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A Simple Framework for MPCs and MPXs

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ABSTRACT

Standard consumption models assume a notional consumption flow that does not distinguish between nondurable and durable consumption. Such notional-consumption models generate notional marginal propensities to consume (MPC). By contrast, empirical work and policy discussions often highlight marginal propensities for expenditure (MPX), which incorporate spending on durables. We compare the notional-consumption model to an isomorphic model with frictionless durables, and map notional MPCs into MPXs. In its minimal formulation, the mapping is: $\text{MPX} \approx (1 + \frac{s}{r+\delta} \times \frac{1}{\tau})\text{MPC}$, with durable share s, interest rate r, durable depreciation rate δ, and time horizon τ. Our analysis can be extended to incorporate durable-adjustment frictions.

1 | Introduction

The most widely used class of consumption models assumes that households maximize the present discounted value of flow utility, where flow utility is a function of a scalar index, c_t, representing flow consumption. This model simplifies the economy by modeling all consumption as a notional,[1] homogeneous flow. This *notional-consumption model* does not specify the sources of this flow; in particular, it does not distinguish between durable and nondurable consumption. This model is often used to analyze the response of notional consumption to wealth shocks—what we call the *notional* MPC.

In practical macroeconomic policy analysis, it is well known that notional consumption is often not the key variable. Macroeconomic policy attempts to influence the value of personal consumption *expenditures* (C in the national accounts; GDP = C + I + G + NX), not the flow of notional consumption. To illustrate the difference, assume a domestic firm manufactures an automobile in January (using domestic parts and labor) and sells it to a household in February for price p. All else equal, the production/sale of this automobile raises GDP in Q1 by p, but raises notional consumption in Q1 by an amount that is approximately two orders of magnitude smaller because the household's consumption flow from the automobile accrues slowly over time. For most policy applications, economists need to understand the dynamics of consumption *expenditure*. We refer to the response of expenditure to wealth shocks as the marginal propensity for expenditure (MPX).[2]

The relationship between notional consumption and expenditure is complex. The two measures are identical for goods that have no durability (e.g., lettuce) and for services. But the low depreciation rates of consumer durable goods—such as furniture and automobiles—generate a wedge between expenditure on durables and notional consumption of durables.

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The discrepancy between notional consumption and expenditure has long been recognized in the household finance literature.[3] Especially in empirical work, economists frequently draw a distinction between the MPX on all consumption expenditures and the MPX on nondurables alone, and commonly find large differences between the two.[4] In the short and medium run, the notional MPC lies below the total MPX and above the nondurable MPX.

In this paper, we propose a portable and tractable modeling device for converting notional MPCs into MPXs. In particular, we show how to extend a notional-consumption model to generate predictions about consumption expenditure in an isomorphic model with durable stocks.

Our modeling device can be built in continuous time (main text) and discrete time (Internet Appendix B).[5] In its minimal formulation, the mapping between MPCs and MPXs is:

$$\text{Total MPX} \approx \left(1 + \frac{s}{r+\delta} \times \frac{1}{\tau}\right) \times \text{Notional MPC},$$

where s is the durable share of notional consumption, r and δ are the interest rate and durable depreciation rate (so that $r+\delta$ is the user cost of durables), and τ is the time horizon (e.g., $\tau = \frac{1}{4}$ for quarterly MPCs/MPXs). The total MPX sums the MPX on nondurables, $(1-s) \times \text{MPC}$, and the MPX on durables, $(s + \frac{s}{r+\delta} \times \frac{1}{\tau}) \times \text{MPC}$. Under this approximation, MPXs are larger than MPCs—especially over short horizons—and the two measures converge as durable consumption flows are progressively cumulated (i.e., as τ increases).

We use BEA data to calibrate $s = 0.126$ and $\delta = 0.223$, and set $r = 0.01$ (our calibration focuses on consumer durables and excludes housing).[6] This calibration yields a straightforward rule-of-thumb for calculating the quarterly MPX in a model of notional consumption: *multiply the MPC by 3*. For example, take a model with a quarterly notional MPC of 15% (comparable to that in the seminal Kaplan and Violante (2014) model)—our rule-of-thumb then implies a quarterly MPX of 45%. Our framework can also be used to compare MPXs on durables and nondurables. We show that our calibrated mapping fits the available data well at quarterly horizons (Section 4.2).

To derive our MPX formula, our extension with durables makes a number of assumptions (see Assumptions 1–3 in Section 3.2). The strongest is that durables are liquid, that is, households do not face adjustment frictions when buying/selling durables. This assumption is also used in Abel (1990), Auclert (2019), and Auclert et al. (2024) to generate related mappings between various measures of expenditure.[7] Fundamentally, strong assumptions are needed in our framework to maintain an isomorphism between the benchmark notional-consumption model and the extension with durables. Thus, an alternate interpretation of our isomorphic durables extension is as an effort to spell out the assumptions *already implicit* in notional-consumption models.

In light of these strong (and unrealistic) assumptions it is perhaps puzzling that, as mentioned earlier, our frictionless MPX framework broadly fits the available data. To reconcile this apparent tension, we also derive a mapping from MPCs to MPXs using a tractable (S, s)-type model with durable-adjustment frictions. While adjustment frictions matter at the household level, we first present a limiting case where adjustment frictions nevertheless have *no effect* on the aggregate mapping from MPCs to MPXs (Caplin and Spulber 1987). When we calibrate the lumpy-adjustment model for consumer durables we find that adjustment frictions only slightly lower the aggregate quarterly mapping from MPCs to MPXs relative to our frictionless model. This supports our simple, frictionless, mapping when applied to expenditure on consumer durables. However, the frictionless model and the lumpy-adjustment model diverge sharply when calibrated with housing, suggesting that researchers studying housing expenditures require specialized models with housing-adjustment frictions (e.g., Berger et al. 2018; Chen et al. 2020; Guren et al. 2021; Fonseca et al. 2024).

Both our frictionless model and our lumpy-adjustment model are stylized, and are complementary to models that rigorously characterize durables.[8] The benefit of the stylized approach here is that it clarifies the wedge between consumption and expenditure, and triangulates notional-consumption models with the data on consumer spending.

Section 2 discusses the importance of having a framework for MPCs and MPXs. Section 3 presents a notional-consumption model and our isomorphic extension with durables. Section 4 presents our main results about converting notional MPCs into MPXs. Section 5 evaluates durable-adjustment frictions. Section 6 concludes.

2 | Distinguishing MPCs and MPXs

2.1 | Terminology

Whenever we use the term consumption we mean notional consumption, that is, the utility-generating consumption flows studied in classical consumption models. Accordingly, we use the term MPC to denote a notional MPC.

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In contrast to notional consumption, the alternative concept we study is expenditure. We refer to the response of expenditure to wealth shocks as the MPX. The difference between consumption and expenditure derives from durability: a durable purchase generates a one-time burst of expenditure but a long-lasting flow of notional consumption. Unless specified otherwise, MPX denotes the *total* MPX, which includes spending on nondurables and consumer durables.[9]

2.2 | The Importance of Mapping MPCs Into MPXs

Given a model of notional consumption, there are two well-known reasons why it is important to develop a mapping between MPCs and MPXs: measurement and policy.

We start by discussing measurement. Empirically, quarterly total MPXs are commonly estimated to be *two- to five-times larger* than quarterly nondurable MPXs (reviewed in Section 4.2). That is, durable purchases compose a large part of the expenditure response to wealth shocks. This suggests that model-based notional MPCs are not the correct tool for capturing the total MPX, since up-front expenditure on durables translates only slowly into cumulated notional consumption. Correspondingly, this also suggests that nondurable MPXs alone do not fully capture the notional MPC, since households derive consumption from durable goods as well. We quantify this discussion in Section 4.

