

Do Deposits Leave the Bank? Household Heterogeneity and the Deposit Channel of Monetary Policy [†]

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ABSTRACT

This paper examines the deposit channel of monetary policy transmission through the lens of an emerging market economy (EME). We find that the standard channel, deposits moving out of the banking system as the deposit spread widens, does not hold for an EME like India, where household participation in financial markets is low, and bond markets are thin. We distinguish between two margins of adjustment: an *extensive margin*, capturing reallocation out of the banking system into bonds, and an *intensive margin*, capturing reallocation within the banking system, from demand to fixed deposits. The extensive margin dominates in the United States, where the semi-elasticity of deposits to bonds is roughly five times as large as in India at the steady state. The intensive margin, by contrast, dominates in India: the semi-elasticity of the within-deposit composition shift is two to two and a half times as large as in the United States. Deposits in India do not simply leave the banking system as they do in the US; they are recomposed within it. We document this pattern empirically using household balance sheet data and bank interest rate pass-through, then develop a static partial equilibrium portfolio-choice model in which heterogeneous households allocate wealth across deposits, bonds, and gold, calibrated to the United States and India as representative advanced and emerging market economies. We show formally that participation and bond-market liquidity account for about 78 percent of the gap between the two countries' extensive-margin responses, with the remainder attributable to differences in asset substitutability. More generally, we combine the relevant structural parameters into a *sufficient statistic* for assessing the deposit channel across economies. For EME central banks, bank-funding transmission depends on deposit-rate pass-through, household participation, and bond-market depth.

Keywords: Deposit Channel; Monetary Policy Transmission; Household Heterogeneity; Emerging Market Economies; Household Portfolio Choice; Financial Market

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1 Introduction

The seminal paper by [Mishkin \(1995\)](#) provides a coherent exposition of the various channels through which monetary policy affects the real economy. One of the most traditional and widely discussed mechanisms, consistent with Keynesian theory, is the interest rate channel.¹ This framework generally assumes a relatively complete and efficient pass-through from policy rates to market lending rates. This assumption is not valid for all economies, as the analysis of the empirical pass-through literature finds that the strength of interest rate pass-through is systematically weaker in economies with less developed financial markets, and strengthens significantly where stock markets are deeper ([Gregor et al., 2021](#)). This is consistent with the concern that motivates our paper: pass-through, and the transmission mechanisms built on it, may not operate uniformly across the advanced economies (AEs) and the emerging market economies (EMEs).

More recently, the literature has identified an additional channel of monetary policy: *deposits channel* of monetary policy transmission ([Drechsler et al., 2017](#)). This channel illustrates how bank deposits decrease in response to an increase in policy rates: banks, exercising market power over depositors, widen the spread between market rates and deposit rates, incentivizing depositors to move their funds into higher-yielding non-bank assets, whose opportunity cost of holding falls as short rates rise ([Nagel, 2016](#)). The mechanism rests on three joint assumptions: i) that banks hold market power over deposit pricing, ii) that households have ready access to liquid, substitutable non-bank assets like bonds into which they can move funds, and iii) that the liquid bond markets are complete. Even in AEs, which are financially deep economies, evidence suggests that the deposits channel's strength is not a fixed structural constant but depends on bank market structure, depositor attention, and the digital technology of asset holding/investing.² This raises a sharper question on the strength of this channel for EMEs where financial markets are incomplete, and bond markets are thinner ([Van Doornik et al., 2024](#); [Cervajal and Bebczuk, 2024](#); [International Monetary Fund, 2025](#)), where households hold large amounts of non-financial assets with low market participation and have markedly less access to liquid substitutes for bank deposits in the first place. To the best of our knowledge, no existing research addresses this question, and the present paper fills this gap.

We argue that household heterogeneity, interacting with a thin bond market presence, can substantially alter how the deposits channel works, and that this interaction is likely to be present in EMEs.

¹The interest rate channel operates through changes in the policy interest rate, which are transmitted to bank lending rates. These changes influence borrowing costs, thereby affecting household consumption and firms' investment decisions, ultimately influencing aggregate output and inflation.

²[Schaffer and Segev \(2021\)](#) show that the lending results in [Drechsler et al. \(2017\)](#) are sensitive to sample construction and the treatment of banks that fund themselves outside local deposit markets. [Begenau and Stafford \(2023\)](#) show that most U.S. bank branches set deposit rates uniformly across markets rather than in response to local concentration, so the cross-sectional mechanism underlying the deposits channel does not operate for the majority of branches. On the household side, [Lu and Wu \(2026\)](#) show that depositor inattention itself confers deposit market power on banks: inattentive depositors withdraw less following rate hikes, dampening the very outflows the channel relies on. The role of technology cuts in more than one direction. [Choi and Rocheteau \(2023\)](#) show theoretically that reduced entry costs into deposit markets, for example through online banking, erode bank market power and thereby weaken transmission; empirically, however, [Koont et al. \(2024\)](#) find that digitalization instead *increases* deposit-rate pass-through, and the sensitivity of deposit outflows, generating destabilizing digital bank runs rather than muting the channel.

The household finance literature has time and again shown that participation in financial markets is not uniform and depends on fixed and per-period participation costs (Vissing-Jorgensen, 2002), and that households differ systematically in how effectively they manage their portfolios (Campbell, 2006). Where marketable financial instruments are scarce or costly to access, as documented for a broad panel of EMEs (Giraldo et al., 2026a), households' opportunity set is constrained not by preference but by the options of assets actually available to them, reshaping the substitutability between deposits and other assets. In our analysis, the deposit channel of monetary policy works through the intensive margin and not the extensive margin in an EME like India. Our mechanism is simple: monetary tightening can lead to an *internal* shift of funds within the banking system, for example from liquid demand deposits toward higher-yielding term deposits, rather than an *external* shift of funds out of the banking system altogether. We term the external margin the *extensive margin* of the deposits channel, and the internal, within-bank reallocation the *intensive margin*. Which of these two margins dominates depends on household engagement with financial markets, portfolio composition, asset substitutability, and the extent of interest-rate pass-through across assets.

To make this comparison concrete, we study the United States, an AE with deep, liquid financial markets and broad household participation in market-based instruments, and India, an EME in which a much larger share of households faces a narrower financial opportunity set and where monetary transmission through bank interest rates has historically been found to be weak (Das, 2015). Table 1 summarizes heterogeneity in financial and gold asset ownership share and value share, using household balance sheet data from both countries. We then build a static portfolio-choice model in which households derive utility from consumption and from a composite of asset-service flows spanning deposits, bonds, and a non-financial asset (gold). We deliberately abstract from borrowing and dynamic saving decisions, keeping the framework static, in order to isolate the pure portfolio-reallocation margin that is the paper's focus. In the model, *active* households can substitute between deposits and non-deposit financial assets, while *passive* households do not hold any financial asset besides deposits; both types can still reallocate between demand and fixed deposits, and between financial and non-financial stores of value. This distinction lets us formally separate the extensive margin (active households' external reallocation into bonds) from the intensive margin (both types' internal reallocation within the deposits), and to derive a set of comparative statics, ultimately combined into a single *sufficient statistic* characterizing the deposits channel's strength, that depends on a small number of structural parameters: the share of financially active households, the degree of bond-market liquidity, and the elasticity of substitution between assets.

