricardian households to the Ricardian household, since the latter will generally increase net savings by more in response.

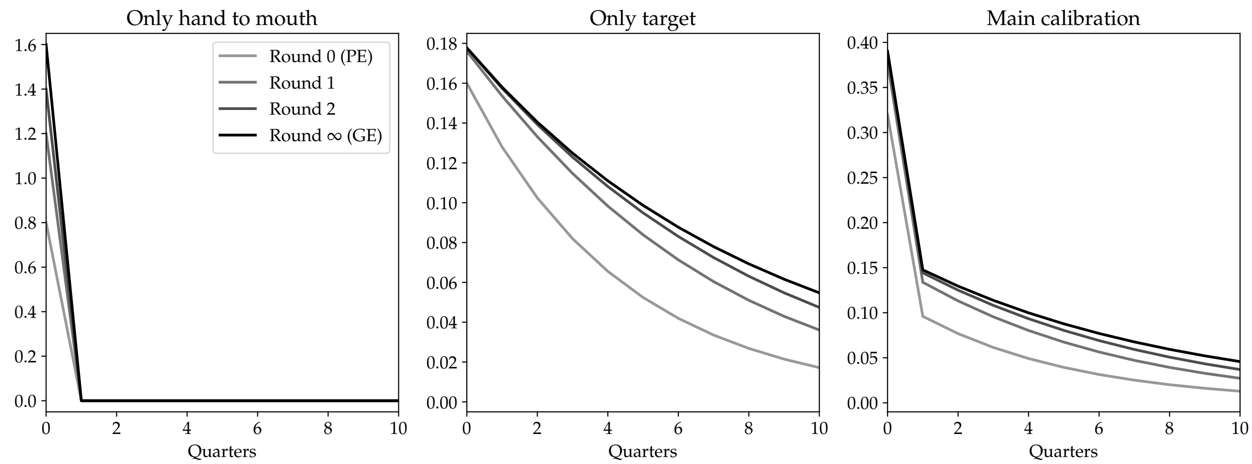

Figure 1: Output response to transfer by household calibration and general equilibrium "rounds"

My main calibration will feature all three of these types, with $\theta_1 = 0.1$, $\theta_2 = 0.4$, and $\theta_3 = 0.5$. In line with the broader interpretation discussed above, the high Ricardian share is intended to capture marginal recipients of aggregate spending that likely have a low or zero MPC: the government (through taxes), foreigners, some business profits, and a small fraction of labor earnings. If aggregate income increases at date t, these assumptions on θ_i imply an aggregate MPC in the first year, quarters t through $t+3$, of 0.34, and an aggregate MPC in the second year, quarters $t+4$ through $t+7$, of 0.10.

Assuming that only 0.1 out of the $\theta_3 = 0.5$ is earned by labor, we can normalize these intertemporal MPCs by total labor earnings 0.6, obtaining a first-year MPC of 0.56 and a second-year MPC of 0.16. Importantly, these are very close to the first two annual intertemporal MPCs, weighted by labor earnings, reported by Auclert et al. (2018) using data from Fagereng, Holm and Natvik (2021).

Finally, I assume that the transfer is relatively *progressive*: from the unit transfer, the non-Ricardian households receive a higher share $a_{i,-1}$ than their ordinary share of marginal income θ_i. In particular, $a_{1,-1} = 0.2$ and $a_{2,-1} = 0.6$.

Beyond the main calibration described so far, to better understand mechanisms I will also consider two related calibrations, both of which have only one non-Ricardian household: an "only hand-to-mouth" calibration where $\theta_1 = 0.5$, $a_{1,-1} = 0.8$, and $\theta_2 = a_{2,-1} = 0$; and an "only target" calibration where $\theta_2 = 0.5$, $a_{2,-1} = 0.8$, and $\theta_1 = a_{1,-1} = 0$. Note that in all these cases, since the allocation of both the transfer and marginal income between non-Ricardian and Ricardian households is the same, the *cumulative* output effect implied by (6) is identical.