Linking MPCs and MPXs also expands the connections between notional-consumption models and the empirical moments emerging from the household finance literature's expanding use of microdata. For example, administrative data on household balance sheets often enables researchers to impute the total expenditure response to wealth shocks, but not the response of its underlying components (discussed in Di Maggio et al. 2020a; Fagereng et al. 2021; Crawley and Kuchler 2023; Sodini et al. 2023). One needs a mapping between MPXs and MPCs to evaluate notional-consumption models against such data. Relatedly, data on household spending is often only partial. Automobile-purchase data is a leading example of this (e.g., Di Maggio et al. 2017, 2020b; Cookson et al. 2022; Agarwal et al. 2023; Berger et al. 2025). Account-level and transactions data are others (e.g., Ganong and Noel 2019; Baugh et al. 2021; Baker and Kueng 2022; Borusyak et al. 2024; Ganong et al. 2024; Hamilton et al. 2024)—such data provides an accurate measure of a subset of expenditures, but may miss some spending categories (e.g., large durable purchases like automobiles). In these cases, our modeling device can be used to rescale these partial MPXs into model-consistent notional MPCs.[10]

Regarding policy, expenditure and MPXs are what matter for the response of GDP to stabilization policy. But notional consumption and notional MPCs are often what is modeled. Our framework provides a helpful mapping from notional consumption to expenditure.

3 | The Household Balance Sheet

We now develop our modeling device for mapping notional consumption into expenditure. We present this framework in continuous time, and provide a discrete-time analogue in Appendix B. We start in Section 3.1 with a standard, partial equilibrium, consumption-saving model featuring a single notional consumption good. We refer to this model as the *Benchmark*, since economic models often study notional consumption flows and do not decompose notional consumption into durable and nondurable components. Next, in Section 3.2 we introduce an extension that explicitly models the purchase of durables. This extension is designed to: (i) be isomorphic to the Benchmark, and (ii) deliver a tractable MPX formula. The isomorphism implies that a researcher can take an existing model of notional consumption and notional MPCs, and use a simple formula to calculate MPXs.

3.1 | Benchmark: Single Notional Consumption Good

A household receives income y_t, which follows an arbitrary (positive) Markov process. It saves in a liquid asset b_t yielding interest rate r to finance a notional consumption flow of c_t. The budget constraint is:

$$\dot{b}_t = y_t + rb_t - c_t, \tag{1}$$

subject to the borrowing constraint $b_t \geq \underline{b}$. The state variables are $x_t = (b_t, y_t)$.

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Additionally, denote by

$$C_\tau = \int_0^\tau c_t dt \tag{2}$$

the cumulative notional consumption flow over a discrete time interval of length τ, which will play an important role below when we specify MPCs over discrete time intervals.

For simplicity we only model a liquid asset here, since this is the asset used to fund consumption. Our modeling tool is portable, however, and also applies in richer environments. Appendix F demonstrates this portability by applying our MPX tool to the model of Maxted et al. (2025), which includes liquid bank deposits, credit cards, and illiquid home equity.

Relatedly, we emphasize that while our subsequent analysis will generally focus on MPCs and MPXs out of liquid-wealth shocks (e.g., stimulus checks), this is only for exposition. Our framework can be applied in a variety of scenarios, like the spending response to house-price changes (e.g., Campbell and Cocco 2007; Mian et al. 2013; reviewed in Cloyne et al. 2019), cash-out and rate refinances (e.g., Berger et al. 2021; Eichenbaum et al. 2022), or even shocks to credit card limits (e.g., Gross and Souleles 2002; Aydin 2022).

3.2 | Extension: Isomorphic Model With Durables

To bridge the gap between consumption and expenditure we now introduce an isomorphic, extended model featuring the purchase of durable goods.[11]

3.2.1 | Setup With Durables

The household now consumes two different goods: nondurables and durables. Nondurable consumption n_t is purchased as a flow. Durable consumption requires the household to hold a stock of durables D_t, which provides durable consumption as a flow and depreciates at rate δ, with $r + \delta > 0$.[12] In keeping with our partial-equilibrium analysis, the price of durables is exogenous and normalized to one. The household continues to save in a liquid bank account, denoted by ℓ_t.

Our extension with durables is isomorphic to the notional-consumption model under three (strong) assumptions which we spell out momentarily. The key idea for establishing the isomorphism is to make assumptions such that

$$c_t = n_t + (r+\delta)D_t, \quad \text{with} \quad n_t = (1-s)\times c_t \quad \text{and} \quad (r+\delta)D_t = s \times c_t, \tag{3}$$

where $s \in [0,1]$. In words, notional flow consumption expenditure c_t is the sum of nondurable flow consumption expenditure n_t and the implied user cost of durables $(r+\delta)D_t$, with the latter equaling a constant share s of the sum. This can be microfounded with the three assumptions below. Alternatively, (3) can be viewed as a direct assumption on household behavior akin to the constant saving rate assumption in a Solow model.

Our first assumption is:

Assumption 1. The durables market is perfectly liquid. The household can buy and sell durables instantaneously at price $p = 1$; there are no transaction costs or time delays. Further, the household can borrow against durables at the market rate r.

With Assumption 1, liquid bank holdings ℓ_t and durables D_t evolve as

$$d\ell_t = [y_t + r\ell_t - n_t]dt - d\psi_t, \tag{4}$$

$$dD_t = -\delta D_t dt + d\psi_t. \tag{5}$$

Because durable purchases can be lumpy, we introduce process ψ_t to record the household's *cumulative* spending on durables from time 0 to t, and denote by $d\psi_t$ the household's durable purchases at time t.

The absence of adjustment costs in Equations (4) and (5) is a direct consequence of Assumption 1. Similarly, because Assumption 1 allows households to borrow against durables, the borrowing constraint now applies to total liquid-wealth

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holdings $\ell_t + D_t$:

$$\ell_t + D_t \geq \underline{b}. \tag{6}$$

Given Assumption 1 we need only one state variable for household wealth, namely total liquid wealth $b_t = \ell_t + D_t$. Accordingly, summing (4) and (5) gives

$$\dot{b}_t = y_t + rb_t - n_t - (r + \delta)D_t. \tag{7}$$

An implication of Assumption 1 is therefore that a relevant measure of the cost of holding durables is the user cost $(r + \delta)D_t$.

Our next assumption is:

Assumption 2. The household values total notional flow consumption, given by the CES aggregator

$$c_t = \left(s^{\frac{1}{\eta}} (fD_t)^{\frac{\eta-1}{\eta}} + (1-s)^{\frac{1}{\eta}} n_t^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}, \tag{8}$$

where n_t is the nondurable consumption flow, fD_t is the durable consumption flow generated by durable stock D_t, $s \in [0, 1]$ is the utility weight on durable consumption, and $\eta > 0$ is the elasticity of substitution.

Given the CES functional form we obtain:

Lemma 1. *Let $R = (r + \delta)/f$ denote the price of a unit of durable flow consumption. Under Assumptions 1 and 2 the optimal intratemporal choices of nondurables and durables are:*

$$n_t = \frac{1-s}{sR^{1-\eta} + 1 - s} Pc_t, \qquad fD_t = \frac{sR^{-\eta}}{sR^{1-\eta} + 1 - s} Pc_t, \tag{9}$$

where

$$P = \left(sR^{1-\eta} + 1 - s \right)^{\frac{1}{1-\eta}}. \tag{10}$$

The cost of attaining notional consumption flow c is

$$n_t + (r + \delta)D_t = Pc_t. \tag{11}$$

To complete the derivation of (3) we impose:

Assumption 3. The consumption flow per unit of durable f equals its user cost, $f = r + \delta$.

With Assumption 3, we see from Lemma 1 that $R = 1$ and CES price index $P = 1$. Using this in Equations (9) and (11) gives result (3).