This distinction also offers a clear lens for interpreting cross-country differences. In a financial system such as that of the United States, where marketable financial assets are widely held and readily accessible, a widening deposit spread can generate substantial substitution away from bank deposits altogether, consistent with the conventional deposits channel. In contrast, where a larger share of house-

Table 1
Composition and Household Ownership of Financial Assets: India and the United States

Asset Category	India	United States
Panel A. Composition of Household Financial Assets		
<i>Percentage share of the value of household financial assets</i>		
Deposits ^a	26.80	11.67
Pension and provident funds, and life insurance ^b	70.52	33.12
Corporate equity and mutual-fund shares ^c	1.05	34.84
Bonds and debt securities ^d	0.00	4.48
Other financial assets ^e	1.63	15.90
<i>Total financial assets</i>	100.00	100.00
<i>Financial assets as % of total assets</i>	—	41.9
Gold and bullion relative to financial assets ^f	46.06	—
Panel B. Household Ownership		
<i>Percentage of households holding each asset category</i>		
Deposits ^a	96.83	98.20
Provident or retirement accounts ^g	19.68	25.44
Mutual funds	0.36	9.05
Bonds and debentures	0.01	8.44
Direct equity shares	1.06	15.18
Gold	82.85	—

Notes: Indian estimates are based on the 2019 All India Debt and Investment Survey (AIDIS). For the United States, Panel A is constructed from the 2019 Federal Reserve Financial Accounts, while Panel B uses the 2019 Survey of Consumer Finances (SCF). Panel A reports asset values as shares of total financial assets; Panel B reports survey-weighted household ownership rates. SCF estimates are averaged across the five imputation implicates. Because the underlying sources use different institutional classifications, the harmonized categories are comparable in broad economic content but are not identical.

^a Indian deposits include current, savings, and term deposits; post-office and small-savings accounts; and deposits with cooperative banks, non-bank financial companies, and self-help groups. U.S. deposits in Panel A combine checkable deposits and currency with time deposits and short-term investments. Panel B uses ownership of transaction accounts.

^b The Indian category combines pension and provident funds with life insurance. The U.S. category combines pension entitlements and life-insurance reserves; the latter measure the accumulated asset value of policies rather than their death benefits.

^c The Indian category combines directly held equity and mutual funds. The U.S. category combines corporate equity, mutual-fund shares, and money-market fund shares.

^d The Indian category consists of bonds and debentures. The U.S. category includes federal and municipal securities and corporate and foreign bonds.

^e For India, the reported categories account for 98.37 percent of financial assets; the remaining 1.63 percent is assigned residually to other financial assets. The U.S. category includes loans and advances, other equity, and miscellaneous financial claims.

^f Gold and bullion are excluded from financial assets. The Indian entry reports their value relative to total financial assets; a comparable U.S. measure is unavailable from the source used in Panel A.

^g The Indian ownership measure refers to provident-fund accounts. The U.S. measure includes IRA and Keogh accounts and employer-sponsored retirement accounts, including 401(k) and 403(b) plans.

holds faces a more restricted set of financial opportunities, as in India, the same monetary tightening tends to produce stronger substitution within the deposit assets and towards gold assets (passive households), with a correspondingly smaller loss of total bank funding. Identical deposit-rate pass-through therefore does not necessarily imply identical deposit outflows, and identical deposit betas need not imply identical effects on bank funding: the deposits channel is not a one-size-fits-all mechanism, but one whose aggregate consequences depend on household participation, portfolio composition, and the menu of assets actually available to households.

Our findings have a direct implication for monetary policy transmission and its assessment across countries. A central bank cannot infer the strength of the deposits channel, or its likely effect on bank funding and credit supply, from the deposit-rate pass-through alone; it must also look at the depth of the financial system and the share of households able to act on a widening spread. Where bond markets are thin, and household participation in them is limited, as in many emerging market economies, policy transmission through bank funding may be muted even when deposit-rate pass-through looks similar to that of an AE. Furthermore, the within-bank deposit reallocation we document suggests that banks' funding composition, rather than its aggregate quantity, may be the more informative margin to analyze.

Related Literature Our paper relates to three strands of literature. The first is the bank-lending channel of monetary transmission, in which balance-sheet strength and access to alternative funding shape banks' ability to insulate lending from monetary shocks ([Kashyap and Stein, 2000](#); [Kashyap et al., 2002](#)). The second, more directly related strand is the deposits channel itself. [Drechsler et al. \(2017\)](#) show that bank market power in deposit markets causes policy tightening to widen deposit spreads, induce deposit outflows, and contract lending; [Schaffer and Segev \(2021\)](#) and [Begenau and Stafford \(2023\)](#) show this mechanism is considerably more fragile empirically than the baseline result suggests, while [Choi and Rocheteau \(2023\)](#) and [Lu and Wu \(2026\)](#) provide complementary theoretical and empirical accounts of how entry costs and depositor attention shape the strength of transmission. [Koont et al. \(2024\)](#) show that digitalization can instead amplify deposit-rate sensitivity, underscoring that technology's effect on the channel is not one-directional. Cross-country evidence on this channel in EMEs remains comparatively scarce; [Giraldo et al. \(2026a\)](#) provide one of the few large panels covering EMEs, and [Bharat et al. \(2026\)](#) document weak transmission through bank interest rates in India specifically. The third strand is household finance, where participation in financial markets is shown to depend on fixed and per-period costs ([Vissing-Jorgensen, 2002](#)), household portfolio behavior varies systematically and imperfectly ([Campbell, 2006](#)), and near-money assets carry a liquidity premium that varies with the level of interest rates ([Nagel, 2016](#)).

We contribute to all three strands by building a simple portfolio framework for the deposits channel that makes the household's opportunity set an explicit determinant of transmission strength. The key distinction is between the deposit rate's *price response* and the household's *quantity response*. A low

deposit-rate pass-through from the policy rate (the deposit beta) determines how far the return on deposits falls behind competing assets when policy rates rise, but it does not by itself determine how many deposits leave the banking system: that response also depends on the household’s opportunity set. In our model, active households can substitute between deposits and non-deposit financial assets, whereas passive households cannot access this margin; both types can reallocate between liquid and fixed deposits and between financial and non-financial stores of value. Monetary tightening can consequently generate an internal shift within the banking sector, such as a move from liquid to term deposits, or an external shift away from bank deposits altogether, and the relative importance of each depends on household engagement, portfolio composition, asset substitutability, and asset-specific interest-rate pass-through. A low deposit pass-through therefore need not imply the same quantity response, or the same contraction in bank funding, across financial systems with different household compositions and market depth.

The rest of the paper is organized as follows. Section 2 describes the data sources for both India and the United States and reports descriptive statistics of the key variables. Section 3 presents stylized facts on household balance sheets and on deposit and bond interest rate pass-through in both countries. Section 4 develops the static portfolio-choice model, laying out the household problem, the nested asset structure, the optimization conditions, and the interest rate pass-through structure. Section 5 derives the model’s comparative statics: the extensive margin governing reallocation from deposits into bonds, the intensive margin governing compositional shifts between demand and term deposits, and the margin governing reallocation between financial and non-financial (gold) assets. Section 6 calibrates the model separately for the United States and India. Section 7 presents the calibrated results and numerically verifies the paper’s central proposition. Section 8 concludes and discusses the implications of our findings for monetary policy transmission.

2 Data

Our empirical analysis consolidates monthly information on deposit quantities, deposit rates, market interest rates, and monetary policy rates for the United States and India. A central objective is to make the two country datasets as comparable as possible. Since the underlying U.S. deposit-rate data are available at a higher frequency than the corresponding Indian series, we harmonize all time-series data to a monthly frequency before carrying out the cross-country analysis. Household balance-sheet data used in the structural calibration come from the 2019 Survey of Consumer Finances (SCF) ([Board of Governors of the Federal Reserve System, 2022](#)) for the United States and the 2019 All India Debt and Investment Survey (AIDIS) ([National Statistical Office , NSO](#)) for India. Appendix Table A1 reports the data sources for both countries.