Results. The three panels of figure 1 show the general equilibrium path of output $\mathbf{y}$ in the hand-to-mouth, target, and main calibrations. They also show the "rounds" of adjustment in (5) that converge to $\mathbf{y}$: the partial equilibrium round 0 $\mathbf{c}^{PE}$, round 1 $(\mathbf{I}+\mathbf{M})\mathbf{c}^{PE}$, and round 2 $(\mathbf{I}+\mathbf{M}+\mathbf{M}^2)\mathbf{c}^{PE}$. Output $\mathbf{y}$ itself can be viewed as round ∞, since it is the sum $(\mathbf{I}+\mathbf{M}+\mathbf{M}^2+\ldots)\mathbf{c}^{PE}$.

Despite identical cumulative output effects (Result 3), the three calibrations are strikingly different, with impact multipliers varying by a factor of nine. In the hand-to-mouth calibration, the entire output response happens at $t = 0$, as hand-to-mouth households immediately spend both the transfer and the income from the resulting boom, and the excess assets immediately pass to the Ricardian household. In the target

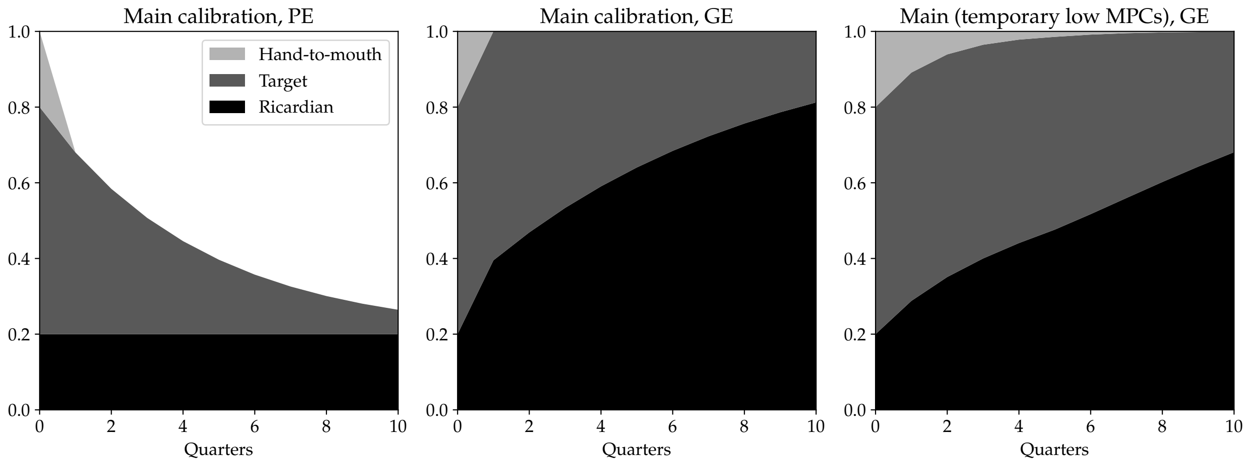

Figure 2: Distribution of assets across household types

calibration, we see the opposite: households slowly draw down their assets, as their increased spending is partly offset by the general equilibrium increase in income, so that assets and spending are more persistent in general than partial equilibrium (Result 2). Only a small fraction (about one-ninth) of the cumulative output effect happens on impact.

The main calibration, blending hand-to-mouth and target households, is intermediate between these two cases. Thanks to the hand-to-mouth households, there is a spike in output in the quarter of the transfer. But this is still less than one-fourth of the cumulative output effect, which has much higher persistence in general than in partial equilibrium.