To interpret Assumption 3, recall that our paper studies the MPC and MPX over relatively short time horizons, typically one quarter. Over such horizons, it is generally reasonable to hold r and hence the user cost of durables $r + \delta$ constant. Then, the ratio of nondurables and durables in Equation (9), and the price index P in Equation (10), are constant. Assumption 3 simply sets this price index to one and is therefore a weak assumption.[13]

3.2.2 | Isomorphism to Notional-Consumption Model

We now prove the isomorphism between the extension with durables and our benchmark notional-consumption model.

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Proposition 2. *Under Assumptions 1 to 3, the extension with durables is isomorphic to the notional-consumption model. In particular, total liquid wealth* $b_t = \ell_t + D_t$ *evolves as*

$$\dot{b}_t = y_t + rb_t - c_t, \tag{12}$$

subject to the borrowing constraint $b_t \geq \underline{b}$*. This is identical to the law of motion and borrowing constraint for* b_t *in Equation (1).*

Proof. Assumption 1 implies that Equation (7) holds. Assumptions 2 and 3 imply that Equation (3) holds. Substituting (3) into (7) yields Equation (12). □

3.2.3 | Cumulative Expenditure Flows

Define X_τ as cumulative *expenditure* over period τ, which is the sum of cumulative expenditure on nondurables X_τ^n and durables X_τ^D:

$$X_\tau = X_\tau^n + X_\tau^D, \quad \text{where} \quad X_\tau^n = \int_0^\tau n_t dt \quad \text{and} \quad X_\tau^D = \int_0^\tau d\psi_t. \tag{13}$$

Cumulative expenditure X_τ will be used to define the MPX.

For nondurables, Equation (3) implies

$$X_\tau^n = (1-s)\int_0^\tau c_t dt, \tag{14}$$

so nondurable spending equals share $1-s$ of total cumulative notional consumption.

For durables, Equation (5) gives

$$X_\tau^D = \int_0^\tau \delta D_t dt + D_\tau - D_0. \tag{15}$$

The first term reflects spending to replace depreciated durables; the remainder is net spending to adjust the durable stock from D_0 to D_τ.

4 | Results: The MPC and MPX

We now present our main result on tractably calculating MPXs from models with (only) notional consumption.

4.1 | Mapping MPCs Into MPXs

In the notional-consumption model of Section 3.1, the MPC is the fraction consumed of a liquid-wealth injection over a discrete time interval. More precisely, denote a point in the state space by $x = (b, y)$. The notional marginal propensity to consume (MPC) over a period of length τ for households with initial state $x_0 = x$ is

$$\text{MPC}_\tau(x) = \frac{\partial}{\partial b}\mathbb{E}\left[\int_0^\tau c(x_t)dt \mid x_0 = x\right], \tag{16}$$

that is, the expected change in cumulative consumption (see Equation (2)) given a change in liquid wealth (Achdou et al. 2022).

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Next consider the extended model of Section 3.2: the MPX is the fraction *spent* of a liquid-wealth injection over a discrete time interval. More precisely, the MPX over a period of length τ for households with initial state $x_0 = x$ is[14]

$$\text{MPX}_\tau(x) = \frac{\partial}{\partial b}\mathbb{E}\left[\int_0^\tau n(x_t)dt + \int_0^\tau d\psi(x_t) \mid x_0 = x\right], \tag{17}$$

that is, the expected change in cumulative expenditure (see Equation (13)) given a change in liquid wealth.

The extension with durables in Section 3.2 yields a simple formula for converting notional consumption to expenditure and hence MPCs into MPXs:

Proposition 3 (The Marginal Propensity for Expenditure). *The nondurable, durable, and total expenditure over a period τ defined in Equation (13) satisfy $X_\tau^n = (1-s)C_\tau$, $X_\tau^D = \frac{s\delta}{r+\delta}C_\tau + D_\tau - D_0$, and $X_\tau = \left(1 - s + \frac{s\delta}{r+\delta}\right)C_\tau + D_\tau - D_0$, with $D_\tau = \frac{s}{r+\delta}c_\tau$. C_τ is the cumulative notional consumption flow defined in Equation (2), and c_τ is the consumption flow at time τ.*

Hence, the MPX over a period τ is:

$$\text{MPX}_\tau(x) = \left(1 - s + \frac{s\delta}{r+\delta}\right)\text{MPC}_\tau(x) + \frac{s}{r+\delta} \times \frac{\partial}{\partial b}\mathbb{E}\left[c(x_\tau) \mid x_0 = x\right]. \tag{18}$$

Equation (18) has three components: (i) nondurable spending of $(1-s)\text{MPC}_\tau(x)$, (ii) spending to replace depreciated durables of $\frac{s\delta}{r+\delta} \times \text{MPC}_\tau(x)$, and (iii) spending to increase the durable stock at time τ of $\frac{s}{r+\delta} \times \frac{\partial}{\partial b}\mathbb{E}\left[c(x_\tau) \mid x_0 = x\right]$.

The MPX can be decomposed into a nondurable MPX and a durable MPX:

$$\text{MPX}_\tau^n(x) = (1-s)\text{MPC}_\tau(x), \tag{19}$$

$$\text{MPX}_\tau^D(x) = \frac{s\delta}{r+\delta} \times \text{MPC}_\tau(x) + \frac{s}{r+\delta} \times \frac{\partial}{\partial b}\mathbb{E}\left[c(x_\tau) \mid x_0 = x\right]. \tag{20}$$

Proof. See Appendix A.2. □

Proposition 3 provides a tractable formula for converting MPCs into MPXs. Only two additional ingredients are needed: the change in expected notional consumption at time τ, and the parameters s and δ. The former can be calculated numerically from the notional-consumption model (e.g., using the Feynman–Kac formula). The latter can be calibrated. Here, we use BEA data to calibrate durable share $s = 0.126$ and depreciation rate $\delta = 0.223$ (recall that our calibration focuses on consumer durables and excludes housing; Appendix C provides calibration details).

This section defines the MPC and MPX out of infinitesimal liquid-wealth shocks. We extend these definitions to discrete shocks in Appendix E.2.

4.1.1 | Implications and Rule-of-Thumb

Returning to Section 2's measurement discussion, Proposition 3 formalizes how empirical estimates of both nondurable and total spending should be evaluated relative to models of notional consumption.

Starting with the nondurable MPX, a common approach for calibrating notional-consumption models is to set the notional MPC to match an empirical estimate of the nondurable MPX. Though reasonable, nondurable MPXs are not quite the correct target. Instead, Equation (19) implies that nondurable MPXs should be multiplied by $\frac{1}{1-s}$ to recover the appropriate MPC-target for notional-consumption models. For our calibration of $s = 0.126$, notional MPCs exceed nondurable MPXs by roughly 15%.

Turning to the total MPX, for further intuition we first simplify Equation (18) using two approximations: we set $\frac{s\delta}{r+\delta} \approx s$ (which is valid if $r/\delta \approx 0$; i.e., depreciation accounts for most of the user cost), and we assume that $\frac{\partial}{\partial b}\mathbb{E}\left[c(x_\tau) \mid x_0 = x\right]$

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TABLE 1 | Selected estimates of quarterly nondurable and total MPXs.