United States. Deposit rates are taken from the data used by [Drechsler et al. \(2017\)](#). These data, based on RateWatch, contain quoted rates on checking, savings, and time-deposit products and are originally

available at a weekly frequency over the period relevant for the analysis. The authors publicly provide the replication files.³ Because the corresponding Indian series and the aggregate U.S. deposit quantities are monthly, we aggregate the weekly U.S. deposit-rate observations to calendar-month averages before merging them with the remaining series. This gives both countries a common time unit and avoids comparing regressions estimated at different sampling frequencies.

The U.S. monetary-policy instrument is the effective Federal Funds Rate. The three-month Treasury-bill rate is used as the baseline return on the liquid bond, while Moody's seasoned Aaa corporate bond yield proxies for the less-liquid bond. The six-month Treasury-bill rate provides a robustness alternative for the liquid-bond return. These series are obtained from the Federal Reserve's H.15 data through FRED.⁴ Aggregate deposit quantities are obtained from the Federal Reserve's H.6 Money Stock Measures. We use total checkable deposits, savings deposits, and small-denomination time deposits, and define core deposits as the sum of these three components.⁵

India. The Indian time-series data are drawn primarily from the Reserve Bank of India's *Database on the Indian Economy* (DBIE) and the *Handbook of Statistics on the Indian Economy*.⁶ The RBI repo rate is the policy instrument. The savings-deposit rate is used for the liquid deposit return, while the term-deposit rate is measured using the midpoint of the reported range for major banks. For market securities, the yield on Treasury bills with residual maturity of 15–91 days is our baseline liquid-bond return, providing a close counterpart to the short Treasury bill used for the United States. We use the ten-year Government of India security yield as the less-liquid bond return. The pre-2011 portion of the savings-deposit-rate series is reconstructed using the administered RBI rates prevailing during that period, after which we use the observed savings-deposit-rate series directly.

For the interest-rate pass-through estimates, the main Indian sample runs from 2001m4 to 2013m12. The starting date is dictated by continuous availability of the repo-rate series and the ending date provides a window close to the U.S. deposit-rate sample. We additionally report estimates over the longer 2001m4–2025m5 period to assess whether the results are sensitive to the choice of sample. The 15–91 day Treasury-bill series contains two isolated missing observations, which are linearly interpolated in constructing the continuous monthly baseline series. All interest rates are expressed at annual rates and converted to decimal form when they enter the model.

Monthly harmonization All cross-country time-series exercises are carried out at monthly frequency. Deposit spreads are defined consistently as the difference between the relevant policy rate and the deposit rate. To examine the relationship between monetary policy and deposits over time, we report

³See Drechsler et al. (2017) and the replication data linked from Philipp Schnabl's [webpage](#). The replication archive is also available through the [Harvard Dataverse](#).

⁴The principal FRED series are the effective Federal Funds Rate (FEDFUNDS); the three-month Treasury bill rate (TB3MS); and Moody's seasoned Aaa corporate bond yield (AAA).

⁵The corresponding historical FRED series are TCDSL; SAVINGSL; and STDLSL. Although some of these historical series were subsequently discontinued or reclassified, this does not affect the sample used in our analysis.

⁶Reserve Bank of India, Database on the Indian Economy: <https://data.rbi.org.in/>.

the rolling regression estimates based on a 36-month window in Section 3. The rolling regressions are intended as descriptive evidence on the evolution of the deposit channel.

Household balance sheets. The cross-country portfolio calibration uses household-level balance-sheet data. For the United States, we use the 2019 Survey of Consumer Finances (SCF) ([Board of Governors of the Federal Reserve System, 2022](#)), including its household survey weights and multiple-imputation structure. The SCF is used to classify households as Active or Passive and to construct the type-specific financial and non-financial portfolio shares used in the model.⁷ For India, we use the 2019 All India Debt and Investment Survey (AIDIS) ([National Statistical Office, NSO](#)), conducted as part of the 77th Round of the National Sample Survey. AIDIS provides detailed information on household holdings of deposits, other financial assets, gold, and other physical assets and is therefore particularly well suited to the portfolio comparisons in the paper.⁸

Return on the non-financial asset. The empirical counterpart of the non-financial asset (N) differs across the two countries. In the United States, N is a broad investable non-financial wealth bundle rather than a single traded asset. We therefore use capital appreciation in the national FHFA Purchase-Only House Price Index as a transparent market-based proxy for its return.⁹ Specifically, we construct the annualized capital-gain rate as

$$r_{N,t}^{US} = 12 \Delta \log P_t^{HPI},$$

where P_t^{HPI} is the price index, and $r_{N,t}^{US}$ is the return on the non-financial asset portfolio for the US. For our calibration, we take its average over the sample period. This gives $\bar{r}_N^{US} \simeq 0.029$, rounded to 0.03 in the calibration table. The FHFA index should not be interpreted as the literal return on every component of N —which also contains business and other non-financial wealth—but as a transparent and consistently measured proxy for the capital-gain component of investable non-financial wealth.

For India, the non-financial asset corresponds to household gold holdings, $N \equiv G$, because gold is more prevalent in the overall portfolio, as reported in Section 3. Directly using average realized gold-price appreciation as the steady-state return is problematic because gold prices are highly volatile and realized capital gains can exceed the model’s benchmark return, which would imply a negative user cost. We therefore separate the long-run expected component of gold returns from short-run gold-price innovations. Following [Barro and Misra \(2016\)](#), who estimate average annual real gold-price appreciation of 1.1 percent over 1836–2011, we set the real expected capital-gain component to 0.011

⁷Federal Reserve Board, 2019 Survey of Consumer Finances: https://www.federalreserve.gov/econres/scf_2019.htm.

⁸Government of India, Ministry of Statistics and Programme Implementation, *All India Debt and Investment Survey–2019*, NSS Report No. 588: https://www.mospi.gov.in/sites/default/files/publication_reports/Report_no588-AIDIS-77R-SeptFinal_0.pdf. The public-use microdata are available through the MoSPI Microdata Library, <https://microdata.gov.in/>. Household asset and liability positions in the survey refer to June 30, 2018.

⁹Federal Housing Finance Agency, FHFA House Price Index datasets: <https://www.fhfa.gov/data/house-price-index>. We use the national monthly Purchase-Only index based on sales-price transactions.

and convert it into nominal terms using average Indian CPI inflation:

$$1 + \bar{r}_G = (1 + 0.011)(1 + \bar{\pi}_{\text{India}}).$$

This produces the values reported in the calibration table for the two Indian sample windows. Monthly movements in the RBI gold-price series are instead interpreted as realizations of the exogenous gold-return shock $\varepsilon_{G,t}$. This distinction is consistent with the model, in which the financial return to gold is separated from the nonpecuniary store-of-value and portfolio services that gold provides through the asset-services aggregate S .

Table 2 reports the summary statistics for the major rates used in our analysis for both countries. Interest rates are noticeably higher in India than in the United States over the respective sample periods. The average Indian repo rate is about 7.1 percent, compared with an average federal funds rate of about 2.3 percent in the United States. In both countries, more liquid deposit rates remain below the policy rate, but the gap is considerably larger in India: the average repo–savings deposit spread is about 3.4 percentage points, whereas the corresponding federal funds–savings spread in the United States is about 1 percentage point. In the United States, time-deposit rates track the policy rate much more closely than checking or savings deposit rates, consistent with stronger repricing of less-liquid deposits. Overall, the descriptive statistics already suggest meaningful cross-country differences in both the level of interest rates and the extent of deposit-rate pass-through.