The first two panels of figure 2 show the evolution of assets for the main calibration, in both partial and general equilibrium.[7] In the partial equilibrium case, the hand-to-mouth households immediately deplete their assets, and the target households do so at a steady pace, with the vast majority gone after ten quarters. The Ricardian households simply hold on to their initial receipts. In general equilibrium, the hand-to-mouth households still immediately deplete their assets, but the target households do so more slowly, with almost two-thirds of their initial assets remaining after four quarters, and one-third remaining after ten quarters. Total assets remain constant, as assets drawn down by others "trickle up" to the Ricardian households (Result 1).

Experiment: temporarily lower MPCs. As discussed earlier, the evidence from Parker, Schild, Erhard, and Johnson suggests that MPCs out of fiscal transfers may have fallen during the pandemic. This could be due to pandemic-specific circumstances (limited opportunities to spend), nonlinearities in the consumption function (with high liquidity from transfers temporarily depressing MPCs), or both. In either case, it seems unlikely that the decline in MPCs is permanent.

In this experiment, I take a reduced-form approach to think about the effects of declining MPCs. I alter the framework from above by assuming that the MPCs out of excess cash on hand temporarily fall for both hand-to-mouth and target households to half their usual levels, $mpc_{1t} = 0.5$ and $mpc_{2t} = 0.1$ for $t = 0, \dots, 4$. I assume that these MPCs then converge back to their original levels at a rate of 25% per quarter, e.g. that $mpc_{1t} = 1 - 0.5 \cdot (0.75)^{t-4}$ for $t \geq 4$. The main calibration is otherwise left unchanged.

[7] At each t, we plot beginning-of-period assets $a_{i,t-1}$ rather than end-of-period assets $a_{i,t}$, so that the initial transfer is visible at $t = 0$.

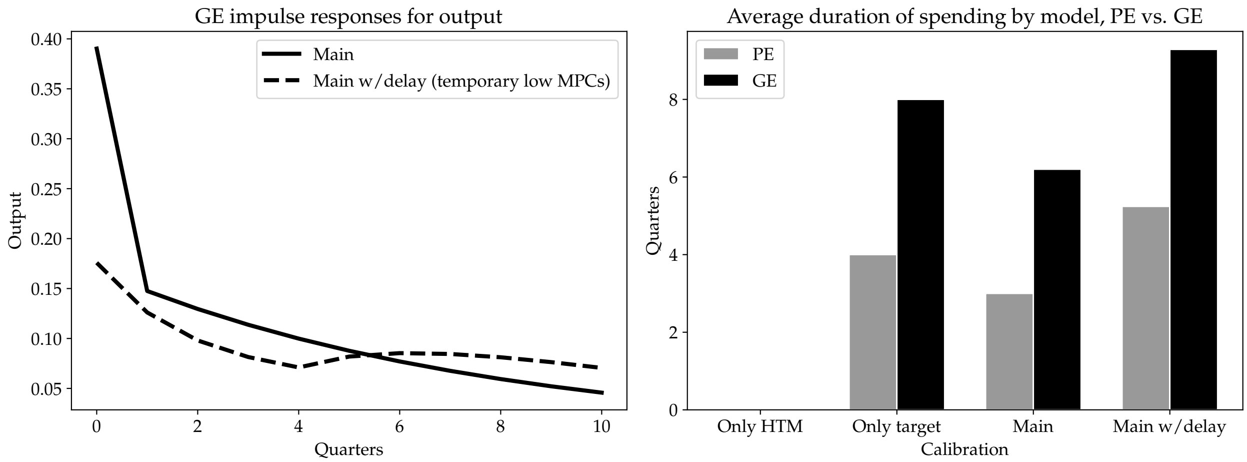

Figure 3: Impulse responses and duration across different scenarios

The left panel of figure 3 shows the resulting path of output for this "delayed spending" variant of the model (dashed line), contrasting with the original results (solid line). The impact effect on output, although substantial, is less than half as large, and the path of output is non-monotonic, increasing slightly with the recovery in MPCs after four quarters. Crucially, the cumulative output effect remains the same in both cases (Result 3), so that the model with temporarily low MPCs actually has a higher output effect after six quarters, with the gap becoming substantial after eight—making up for the smaller impact effect. The rightmost panel of figure 2 shows the corresponding evolution of assets: due to the temporary decline in MPCs, less "trickling up" of assets takes place than in the original calibration, so that more assets remain with hand-to-mouth and target households, ready to be spent.