	Nondurable MPX	Total MPX
Souleles (1999)	9%	64%
Parker et al. (2013)	12%–30%	50%–90%
Kueng (2018)	25%	73%
Parker et al. (2022)[a]	10%	23%
Boehm et al. (2025)[b]	7%	23%
Orchard et al. (2025)	0%	30%

Notes: [a]This reports the first round of Economic Impact Payments. For the second (third) round, Parker et al. (2022) estimate an 8% (1%) nondurable MPX and a 25% (1.5%) total MPX. [b]Boehm et al. (2025) report one-month MPXs (not quarterly MPXs), but find that spending is concentrated in that month.

is roughly constant in τ so that $\text{MPC}_\tau(x) \approx \tau \times \frac{\partial}{\partial b}\mathbb{E}\left[c(x_\tau) \mid x_0 = x\right]$. We can then rewrite (18) as:[15]

$$\text{MPX}_\tau(x) \approx \left(1 + \frac{s}{r+\delta} \times \frac{1}{\tau}\right)\text{MPC}_\tau(x). \tag{21}$$

Equation (21) clarifies the (approximate) dynamics linking MPXs and MPCs. MPXs are larger than MPCs, particularly over short horizons when τ is small. Over longer horizons, the two converge. In short, MPXs are more front-loaded than MPCs: durable expenditure is lumpy, whereas the consumption flows provided by these durables takes time to cumulate.

Equation (21) also provides a useful approximation for converting MPCs into total MPXs: multiply the MPC by $\left(1 + \frac{s}{r+\delta} \times \frac{1}{\tau}\right)$ to recover the MPX. Importantly, this mapping requires no additional modeling—durable share s, interest rate r, and depreciation rate δ are empirical objects that can be calibrated.

We highlight this formula's usefulness for the standard case of quarterly MPCs. Our calibration of $s = 0.126$, $r = 0.01$, and $\delta = 0.223$ implies $\left(1 + \frac{s}{r+\delta} \times \frac{1}{\tau}\right) \approx 3$.[16] Thus, a rule-of-thumb for converting quarterly MPCs into quarterly MPXs is:[17]

Remark 1 (The "Quarterly MPC Times 3" Rule-of-Thumb). The one-quarter MPX is roughly three-times the one-quarter MPC.

A key implication of this rule-of-thumb is that the notional MPCs generated by notional-consumption models should not be interpreted as predictions regarding the total expenditure response to wealth shocks. For example, a quarterly MPC of 15% can easily be consistent with a household *spending* 45% of a liquidity injection within the quarter. This is not a critique of notional-consumption models. Rather, our rule-of-thumb simply quantifies the well-known fact that notional consumption is different than expenditure.

4.2 | Taking the MPX Mapping to the Data

Our rule-of-thumb is derived using only our extended model and our calibration of s, r, and δ. We now evaluate whether our MPX mapping holds empirically.

Table 1 presents selected studies estimating both the quarterly nondurable and total MPX. In the model, Equations (19) and (21) imply that the total MPX is approximately $\left(\frac{(r+\delta)\tau+s}{(r+\delta)\tau(1-s)}\right)$-times the nondurable MPX, or 3.6 in our quarterly calibration. Overall, the available evidence is broadly consistent with this calibrated quarterly mapping (our mapping is, perhaps, modestly too high; we address this next).

5 | Durable-Adjustment Frictions

Our mapping in Remark 1 relies on frictionless durable adjustment. A natural question is: how do adjustment frictions affect this mapping? Durable adjustment is certainly subject to a variety of frictions that should, presumably, affect the

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mapping from MPCs to MPXs. Nevertheless, we just showed in Section 4.2 that our frictionless mapping aligns well with the data. This tension is puzzling. We now propose a resolution.

To do so, we present an (S, s)-type model with durable-adjustment frictions that can be characterized analytically. Our derivation of a lumpy-adjustment model starting from a notional-consumption model broadly parallels Bertola et al. (2005).[18] We stick to a stylized framework to develop sharper insights on how adjustment frictions will, and will not, affect the mapping from MPCs to MPXs.

We caution readers at the outset that the mapping from MPCs in a *frictionless* notional-consumption model to MPXs in a *frictional* lumpy-adjustment model will require simplifications and approximations. The exercise below is intended to build helpful intuitions, and is again complementary to richer models.

5.1 | Special Case: Notional-Consumption Model

In Section 3 we presented a general notional-consumption framework, then developed an isomorphic extension with frictionless durables. Here—to incorporate adjustment frictions—we focus on a tractable special case where the equilibrium notional-consumption process follows geometric Brownian motion (GBM):

$$\frac{dc_t}{c_t} = \nu dt + \sigma dB_t, \tag{22}$$

where ν is the growth rate of consumption, σ is the volatility of consumption growth, and B_t is a standard Brownian motion. There are many ways to microfound GBM consumption and we provide two in Appendix D.1, one with labor-income risk and one with asset-price risk (the seminal Merton (1969) model).

5.2 | Extension: Adjustment Frictions and Lumpy Adjustment

5.2.1 | Setup With Lumpy Durables

We now extend the special-case notional-consumption model of Section 5.1 with durable-adjustment frictions. We follow similar steps as Section 3.2, but generalize Assumption 1 by requiring that households pay a fixed effort (utility) cost of $A \geq 0$ to adjust their durable stock (we maintain Assumptions 2 and 3):[19]

Assumption 1′. Assumption 1 holds, except that durable adjustment now incurs a fixed utility cost $A \geq 0$.

When $A > 0$, the household adjusts its durables only occasionally and lumpily. Durable-adjustment frictions imply that we need to track the durable stock as a separate state variable. Because adjustment only incurs utility costs, however, a relevant measure of the pecuniary cost of holding durables continues to be the user cost $(r + \delta)D_t$.

Accordingly, let $o_t = n_t + (r + \delta)D_t$ denote the household's effective "wealth-outflow" at time t. We showed in Section 3.2 that for any o_t, the optimal durable stock is $D_t^* = \frac{s}{r+\delta} o_t$. With adjustment frictions, welfare losses arise because the household allows its durable stock to deviate from D_t^*. For a given path of o_t we can approximate these welfare losses, and minimize them, to approximate the household's durable adjustment decisions.

Approximation 1. Let $h(D_t, n_t)$ denote CES aggregator (8) and assume log period utility $\ln(h(D_t, n_t))$. To approximate the welfare loss from holding a suboptimal level of durables, a second-order approximation in log-deviations around D_t^* (holding o_t constant) gives:

$$\ln\big(h(D_t,\ o_t - (r+\delta)D_t)\big) - \ln\big(h(D_t^*,\ o_t - (r+\delta)D_t^*)\big) \approx \frac{\lambda}{2}\Big(\ln(D_t) - \ln(D_t^*)\Big)^2, \quad \text{where } \lambda = \frac{-s}{\eta(1-s)}.$$

Since $\lambda < 0$, larger deviations from D^* generate larger welfare losses. See Appendix D.2 for approximation details.

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Let $z_t = \ln(D_t/D_t^*)$ denote the log-ratio of durables to their optimal level ("durables gap"). Under Approximation 1, households endogenously time discrete durable-stock adjustments to maximize the flow of $\frac{\lambda}{2}(z_t)^2$ net of cost-A adjustments. That is, the resulting optimization problem is:

$$v(z_0) = \max_{\tau} \mathbb{E}_0\left[\int_0^{\tau} e^{-\rho t}\frac{\lambda}{2}z_t^2 dt + e^{-\rho\tau}(v^* - A)\right], \quad \text{where} \tag{23}$$

$$v^* = \max_{z} v(z),$$

where ρ is the household's exponential discount rate, and where o_t and z_t follow the diffusion processes below. At time t, the household's durable stock is $D_t = D_t^* e^{z_t} = \frac{s}{r+\delta} o_t e^{z_t}$, and its nondurable purchases are $n_t = o_t - (r+\delta)D_t = o_t(1 - se^{z_t})$.