Table 2
Summary Statistics: Interest Rates and Deposit Spreads

Country	Variable	Obs.	Mean	Std. Dev.	Min.	Max.
<i>Panel A: India</i>						
	Policy repo rate	153	7.054	1.136	4.750	9.000
	Savings Deposit Rate	153	3.679	0.240	3.5	4
	Repo–savings deposit spread	153	3.449	1.076	1.250	5.500
	Time Deposit Rate	153	6.933	1.122	5.02	8.91
	Repo Rate–Term deposit rate spread	153	6.480	2.35	-1.56	9.00
	10-year government security yield	177	8.011	1.602	5.105	11.890
<i>Panel B: United States</i>						
	Federal funds rate	178	2.299	2.167	0.125	6.500
	Checking deposit rate	178	0.579	0.526	0.074	1.723
	Savings deposit rate	178	1.328	0.978	0.165	3.384
	Time deposit rate	178	2.480	1.644	0.327	5.864
	Fed funds–checking deposit spread	178	1.720	1.781	-0.166	4.794
	Fed funds–savings deposit spread	178	0.971	1.343	-0.780	3.433
	Fed funds–time deposit spread	178	-0.181	0.695	-1.973	1.107

Notes: All interest rates and spreads are reported in percentage points per annum. Deposit spreads are defined as the policy rate minus the corresponding deposit rate; therefore, a larger positive spread indicates weaker pass-through of the policy rate to the deposit rate. Observation counts differ across Indian series because of differences in data availability. Data for the U.S. is from the replication package of [Drechsler et al. \(2017\)](#), while for India it is from the RBI and CEIC.

3 Stylized Facts

Household portfolio composition in India and the United States. Figure 1 compares household portfolio composition across the wealth distribution in India and the United States. The Indian panel is constructed using the 2019 All India Debt and Investment Survey (AIDIS), while we use the 2019 Survey of Consumer Finances (SCF) for the U.S. Both surveys provide detailed information on household balance sheets and allow us to analyze how the wealth composition varies across households rather than only comparing aggregate asset holdings.

For India, we focus on the non-business portion of the household portfolio and group assets into three categories: gold, deposits, and other financial assets. Gold consists of bullion and ornaments. Deposits include bank and post office accounts as well as fixed and term deposits and other deposit-like savings instruments, while financial assets include instruments such as shares, debentures, mutual funds, insurance-related savings, annuities, and receivables. For each household, the three components are expressed as shares of non-business wealth,

$$W_i^{NB} = G_i + D_i + F_i,$$

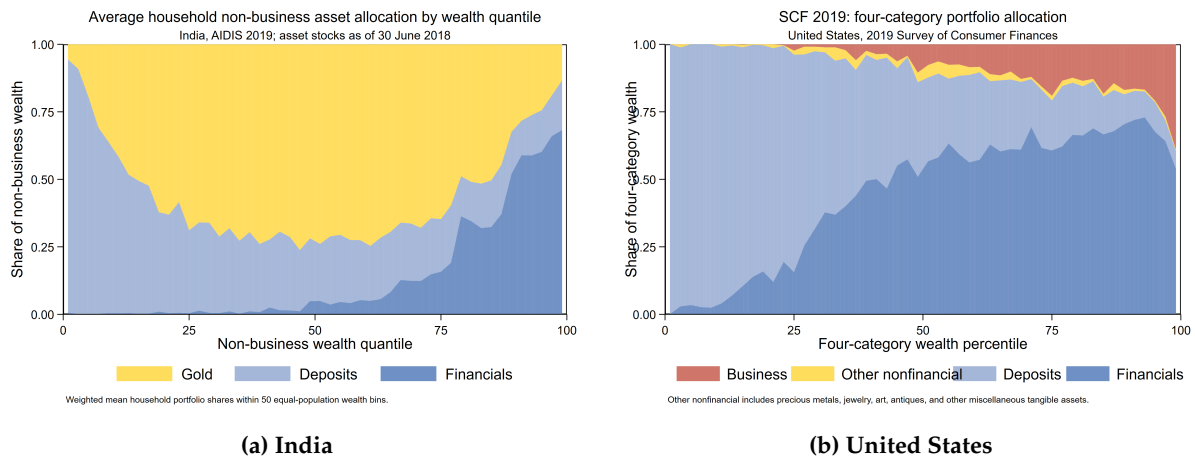
and place households into survey-weighted, equal-population wealth bins based on their overall ranking in the wealth quintile distribution,

For the United States, we construct four broad asset classes from the 2019 SCF: deposits, financial assets other than deposits, business wealth, and other non-financial assets. Deposits consist of liquid transaction accounts and certificates of deposit. Financial assets contain the remaining financial portfolio, including stocks, bonds, mutual funds, retirement accounts, and other managed financial assets. Business wealth combines equity in household businesses with net equity in non-residential real estate. The remaining non-financial category includes assets such as precious metals, jewelry, antiques, art, and other miscellaneous tangible assets. Thus, unlike the Indian gold category, the U.S. “other non-financial” category should not be interpreted as gold alone. The SCF portfolios are likewise ranked into survey-weighted equal-population wealth bins, with the estimates averaged across the survey’s five implicates.

The contrast between the two household balance sheets in Figure 1 is striking. In India, gold accounts for a large part of non-business wealth across much of the wealth distribution. Deposits are particularly important toward the lower end, while other financial assets remain very small for a large fraction of households and become quantitatively important only toward the upper part of the distribution. Thus, outside the wealthiest households, the menu of conventional financial assets appearing on Indian household balance sheets is relatively narrow: households largely hold deposits alongside a substantial stock of physical gold.

The U.S. pattern is very different. Financial assets become important much earlier in the wealth

Figure 1
Household portfolio composition across the wealth distribution: India and the United States.



Notes: Panel (a) uses the 2019 All India Debt and Investment Survey (AIDIS). Indian non-business wealth is defined as the sum of gold, deposits, and financial assets, and the figure reports survey-weighted average household portfolio shares within equal-population wealth bins. Panel (b) uses the 2019 Survey of Consumer Finances (SCF). U.S. four-category wealth is the sum of deposits, financial assets excluding deposits, business wealth, and other non-financial assets. "Other non-financial" includes precious metals and jewelry as well as antiques, art, and other miscellaneous tangible assets and therefore should not be interpreted as a measure of gold alone. SCF estimates use the survey weights and average the corresponding estimates across the five imputation implicates. The Indian panel excludes business wealth, whereas the U.S. panel shown here retains business wealth.

distribution and account for a large share of household portfolios for most of it. Deposits are relatively important among households at the lower end, but their portfolio share falls as wealth rises and households move toward stocks, retirement accounts, mutual funds, bonds, and other financial instruments. Business wealth also becomes increasingly important in the upper tail. Miscellaneous non-financial assets, including precious metals and jewelry, account for only a small fraction of the U.S. household portfolio. The main difference is therefore not simply that U.S. households are wealthier, but that they hold their wealth in a much broader set of financial claims.

These differences directly affect the deposit channel of monetary policy. The mechanism requires more than incomplete pass-through to deposit rates. It also requires households to have access to alternative assets into which they can reallocate deposits. When policy rates rise faster than deposit rates, the return differential between deposits and market-based assets widens. The resulting decline in deposit demand should therefore depend on both the attractiveness of the outside assets and the fraction of households able to hold them.

The U.S. panel suggests that other substitutable products are available to a broad segment of households. Non-deposit financial assets appear well before the upper end of the wealth distribution and account for an increasing share of portfolios as wealth rises. For these households, a higher relative return on Treasury securities, bonds, mutual funds, or other market-based claims can push funds out of the banking system. This is the conventional deposit-channel mechanism emphasized in the U.S. literature: sluggish deposit-rate adjustment raises deposit spreads and encourages households to substitute from bank deposits toward higher-yielding non-bank assets.