Finally, the right panel of figure 3 shows the *duration* of the output increase (or, in partial equilibrium, the increase in household spending) by calibration: the average date at which the increase in output or spending takes place. Across the board, duration is higher in general than partial equilibrium, in line with Result 2. Among the original calibrations, it is highest with only target households, and lowest (zero) with only hand-to-mouth households, with the main calibration being in the middle. But the temporary fall in MPCs pushes up duration substantially, to the point where it exceeds every original calibration. Importantly, in all these cases, cumulative output is the same: higher duration simply means that the same overall increase in output is pushed toward later dates.

I suspect that the events of the last few years resemble the delayed-spending case. Although a vast fiscal intervention pushed household liquidity to unprecedented levels, the demand-side effects—through substantial—were not as large as we would normally expect, because MPCs were lower than usual during the pandemic. But since households still had these "excess savings" on their balance sheets, this merely set us up for a more prolonged boom in demand—an inflationary boom that, as of the end of 2022, has not yet receded.

A lingering question for future work: the role of asset markets

The framework I have outlined, although useful, relies on one precarious assumption: that whatever portion of a transfer is not consumed by household i today is still subject to the same marginal propensity to consume, mpc_i, in the next period. One can imagine the opposite assumption: that whenever a household receives income, it either consumes that income immediately, or it places the income into long-term savings, out of which the MPC is very low.

In its extreme form, this alternative assumption seems inconsistent with the evidence on intertemporal MPCs highlighted by Auclert et al. (2018), which shows that elevated consumption persists for several years following an income shock. (Indeed, I tried to match this evidence in my calibration here.) But that same evidence does allow for *some* diversion to long-term savings. Indeed, Fagereng et al. (2021) find that five years after an unexpected income shock, about 10% of the income remains unconsumed, and much of this is held in investments like stocks, bonds, and mutual funds.

What if the counterpart of lower MPCs during the pandemic was a much higher allocation to long-term savings? If so, my analysis above would be wrong: it assumes that non-Ricardian households eventually return to their typical high MPCs out of excess assets. If these assets were instead moved to some form of sticky long-term savings, that might never have happened—and the pandemic's low MPCs might have truly *dampened* the demand effect from transfers, rather than merely delaying it.

But this raises another question: what vehicles were households saving in, and might those have demand effects in their own right? In a simple model where different assets are highly (perhaps perfectly) substitutable, the answer is no: the high substitutability across assets means that the exact choice of where to save is fungible, and in equilibrium it matters little for aggregate outcomes whether a given household invests in stocks, bonds, or deposits. If, however, we assume *inelastic* markets, in the spirit of Gabaix and Koijen (2021), this changes. Investing in stocks will push up stock prices, potentially leading other households to increase their consumption due to wealth effects, and also to higher corporate investment spending. Investing in real estate will push up real estate prices, allowing existing owners to lever up, and increasing both consumption and construction spending. Even a transfer that is "saved", *if it is saved in the right places*, can push up aggregate demand.

At least superficially, this story seems to fit the pandemic experience: as households flush with cash moved into the stock market and real estate—a process already documented in some papers—prices in both markets surged from late 2020 through 2021. This surge in prices likely contributed to aggregate demand and inflation.

Together with Adrien Auclert, Ludwig Straub, and Lingxuan Wu, in ongoing research I am building a theoretical framework to understand this interaction between inelastic markets and aggregate demand. But a great deal of empirical work is also needed. Perhaps the successors to this paper can document not only the marginal propensity to consume, but also the marginal propensity to save in each kind of asset.

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