We close the model by specifying the evolution of o_t:

Approximation 2. Wealth-outflow process o_t equals c_t from the underlying special-case notional-consumption model and therefore follows geometric Brownian motion (GBM):

$$\frac{do_t}{o_t} = \nu dt + \sigma dB_t. \tag{24}$$

Approximation 2 holds exactly using the frictionless extension of Section 3.2 with $A = 0$. Once $A > 0$, Equation (24) is only an approximation because adjustment frictions can affect the household's desired wealth-outflow path o_t.[20]

Given Approximation 2, the durables gap $z_t = \ln(D_t/D_t^*)$ follows arithmetic Brownian motion between adjustments:

$$dz_t = -\left(\nu + \delta - \frac{\sigma^2}{2}\right)dt - \sigma dB_t, \tag{25}$$

since $dD_t = -\delta D_t dt$ and $D_t^* = \frac{s}{r+\delta} o_t$. Compared to Equation (24), the terms νdt and σdB_t now enter with *negative* signs because positive spending growth implies that a household's durable stock is shrinking relative to D^*. Additionally, a $-\delta dt$ term arises in (25) because durables depreciate at rate δ (an Itô-correction term also arises).

5.2.2 | Lumpy-Adjustment Model: Characterization

Together, optimization problem (23) and law-of-motion (25) characterize a tractable (S, s)-type model with one state variable—the durables gap z—which can be characterized analytically. For details, see Bertola and Caballero (1990), Eberly (1994), and Bertola et al. (2005). We summarize the solution here, with additional explanation in Appendix D.2.

Each household's optimal strategy is characterized by two "action points" and one "return point." The action points are a lower threshold $\underline{z}$ where the durable stock is too low and the household discretely increases its durables, and an upper threshold $\overline{z}$ where the durable stock is too high and the household discretely decreases its durables. Whenever the household takes action, it adjusts its durables such that z equals return point z' (where $\underline{z} \le z' \le \overline{z}$). Between adjustments, z evolves stochastically following Equation (25); in our calibrations, z typically drifts downward as durables depreciate.

Under this optimal strategy the ergodic density for z, denoted $g(z)$, is characterized by Equation (IA27) in Appendix D.2. Importantly, the shape of $g(z)$ depends on the ratio $\frac{\nu+\delta}{\sigma^2}$. As this ratio gets bigger—in particular because σ decreases or δ increases—$g(z)$ converges to a uniform density.

Figure 1 illustrates our lumpy-adjustment model: the blue curve plots ergodic density $g(z)$, the two solid gray lines mark the action points $\underline{z}$ and $\overline{z}$, and the dashed gray line marks return point z'. Households to the left of the dotted red line will adjust within the next quarter if not hit by offsetting Brownian shocks.

Panel (a) of Figure 1 shows our baseline calibration for consumer durables, which sets $\delta = 0.223$ and $\sigma = 0.134$ (Appendix D.3 provides calibration details and robustness). We also set effort cost $A = 0.039$ to target an annual adjustment probability of 0.24 (Beraja and Zorzi 2024). For comparison (which will be relevant shortly), Panel (b) shows the model that results from taking $\sigma \to 0$.

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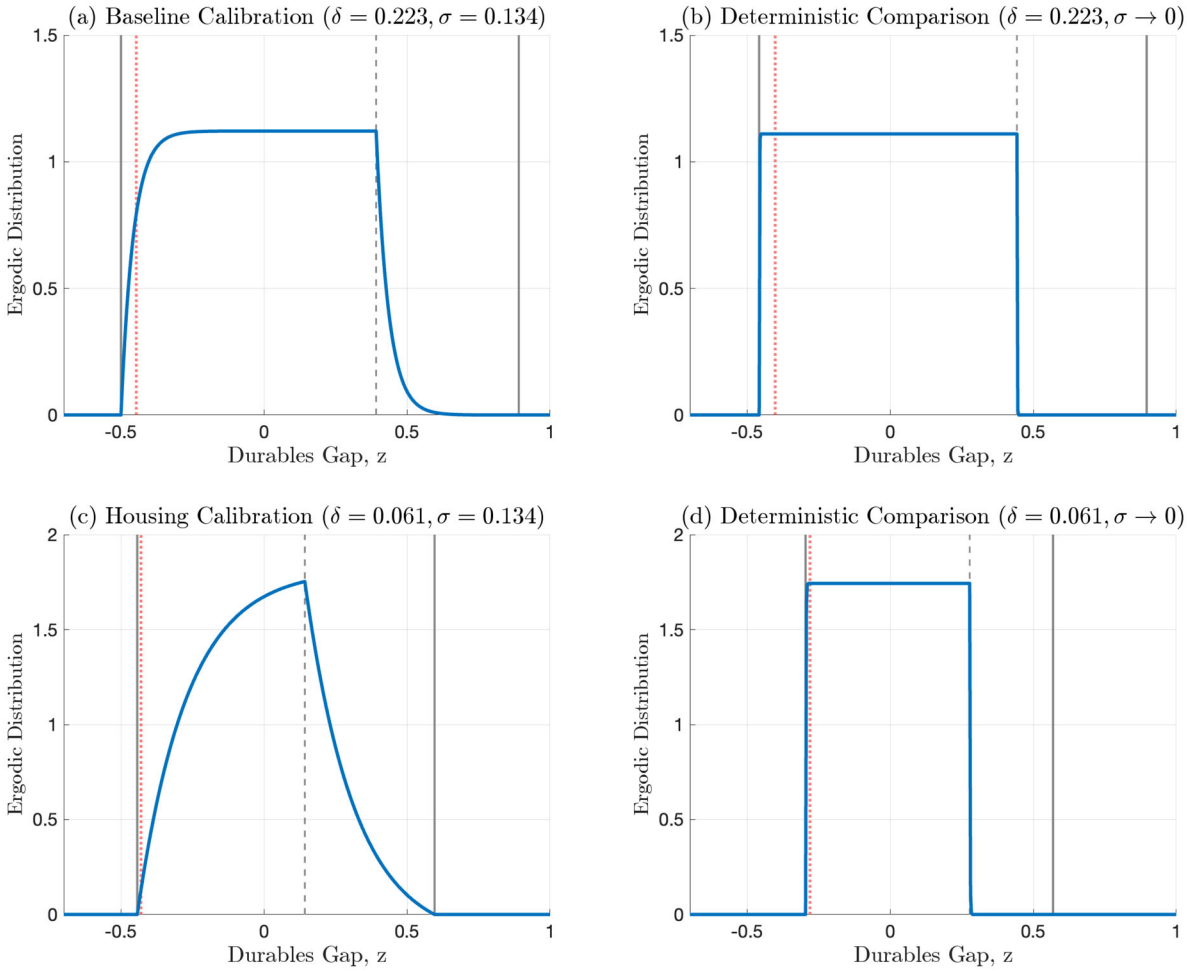


FIGURE 1 | Lumpy-adjustment model.
Notes: See the text for figure details, and Appendix D.3 for calibration details.

In Panel (c), we recalibrate the lumpy-adjustment model to include housing as part of the durable stock. Importantly, this lowers δ from 0.223 to 0.061 (full recalibration details in Appendix D.3). Panel (d) shows the corresponding $\sigma \to 0$ model. We discuss this housing case in Section 5.4.

5.3 | Results: The MPX With Lumpy Adjustment

5.3.1 | From Lumpy Adjustment to MPXs

Since state variable z is the log-ratio of durables to their optimal level, changes in z do not translate directly into changes in dollars of spending (the relevant concept for MPXs).

To back out the MPX implied by the lumpy-adjustment model, we start from the ergodic distribution $g(z)$ and feed in a small $\epsilon > 0$ wealth shock to each household.[21] For comparison, we also feed this ϵ-shock into the underlying frictionless notional-consumption model of Section 5.1. In the notional-consumption model, denote each household's instantaneous MPC by μ.[22] We can approximately characterize the aggregate MPX implied by the lumpy-adjustment model relative to this μ from the underlying notional-consumption model. Taking o_t from the notional-consumption model (Approximation 2), this means that we consider a shock that increases each household's o_t by $\mu\epsilon$ and hence generates a change in their z_t of $-\frac{\mu\epsilon}{o_t}$. We summarize our (heuristic) approximation here, with details in Appendix D.4.