The Indian panel points to a different adjustment margin. For much of the wealth distribution,

deposits are the principal conventional financial asset, while non-deposit financial instruments remain quantitatively small. A large share of households may therefore have limited scope to respond to monetary tightening by moving directly from deposits into marketable securities. This need not imply that their portfolios are unresponsive. Because term-deposit rates generally adjust more strongly to the policy rate than savings-deposit rates, households may instead reallocate within the banking system, from liquid savings deposits toward fixed or term deposits. Some adjustment may also occur between financial assets and gold, although this is conceptually distinct from the conventional deposit-to-securities channel.

This motivates the two forms of heterogeneity built into the model. One type of household, called *Active households*, can substitute between deposits and non-deposit financial assets, whereas the other type, *Passive households*, lacks this external financial margin and can adjust mainly within the deposit bundle or between deposits and non-financial wealth. Since the proportion of Active households and their portfolio weights differ across India and the United States, an identical change in policy rates can generate different aggregate deposit responses. In particular, the model allows the conventional deposit-to-securities channel to be stronger in the United States while the reallocation from demand deposits toward fixed deposits plays a relatively larger role in India.

Figure 1 should not, by itself, be interpreted as evidence of a causal response to monetary policy. Rather, it highlights the portfolio structure that determines which substitution margins are available when relative returns change. The subsequent empirical analysis examines how deposit quantities and asset returns actually respond to policy-rate movements, while the model uses the cross-country differences displayed here to determine household participation and portfolio composition.

3.1 Empirical Evidence

Before turning to the model, we document a set of time-varying relationships between monetary policy and household deposits in the United States and India. The purpose of this exercise is descriptive. We do not interpret the rolling coefficients below as causal estimates of the deposit channel. Instead, they provide a simple way to compare how the sensitivity of different deposit categories to monetary conditions evolves over time in the two economies.

We focus on three deposit aggregates: savings deposits, short-term time deposits, and core deposits. For the United States, monetary policy is measured using the Federal Funds Rate. For India, we use the RBI repo rate. The deposit series are matched as closely as possible across the two countries, although the underlying institutional definitions are not identical.

For each deposit category d , country c , and month t , we estimate a 36-month rolling regression of the form

$$g_{\tau}^{d,c} = \alpha_t^{d,c} + \beta_t^{d,c} X_{\tau}^c + \varepsilon_{\tau}^{d,c}, \quad \tau = t - 35, \dots, t, \quad (1)$$

where $g_{\tau}^{d,c}$ denotes the growth rate of the corresponding deposit aggregate and X_{τ}^c denotes the monetary-

policy variable. The coefficient $\beta_t^{d,c}$ is therefore re-estimated in every 36-month window. The figures report the resulting sequence of rolling coefficients together with 95 percent confidence intervals.

We consider several alternative specifications for X_τ^c . The first uses the level of the policy rate,

$$X_\tau^c = r_\tau^c, \quad (2)$$

where r_τ^c is the Federal Funds Rate in the United States and the repo rate in India. We then repeat the exercise using changes in the policy rate,

$$X_\tau^c = \Delta r_\tau^c. \quad (3)$$

Finally, we consider the deposit spread,

$$s_\tau^{d,c} = r_\tau^c - r_\tau^{d,c}, \quad (4)$$

and its change,

$$X_\tau^c = \Delta s_\tau^{d,c}. \quad (5)$$

These alternative specifications are useful because the deposit channel is ultimately driven by the opportunity cost of holding deposits rather than by the policy rate alone.

Figure 2 first plots the rolling coefficient linking savings-deposit growth to the policy-deposit spread. The contrast across the two countries is pronounced. In the United States, the coefficient varies substantially over time. It declines sharply in the mid-2000s, subsequently recovers, and remains well below one for most of the sample. In India, by contrast, the corresponding coefficient is much more stable for much of the sample and only begins to decline materially after the early 2010s.

This difference is consistent with the institutional structure emphasized in the paper. U.S. households have access to a broad menu of liquid marketable assets, so changes in the relative return on deposits can induce substantial portfolio reallocation outside the banking system. Indian households, in contrast, are much more concentrated in deposits and other traditional saving instruments, with limited direct participation in marketable securities. Accordingly, movements in deposit spreads need not translate into the same degree of substitution away from bank deposits.

Figures 3–5 repeat the rolling exercise separately for savings deposits, short-term time deposits, and core deposits. Across specifications, two broad patterns emerge.

First, the response of U.S. savings and core deposits is considerably more time-varying than the corresponding response in India. In several windows, particularly around periods of higher monetary-policy adjustment in terms of changes in the policy rates, the U.S. coefficients become negative. This is consistent with the conventional deposit channel: when market rates rise relative to the rates paid on liquid deposits, households reduce their holdings of these deposits and shift toward alternative assets.

Second, time deposits behave differently from savings deposits. In both countries, time-deposit

rates tend to adjust more strongly to policy rates than savings-deposit rates. As a result, the opportunity-cost increase associated with monetary tightening is smaller for time deposits. The rolling coefficients are correspondingly less negative, and in some windows are positive. This suggests that part of the response to monetary tightening may take place *within* the banking system, through substitution from more liquid deposits toward higher-yielding term deposits, rather than through an outright decline in total deposits.

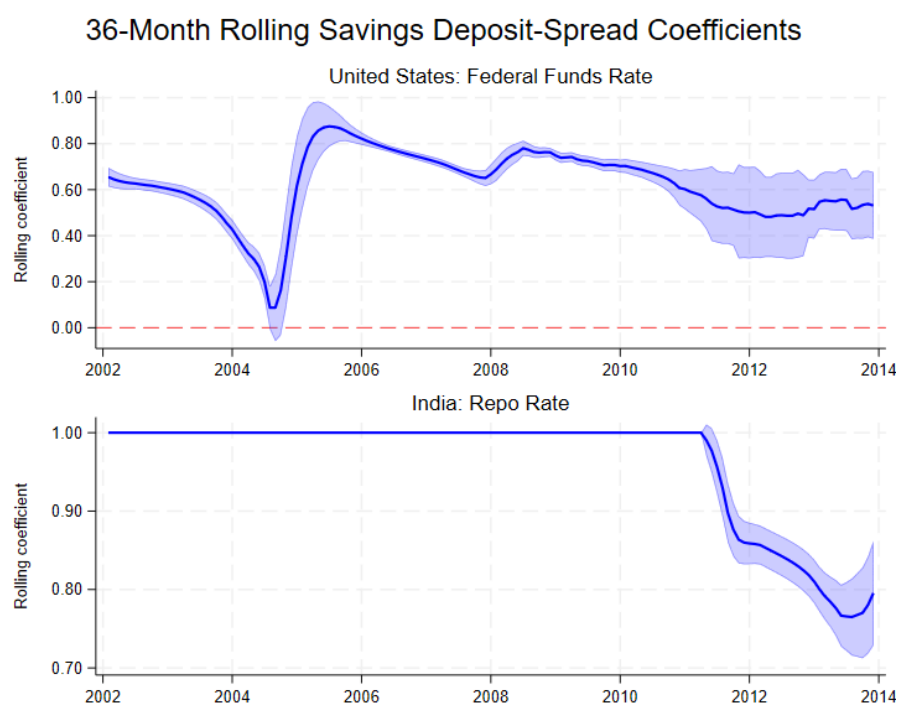
The cross-country difference is clearest for core deposits. In the United States, the rolling coefficients are frequently negative, particularly in the later part of the sample, indicating that tighter monetary conditions are associated with weaker growth in the most liquid deposit categories. In India, the relationship is less consistently negative and displays larger episodic movements. This is consistent with a weaker market-based deposit channel and a greater role for reallocation across deposit categories.

The difference is economically plausible given the composition of household portfolios documented earlier. U.S. households hold substantially larger shares of marketable securities and other non-deposit financial assets, while Indian households remain much more concentrated in deposits, provident-fund-type instruments, and gold. The same change in the relative return on deposits therefore generates a larger outside option for U.S. households than for Indian households.

Taken together, the rolling-regression evidence motivates three features of the model developed below. First, the sensitivity of deposit quantities to monetary policy is not uniform across deposit types. Second, the relevant margin is not only the level of the policy rate, but the relative user cost of deposits and competing assets. Third, the strength of the deposit channel depends on the household's opportunity set in terms of the instruments constituting their portfolio.

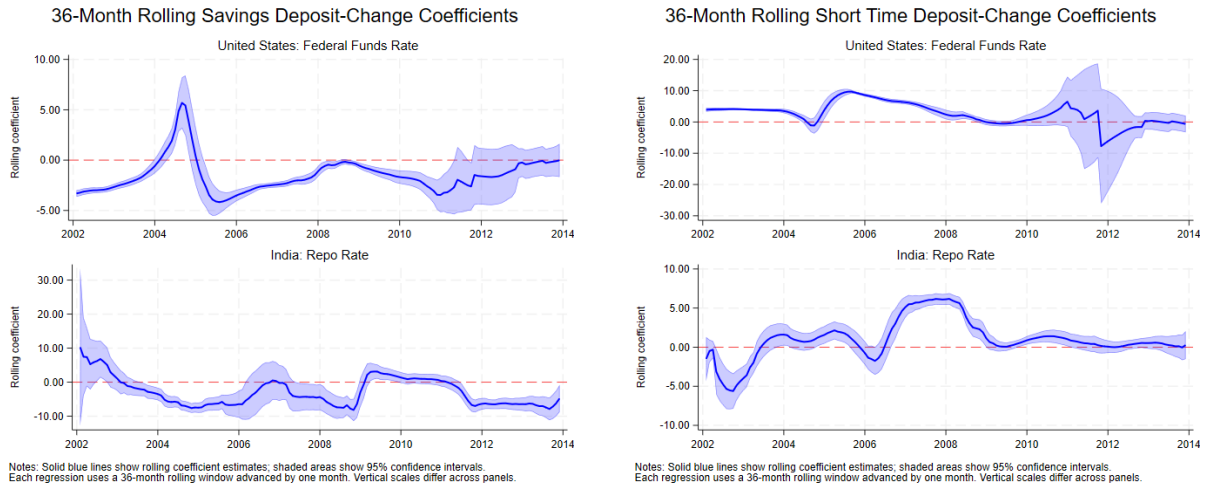
These observations motivate a model with heterogeneous households, imperfect pass-through from policy rates to asset returns, and multiple margins of portfolio substitution. Active households can reallocate between deposits and marketable financial assets, while Passive households have a more restricted asset menu. The model therefore allows monetary tightening to generate both substitution within deposits and substitution from deposits toward non-bank assets, with the relative importance of the two margins differing across the United States and India.

Figure 2
Rolling Relationship between Savings Deposit Spread and Policy Rate



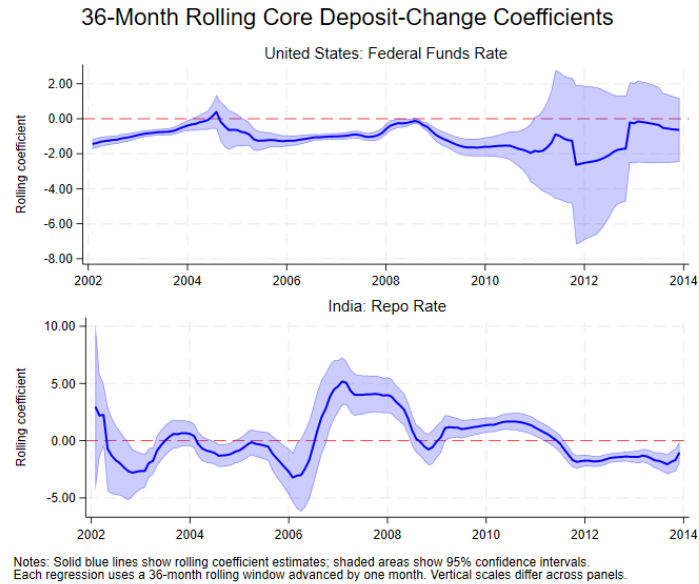
Notes: Solid blue lines show rolling coefficient estimates; shaded areas show 95% confidence intervals. Each regression uses a 36-month rolling window advanced by one month. Vertical scales differ across panels.