Starting with the nondurable MPX, note that this ϵ-shock alters only a vanishingly small set of households' extensive-margin adjustment processes over a given time period of length τ. For all other households, additional spending is

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predominantly on nondurables in our main applications. Cumulating over τ then gives the approximation:

$$\text{MPX}_\tau^n \approx \mu \times \tau.$$

For the durable MPX, we calculate four moments from the lumpy-adjustment model: (i) how far households adjust up upon hitting $\underline{z}$, (ii) how far households adjust down upon hitting $\overline{z}$, (iii) how a small wealth shock affects the number of households jumping up per period τ, and (iv) how a small wealth shock affects the number of households jumping down per period τ. Together, (i) and (iii) capture how a wealth shock affects households' extensive-margin durable purchases, while (ii) and (iv) capture how it affects durable sales.

In more detail, assume for now that all households have the same initial wealth-outflow o_t (this drops out later). Then, moment (i) is approximately $D_t^*\left(e^{z'} - e^{\underline{z}}\right) \approx \frac{so_t}{r+\delta}\left(z' - \underline{z}\right)$, and moment (ii) is approximately $D_t^*\left(e^{\overline{z}} - e^{z'}\right) \approx \frac{so_t}{r+\delta}\left(\overline{z} - z'\right)$.

For moments (iii) and (iv), we need some additional notation. Denote by $\hat{u}_\tau(z)$ the expected number of upward-adjustments that a household starting at z will make over the subsequent period τ, and by $\hat{d}_\tau(z)$ the corresponding downward-adjustment measure. As already discussed, the ϵ-shock generates a change in each household's o_t of $\mu\epsilon$ and hence a change in their z_t of $-\Delta$ with $\Delta = \frac{\mu\epsilon}{o_t}$. Starting from the ergodic density $g(z)$, we therefore consider a leftward-shift in the density to $\tilde{g}(z;\Delta) = g(z+\Delta)$; that is, a *decrease* in each household's z. For the perturbed density $\tilde{g}(z;\Delta)$, the *aggregate* number of upward-adjustments that occur within period τ is:

$$\mathcal{U}_\tau(\Delta) = \int_{\text{supp}(\tilde{g})} \hat{u}_\tau(z)\tilde{g}(z;\Delta)dz.$$

Let $\mathcal{D}_\tau(\Delta)$ denote the corresponding measure for the aggregate number of downward-adjustments.

With this notation in hand, moment (iii) is then $\mathcal{U}_\tau'(0) \times \frac{\mu\epsilon}{o_t}$, which denotes the change in the aggregate number of upward-adjustments if all households experience a (leftward) change in their z_t of $-\frac{\mu\epsilon}{o_t}$. Similarly, moment (iv) is $\mathcal{D}_\tau'(0) \times \frac{\mu\epsilon}{o_t}$. Note that $\mathcal{U}_\tau'(0) > 0$ and $\mathcal{D}_\tau'(0) < 0$, since a negative z-shock moves households toward $\underline{z}$ and away from $\overline{z}$.

Putting this together, we approximate the aggregate durable MPX as:

$$\text{MPX}_\tau^D \approx \mathcal{U}_\tau'(0) \times \mu \times \left(\frac{s}{r+\delta}\left(z' - \underline{z}\right)\right) - \mathcal{D}_\tau'(0) \times \mu \times \left(\frac{s}{r+\delta}\left(\bar{z} - z'\right)\right).$$

Finally, denoting the MPC of the underlying notional-consumption model by $\text{MPC}_\tau \approx \mu\tau$, our approximate mapping from the MPC of the notional-consumption model to the total MPX of the lumpy-adjustment model is:

$$\begin{aligned}\text{MPX}_\tau &= \text{MPX}_\tau^n + \text{MPX}_\tau^D \\ &\approx \left[1 + \mathcal{U}_\tau'(0) \times \frac{1}{\tau} \times \left(\frac{s}{r+\delta}\left(z' - \underline{z}\right)\right) - \mathcal{D}_\tau'(0) \times \frac{1}{\tau} \times \left(\frac{s}{r+\delta}\left(\overline{z} - z'\right)\right)\right]\text{MPC}_\tau. \end{aligned} \tag{26}$$

Equation (26) is straightforward to compute: $\mathcal{U}_\tau'(0)$, $\mathcal{D}_\tau'(0)$, $\underline{z}$, $\overline{z}$, and z' can be calculated numerically, while s, r, and δ can be calibrated.

5.3.2 | Limit Case: Caplin and Spulber (1987)

Building on the insights of Caplin and Spulber (1987), taking $\sigma \to 0$ delivers an intuitively useful limiting case. This $\sigma \to 0$ case is illustrated in the righthand panels of Figure 1: it features a uniform distribution of households between $\underline{z}$ and z'. Depreciation means households deterministically slide from right to left over time, and jump up to z' whenever they hit $\underline{z}$.

In this limiting case the uniform ergodic density is $g(z) = \frac{1}{z'-\underline{z}}$, implying that $\mathcal{U}_\tau'(0) = \frac{1}{z'-\underline{z}}$ and $\mathcal{D}_\tau'(0) = 0$. Equation (26) therefore becomes:

$$\text{MPX}_\tau \approx \left(1 + \frac{s}{r+\delta} \times \frac{1}{\tau}\right)\text{MPC}_\tau,$$

which is exactly Equation (21) used to derive our frictionless rule-of-thumb in Remark 1.

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In short, the *frictional* model with $\sigma \to 0$ produces the same mapping from notional MPCs to MPXs as our *frictionless* model. Although adjustment frictions imply that fewer households adjust their durables at any time, those same frictions also imply that when households adjust, they adjust by more. When the distribution of households is uniform between the adjustment bands, these two effects cancel out. This is a key takeaway—adjustment frictions certainly matter at the household level, but such frictions do not necessarily affect the aggregate mapping from MPCs to MPXs.

5.3.3 | Calibrated Solution

It turns out that this $\sigma \to 0$ case provides a reasonable qualitative approximation to our baseline consumer-durables calibration (in Panel (a) of Figure 1). Using Equation (26) for our baseline calibration, we calculate that the quarterly MPX is 2.6-times the quarterly notional MPC. While this is not quite the same as our frictionless three-to-one rule, adjustment frictions only modestly change the quantitative finding. For intuition, compare Panels (a) and (b) of Figure 1. For low enough σ, households around the dotted red line are the ones who are pushed into adjusting by the wealth shock. This mass is qualitatively similar for the $\sigma = 0.134$ and $\sigma \to 0$ cases (especially compared to the housing calibration discussed shortly).

5.4 | Housing Expenditures

We have thus far focused on (non-housing) consumer durables and excluded major housing adjustments (i.e., residential investment). There are three reasons for this choice.

First, we want our mapping to be consistent with the empirical literature estimating MPXs (see Table 1). This literature generally omits residential investment.

The second reason relates to supply-side considerations. Housing investments take time to plan, permit, and build, and hence are less likely to adjust over the quarterly horizon we focus on. Consumer durables still include other inputs to housing quality that are more easily adjusted, such as furniture and appliances.

The third reason is demand-side adjustment frictions. Although we just illustrated in Section 5.3 that an (S, s)-type model produces a qualitatively similar mapping from MPCs to MPXs as its frictionless counterpart when calibrated to consumer durables, this result does not extend to housing.

When we include housing as a durable, the calibrated durable share increases to $s = 0.260$ and the depreciation rate decreases to $\delta = 0.061$ (details in Appendix C). In the frictionless mapping of Equation (21), this calibration implies that the quarterly MPX is (unrealistically) 16-times the quarterly MPC.