Figure 3
Rolling Relationship between Deposit Growth and Policy Rates



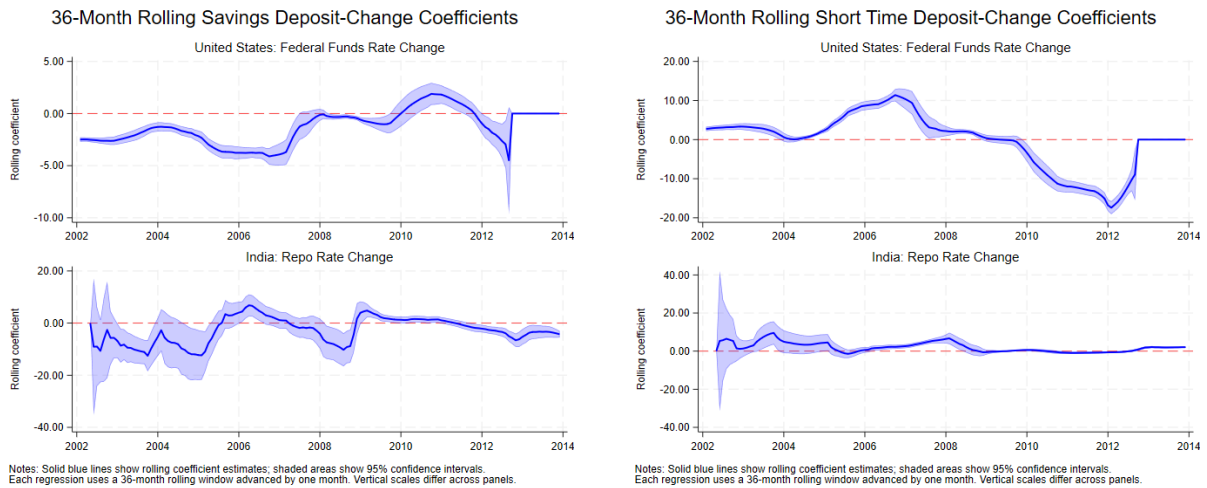
(a) Savings deposits

(b) Short-term time deposits



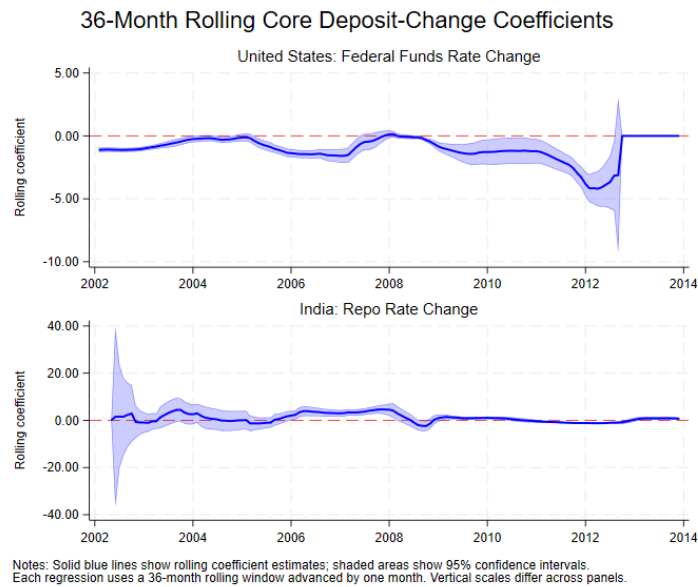
(c) Core deposits

Figure 4
Rolling Relationship between Deposit Growth and Δ Policy Rates



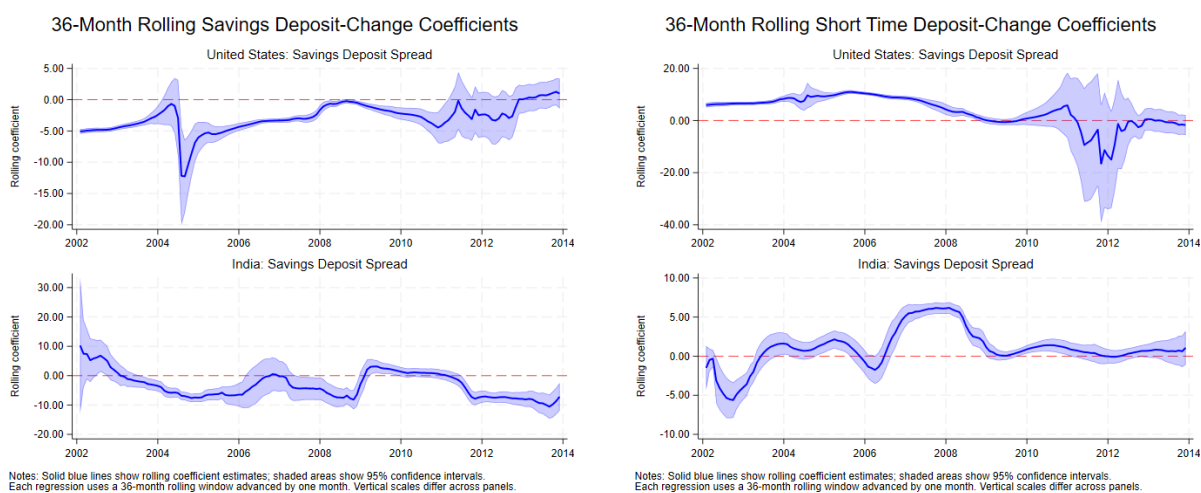
(a) Savings deposits

(b) Short-term time deposits



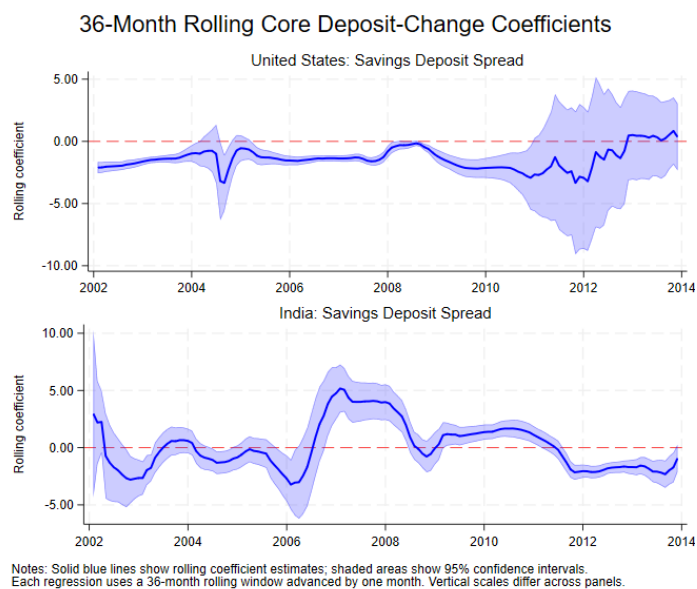
(c) Core deposits

Figure 5
Rolling Relationship between Deposit Growth and Deposit Spreads



(a) Savings deposits

(b) Short-term time deposits



(c) Core deposits

4 Model

This section develops a partial equilibrium model to study the demand deposit channel of monetary policy. The focus is on household portfolio reallocation across financial and non-financial assets following changes in the policy rate. Because interest rates are exogenous and no market-clearing conditions are imposed, a partial equilibrium framework suffices to characterize household responses.

Consider a static one-period economy populated by a continuum of households of unit mass. A fraction $\lambda \in [0, 1]$ are *active* households with access to the government bond market, while the remaining fraction $(1 - \lambda)$ are *passive* households that can invest only in bank deposits and non-financial assets.

4.1 Household

There are two household types $j \in \{a, p\}$ for active and passive, respectively. For a household of type j , the utility is additively separable and CRRA in consumption c and in the composite index of asset services S ,

$$U(c^j, S^j) = \ln c^j + \chi_j^j \ln S^j \quad (6)$$

where $\chi_j^j > 0$ is a relative weight on the services. The following is the budget constraint:

$$c^j + P_S^j S^j = W^j \quad (7)$$

W^j is the household's period resource flow and $P^j S^j$ is the user-cost price index of the asset-services bundle S^j . As in [Jorgenson \(1963\)](#) and [Barnett \(1980\)](#), holding an asset is priced at its opportunity-cost differential relative to a benchmark rate r , not at its full return, so that c and S do not double-count the same resource.

4.2 Assets

Assets are aggregated at three levels. The first level is the CES composite of Financial and Non-Financial Assets. S^j aggregates a financial composite F^j and a non-financial composite N^j :

$$S^j = \left(\theta_{F,j}^{1/\eta_j} (F^j)^{\frac{\eta_j-1}{\eta_j}} + \theta_{N,j}^{1/\eta_j} (N^j)^{\frac{\eta_j-1}{\eta_j}} \right)^{\frac{\eta_j}{\eta_j-1}} \quad (8)$$

where η_j is the elasticity of substitution between the financial and non-financial composite and shares $\theta_{F,j}, \theta_{N,j}$ for financial and non-financial assets, respectively, such that $\theta_{F,j} + \theta_{N,j} = 1$. Cost minimization for a given S^j yields the expenditure identity:

$$P_S^j S^j = P_F^j F^j + P_N^j N^j, \quad (9)$$

where $P_S^j = \left(\theta_{F,j} (P_F^j)^{1-\eta_j} + \theta_{N,j} (P_N^j)^{1-\eta_j} \right)^{\frac{1}{1-\eta_j}}$ is the aggregate price index of the services. We consider gold G as the only non-financial asset in our model with price P_N^j . $N^j \equiv G^j$ and its price is simply its user cost.

4.2.1 Financial Assets

Financial Assets F^j is the CES Composite of Deposits D^j and Bonds B^j . F^j aggregates deposits D^j and bonds B^j with CES elasticity ϕ_j and shares α_D^j, α_B^j with $\alpha_D^j + \alpha_B^j = 1$:

$$F^j = \left((\alpha_D^j)^{1/\phi_j} (D^j)^{\frac{\phi_j-1}{\phi_j}} + (\alpha_B^j)^{1/\phi_j} (B^j)^{\frac{\phi_j-1}{\phi_j}} \right)^{\frac{\phi_j}{\phi_j-1}} \quad (10)$$

The household's total expenditure on the financial asset is as follows,

$$P_F^j F^j = P_D^j D^j + P_B^j B^j \quad (11)$$

where, $P_F^j = \left(\alpha_D^j (P_D^j)^{1-\phi_j} + \alpha_B^j (P_B^j)^{1-\phi_j} \right)^{\frac{1}{1-\phi_j}}$. By definition the Passive households have no bond market access, thus $\alpha_B^p \equiv 0, \alpha_D^p \equiv 1$, so $F^p \equiv D^p$ and $P^j F^j \equiv P^j D^j$. For the Active households $\alpha_B^a \in (0, 1)$.