The predictions of the lumpy-adjustment model are now sharply different, however. Housing's slower depreciation moves ergodic distribution $g(z)$ further from the near-uniform distribution that is needed for the lumpy-adjustment model to approximate its frictionless counterpart (compare Panels (c) and (d) of Figure 1). In the lumpy-adjustment model with housing, Equation (26) now implies that the quarterly MPX is only 5.5-times the quarterly MPC, or roughly just one-third of its frictionless counterpart.[23]

Overall, our summary view is that our frictionless modeling device provides a reasonable approximation of expenditure on (non-housing) consumer durables, and researchers interested in housing expenditures likely require specialized models of housing.[24]

6 | Conclusion

Policy and empirical analyses often focus on the response of consumption expenditures to wealth shocks. But economists' benchmark model studies notional consumption. To bridge the gap, this paper develops a simple framework for converting MPCs into MPXs. Our framework is parsimonious and portable, and matches the available data well.

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Endnotes

[1] In this model, consumption is "notional" because it is a theoretical concept without a clear empirical counterpart.

[2] Our MPX terminology is similar to Auclert (2019) and Crawley and Kuchler (2023).

[3] For example, Mankiw (1982), Hayashi (1985), Lusardi (1996), Padula (2004), Parker et al. (2013), and Jappelli and Pistaferri (2014). Aguiar and Hurst (2005) emphasize a separate, but related, distinction of consumption versus expenditure, where consumption includes home production.

[4] We review this literature in Section 4.2.

[5] The Internet Appendix is available in the online version of this article on the *Journal of Finance: Insights and Perspectives* website. Hereafter simply Appendix.

[6] Section 5.4 discusses housing. Appendix C provides calibration details.

[7] See Appendix B.5 for further discussion of how our paper relates to this research.

[8] Recent examples include Berger and Vavra (2015), Beraja and Wolf (2021), McKay and Wieland (2021), Beraja and Zorzi (2024), and de Silva and Mei (2025).

[9] In practice, almost all of our subsequent analysis focuses on non-housing notional consumption and non-housing consumer durables. We analyze housing in Section 5.4.

[10] For illuminating applications of the sorts of approaches discussed above, see for example Borusyak et al. (2024), Berger et al. (2025), Boehm et al. (2025), and Ganong et al. (2025).

[11] Appendix E.3 discusses durable rentals.

[12] D_t here can be thought of as an aggregated composite of many durable goods (we provide a CES-based microfoundation in Appendix E.1).

[13] For monetary policy analysis, notional-consumption models may miss effects related to the impact of rate changes on the user cost of durables (see Auclert 2019; McKay and Wieland 2021).

[14] Our notation $\int_0^\tau d\psi(x_t)$ represents cumulative durables spending as the household's state evolves from x_0 to x_τ, always starting from $\psi_0 = \psi(x_0) = 0$. For comparability to the notional-consumption model, the liquid-wealth injection is specifically a shock to ℓ.

[15] We thank Greg Kaplan for this helpful suggestion.

[16] We use BEA data to calibrate s and δ (Appendix C). We set $r = 0.01$ following the notional-consumption model of Maxted et al. (2025), to which we apply our mapping in Appendix F.

[17] We obtain comparable results using the quarterly one-period MPX from our discrete-time framework (details in Appendix B.3).

[18] See also Bertola and Caballero (1990), Eberly (1994), and further references therein.

[19] Assumption 1 implicitly fixes A to 0. Setting $A > 0$ loosely captures some adjustment frictions (like search costs—e.g., Argyle et al. 2023; Agarwal et al. 2024), but not others (like financial constraints that limit durable financing—e.g., Eberly 1994; Benmelech et al. 2017; Green et al. 2020).

[20] A household's desired spending on nondurables will generally depend on whether its durable stock is relatively too high/low. See also Bertola et al. (2024) for a discussion.

[21] If Brownian shocks are idiosyncratic then ergodic distribution $g(z)$ is also the long-run cross-sectional distribution. If Brownian shocks are partially systematic, however, then any time-specific cross-sectional distribution will not necessarily equal $g(z)$. In the latter case, our MPX formula in Equation (26) should be interpreted as a time-series average. See Appendix D.5 for more.

[22] The instantaneous MPC is $\frac{\partial c(x)}{\partial b}$, where c is the notional consumption rate (Achdou et al. 2022).

[23] As just discussed, supply-side frictions should lower this even further.

[24] See also Appendix D.5 for further discussion of various issues not covered in the main text, such as durable-financing constraints and time-dependent inaction.

References

Abel, A. B. 1990. "Consumption and Investment." *Handbook of Monetary Economics* 2: 725–778.

Achdou, Y., J. Han, J.-M. Lasry, P.-L. Lions, and B. Moll. 2022. "Income and Wealth Distribution in Macroeconomics: A Continuous-Time Approach." *Review of Economic Studies* 89: 45–86.

Agarwal, S., G. Amromin, and S. Chomsisengphet, et al. 2023. "Mortgage Refinancing, Consumer Spending, and Competition: Evidence From the Home Affordable Refinance Program." *Review of Economic Studies* 90: 499–537.

Agarwal, S., J. Grigsby, A. Hortaçsu, G. Matvos, A. Seru, and V. Yao. 2024. "Searching for Approval." *Econometrica* 92: 1195–1231.

29933153, 2026, 1, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/jfi2.70006, Wiley Online Library on [02/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Aguiar, M., and E. Hurst. 2005. "Consumption Versus Expenditure." *Journal of Political Economy* 113: 919–948.

Argyle, B., T. Nadauld, and C. Palmer. 2023. "Real Effects of Search Frictions in Consumer Credit Markets." *Review of Financial Studies* 36: 2685–2720.

Auclert, A. 2019. "Monetary Policy and the Redistribution Channel." *American Economic Review* 109: 2333–2367.

Auclert, A., M. Rognlie, and L. Straub. 2024. "The Intertemporal Keynesian Cross." *Journal of Political Economy* 132: 4068–4121.

Aydin, D. 2022. "Consumption Response to Credit Expansions: Evidence From Experimental Assignment of 45,307 Credit Lines." *American Economic Review* 112: 1–40.

Baker, S. R., and L. Kueng. 2022. "Household Financial Transaction Data." *Annual Review of Economics* 14: 47–67.

Baugh, B., I. Ben-David, H. Park, and J. A. Parker. 2021. "Asymmetric Consumption Smoothing." *American Economic Review* 111: 192–230.

Benmelech, E., R. R. Meisenzahl, and R. Ramcharan. 2017. "The Real Effects of Liquidity During the Financial Crisis: Evidence From Automobiles." *Quarterly Journal of Economics* 132: 317–365.

Beraja, M., and C. K. Wolf. 2021. "Demand Composition and the Strength of Recoveries." NBER Working Papers 29304, National Bureau of Economic Research, Inc.

Beraja, M., and N. Zorzi. 2024. "Durables and Size-Dependence in the Marginal Propensity to Spend." NBER Working Papers 32080, National Bureau of Economic Research, Inc.

Berger, D., G. Gee, N. Turner, and E. Zwick. 2025. "Stimulating Auto Markets." *Mimeo*.

Berger, D., V. Guerrieri, G. Lorenzoni, and J. Vavra. 2018. "House Prices and Consumer Spending." *Review of Economic Studies* 85: 1502–1542.

Berger, D., K. Milbradt, F. Tourre, and J. Vavra. 2021. "Mortgage Prepayment and Path-Dependent Effects of Monetary Policy." *American Economic Review* 111: 2829–2878.

Berger, D., and J. Vavra. 2015. "Consumption Dynamics During Recessions." *Econometrica* 83: 101–154.

Bertola, G., and R. J. Caballero. 1990. "Kinked Adjustment Costs and Aggregate Dynamics." *NBER Macroeconomics Annual* 5: 237–288.

Bertola, G., L. Guiso, and L. Pistaferri. 2005. "Uncertainty and Consumer Durables Adjustment." *Review of Economic Studies* 72: 973–1007.

Bertola, G., L. Guiso, and L. Pistaferri. 2024. "Correction to: Uncertainty and Consumer Durables Adjustment." *Review of Economic Studies* 91: 2543–2544.

Boehm, J., E. Fize, and X. Jaravel. 2025. "Five Facts About MPCs: Evidence From a Randomized Experiment." *American Economic Review* 115: 1–42.

Borusyak, K., X. Jaravel, and J. Spiess. 2024. "Revisiting Event-Study Designs: Robust and Efficient Estimation." *Review of Economic Studies* 91: 3253–3285.

Campbell, J. Y., and J. F. Cocco. 2007. "How Do House Prices Affect Consumption? Evidence From Micro Data." *Journal of Monetary Economics* 54: 591–621.

Caplin, A. S., and D. F. Spulber. 1987. "Menu Costs and the Neutrality of Money." *Quarterly Journal of Economics* 102: 703–725.

Chen, H., M. Michaux, and N. Roussanov. 2020. "Houses as ATMs: Mortgage Refinancing and Macroeconomic Uncertainty." *Journal of Finance* 75: 323–375.

Cloyne, J., K. Huber, E. Ilzetzki, and H. Kleven. 2019. "The Effect of House Prices on Household Borrowing: A New Approach." *American Economic Review* 109: 2104–2136.

Cookson, J. A., E. P. Gilje, and R. Z. Heimer. 2022. "Shale Shocked: Cash Windfalls and Household Debt Repayment." *Journal of Financial Economics* 146: 905–931.

Crawley, E., and A. Kuchler. 2023. "Consumption Heterogeneity: Micro Drivers and Macro Implications." *American Economic Journal: Macroeconomics* 15: 314–341.

de Silva, T., and P. Mei. 2025. "Selective Inattention to Interest Rates." SSRN 5291837.

Di Maggio, M., A. Kermani, and B. J. Keys, et al. 2017. "Interest Rate Pass-Through: Mortgage Rates, Household Consumption, and Voluntary Deleveraging." *American Economic Review* 107: 3550–3588.

Di Maggio, M., A. Kermani, and K. Majlesi. 2020a. "Stock Market Returns and Consumption." *Journal of Finance* 75: 3175–3219.

Di Maggio, M., A. Kermani, and C. J. Palmer. 2020b. "How Quantitative Easing Works: Evidence on the Refinancing Channel." *Review of Economic Studies* 87: 1498–1528.

Eberly, J. C. 1994. "Adjustment of Consumers' Durables Stocks: Evidence from Automobile Purchases." *Journal of Political Economy* 102: 403–436.

Eichenbaum, M., S. Rebelo, and A. Wong. 2022. "State-Dependent Effects of Monetary Policy: The Refinancing Channel." *American Economic Review* 112: 721–761.

29933153, 2026, 1, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/jfi2.70006, Wiley Online Library on [02/11/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Fagereng, A., M. B. Holm, and G. J. Natvik. 2021. "MPC Heterogeneity and Household Balance Sheets." *American Economic Journal: Macroeconomics* 13: 1–54.

Fonseca, J., L. Liu, and P. Mabille. 2024. "Unlocking Mortgage Lock-In: Evidence From a Spatial Housing Ladder Model." SSRN 4874654.

Ganong, P., F. Greig, P. Noel, D. M. Sullivan, and J. Vavra. 2024. "Spending and Job-Finding Impacts of Expanded Unemployment Benefits: Evidence from Administrative Micro Data." *American Economic Review* 114: 2898–2939.

Ganong, P., D. Jones, P. Noel, D. Farrell, F. Greig, and C. Wheat. 2025. "Liquid Wealth and Consumption Smoothing of Typical Labor Income Shocks." *Mimeo*.

Ganong, P., and P. Noel. 2019. "Consumer Spending During Unemployment: Positive and Normative Implications." *American Economic Review* 109: 2383–2424.

Green, D., B. T. Melzer, J. A. Parker, and A. Rojas. 2020. "Accelerator or Brake? Cash for Clunkers, Household Liquidity, and Aggregate Demand." *American Economic Journal: Economic Policy* 12: 178–211.

Gross, D. B., and N. S. Souleles. 2002. "Do Liquidity Constraints and Interest Rates Matter for Consumer Behavior? Evidence From Credit Card Data." *Quarterly Journal of Economics* 117: 149–185.

Guren, A. M., A. Krishnamurthy, and T. J. McQuade. 2021. "Mortgage Design in an Equilibrium Model of the Housing Market." *Journal of Finance* 76: 113–168.

Hamilton, S., G. Liu, J. Miranda-Pinto, and T. Sainsbury. 2024. "A $100,000 Marshmallow Experiment: Withdrawal and Spending Responses to Early Retirement-Savings Access." *Mimeo*.

Hayashi, F. 1985. "The Permanent Income Hypothesis and Consumption Durability: Analysis Based on Japanese Panel Data." *Quarterly Journal of Economics* 100: 1083–1113.

Jappelli, T., and L. Pistaferri. 2014. "Fiscal Policy and MPC Heterogeneity." *American Economic Journal: Macroeconomics* 6: 107–136.

Kaplan, G., and G. L. Violante. 2014. "A Model of the Consumption Response to Fiscal Stimulus Payments." *Econometrica* 82: 1199–1239.

Kueng, L. 2018. "Excess Sensitivity of High-Income Consumers." *Quarterly Journal of Economics* 133: 1693–1751.

Lusardi, A. 1996. "Permanent Income, Current Income, and Consumption: Evidence From Two Panel Data Sets." *Journal of Business & Economic Statistics* 14: 81–90.

Mankiw, N. G. 1982. "Hall's Consumption Hypothesis and Durable Goods." *Journal of Monetary Economics* 10: 417–425.

Maxted, P., D. Laibson, and B. Moll. 2025. "Present Bias Amplifies the Household Balance-Sheet Channels of Macroeconomic Policy." *Quarterly Journal of Economics* 140: 691–743.

McKay, A., and J. F. Wieland. 2021. "Lumpy Durable Consumption Demand and the Limited Ammunition of Monetary Policy." *Econometrica* 89: 2717–2749.

Merton, R. C. 1969. "Lifetime Portfolio Selection Under Uncertainty: The Continuous-Time Case." *Review of Economics and Statistics* 51: 247–257.

Mian, A., K. Rao, and A. Sufi. 2013. "Household Balance Sheets, Consumption, and the Economic Slump." *Quarterly Journal of Economics* 128: 1687–1726.

Orchard, J. D., V. A. Ramey, and J. F. Wieland. 2025. "Micro MPCs and Macro Counterfactuals: The Case of the 2008 Rebates." *Quarterly Journal of Economics* 140: 2001–2052.

Padula, M. 2004. "Consumer Durables and the Marginal Propensity to Consume Out of Permanent Income Shocks." *Research in Economics* 58: 319–341.

Parker, J. A., J. Schild, L. Erhard, and D. S. Johnson. 2022. "Economic Impact Payments and Household Spending During the Pandemic." *Brookings Papers on Economic Activity* 81–130.

Parker, J. A., N. S. Souleles, D. S. Johnson, and R. McClelland. 2013. "Consumer Spending and the Economic Stimulus Payments of 2008." *American Economic Review* 103: 2530–2553.

Sodini, P., S. Van Nieuwerburgh, R. Vestman, and U. von Lilienfeld-Toal. 2023. "Identifying the Benefits From Homeownership: A Swedish Experiment." *American Economic Review* 113: 3173–3212.

Souleles, N. S. 1999. "The Response of Household Consumption to Income Tax Refunds." *American Economic Review* 89: 947–958.

Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Appendix S1: Internet Appendix.

Replication Code.

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