4.2.2 Deposits and Bonds

At the third level, we have Deposits D^j and Bonds B^j as Cobb– Douglas composites. D^j is a Cobb– Douglas composite of demand deposits D_d^j and fixed deposits D_f^j , share of the demand deposit $\gamma_j \in (0, 1)$:

$$D^j = \frac{(D_d^j)^{\gamma_j} (D_f^j)^{1-\gamma_j}}{\gamma_j^{\gamma_j} (1-\gamma_j)^{1-\gamma_j}} \quad (12)$$

The total expenditure on the deposits is,

$$P_D^j D^j = \pi_{Dd}^j D_d^j + \pi_{Df}^j D_f^j \quad (13)$$

where $P_D^j = \pi_{Dd}^{\gamma_j} \pi_{Df}^{1-\gamma_j}$ is the aggregate deposit price index and π_{Dd}, π_{Df} are the user costs of holding demand deposit and a term/fixed deposit. B^j is the aggregate bond holdings is a Cobb–Douglas composite of liquid bonds B_L^j and illiquid (non-liquid) bonds B_{NL}^j , share parameter $\mu_j \in (0, 1)$:

$$B^j = \frac{(B_L^j)^{\mu_j} (B_{NL}^j)^{1-\mu_j}}{\mu_j^{\mu_j} (1-\mu_j)^{1-\mu_j}} \quad (14)$$

The total expenditure on the bonds is,

$$P_B^j B^j = \pi_{BL}^j B_L^j + \pi_{BN}^j B_{NL}^j \quad (15)$$

where $P_B^j = \pi_{BL}^{\mu_j} \pi_{BN}^{1-\mu_j}$ is the composite price of the bonds and π_{BL}, π_{BN} are the user costs of liquid and illiquid bonds, respectively. The user cost π_k for asset k , where $k \in \{D_d, D_f, B_L, B_{NL}, G\}$ is priced at its opportunity cost relative to the benchmark rate r , following Jorgenson (1963), Diewert (1974), and Barnett (1978, 1980):

$$\pi_k = \frac{r - r_k}{1 + r} \quad (16)$$

We can thus rewrite the budget constraint as,

$$c^j + \pi_{Dd} D^j + \pi_{Df} D^j + \pi_{Df} D^j + \pi_{BL} B_L^j + \pi_{BN} B_N^j = W^j \quad (17)$$

where, $\pi_{Dd} = \frac{r - r_{Dd}}{1 + r}$, $\pi_{Df} = \frac{r - r_{Df}}{1 + r}$, $\pi_{BL} = \frac{r - r_{BL}}{1 + r}$, $\pi_{BN} = \frac{r - r_{BNL}}{1 + r}$, and $\pi_G = \frac{r - r_G}{1 + r}$. r is the envelope/benchmark rate, assumed to weakly dominate every r_k in pure pecuniary terms once liquidity services are stripped out.

4.3 Optimization

Households solve an optimization problem with two decisions. First, they decide how much to spend on consumption and asset services, then choose the optimal demand bundle for each asset discussed above.

4.3.1 Optimal consumption and asset services

The household maximizes (6) subject to the static budget constraint (7) and get the following closed-form solution,

$$c^{j*} = \frac{1}{1 + \chi^j} W^j, \quad P_S^j S^{j*} = \frac{\chi^j}{1 + \chi^j} W^j \quad (18)$$

Consumption and total service expenditure are therefore constant shares of $W^j - 1/(1 + \chi^j)$ and $\chi^j/(1 + \chi^j)$ respectively — independent of P_S^j . This is the expected Cobb–Douglas property: log utility implies unit elasticity of substitution between c^j and S^j , so the expenditure share on services does not respond to changes in its own price. Any sensitivity of $\mathcal{E}(r)$ to a policy-rate change under log utility therefore operates entirely through the lower-tier CES nests (Tiers 1–3), not through the consumption–services margin itself.

4.3.2 Optimal Demand functions for assets

For financial and non-financial assets the households minimize $P_F^j F^j + P_N^j N^j$ subject to (8) yields the following standard CES demand functions,

$$N^{j*} = \theta_{N,j} \left(\frac{P_N^j}{P_S^j} \right)^{-\eta_j} S^j \quad (19)$$

and

$$F^{j*} = \theta_{F,j} \left(\frac{P_F^j}{P_S^j} \right)^{-\eta_j} S^j \quad (20)$$

for financial assets and non-financial assets, respectively. Now given F^{j*} from above, the households minimize $P_D^j D^j + P_B^j B^j$ subject to (10) yielding the following demand function,

$$D^{j*} = \alpha_D^j \left(\frac{P_D^j}{P_F^j} \right)^{-\phi_j} F^{j*} \quad (21)$$

$$B^{j*} = \alpha_B^j \left(\frac{P_B^j}{P_F^j} \right)^{-\phi_j} F^{j*} \quad (22)$$

for total deposits and bonds, respectively. In the above equation, the aggregate price index on financial assets is $P_F^j = \left[\alpha_{D,j} \left(P_D^j \right)^{1-\phi_j} + \alpha_{B,j} \left(P_B^j \right)^{1-\phi_j} \right]^{\frac{1}{1-\phi_j}}$.

Cobb–Douglas cost minimization gives constant expenditure shares of $P_D^j D^{j*}$ and $P_B^j B^{j*}$:

$$D_d^{j*} = \gamma_j \frac{P_D^j}{\pi_{Dd}} D^{j*}, \quad D_f^{j*} = (1 - \gamma_j) \frac{P_D^j}{\pi_{Df}} D^{j*} \quad (23)$$

$$B_L^{j*} = \mu^j \frac{P_B^j}{\pi_{BL}} B^{j*}, \quad B_{NL}^{j*} = (1 - \mu^j) \frac{P_B^j}{\pi_{BNL}} B^{j*} \quad (24)$$

where, $P_D^j = \pi_{Dd}^{\gamma_j} \pi_{Df}^{1-\gamma_j}$ and $P_B^j = \pi_{BL}^{\mu_j} \pi_{BN}^{1-\mu_j}$.

4.4 Interest rates structure

r_{D_d} is the deposit interest rate for savings deposits. r_{D_f} is the deposit interest rate for term deposits. r is the envelope or the benchmark rate from the pure illiquid asset. r_{policy} is the policy rate. r_G is the return from investing in gold. r_{B_L} and r_{B_N} are the returns from liquid and illiquid bonds, respectively.

Each asset-specific rate is modeled as a mean rate plus partial pass-through from the policy rate. For $k \in \{D_d, D_f, B_L, B_N\}$,

$$r_k = \bar{r}_k + \beta_k r_{policy} \quad (25)$$

where $\bar{r}_k$ is the asset-specific mean (intercept) rate and $\beta_k \in [0, 1]$ is the pass-through coefficient, both calibrated parameters. $\beta_k = 1$ corresponds to full pass-through (the asset rate moves one-for-one with the policy rate); $\beta_k = 0$ corresponds to no pass-through (the rate is fixed at its mean regardless of policy).

Gold is the exception: its return does not respond to the policy rate at all, but instead follows an idiosyncratic shock uncorrelated with monetary policy,

$$r_G = \bar{r}_G + \epsilon_G, \quad \mathbb{E}[\epsilon_G] = 0 \quad (26)$$

Equation (26) is the limiting case $\beta_G = 0$ of (25), but is written separately to emphasize that the fluctuation in r_G comes from an independent shock (e.g., global gold-price movements) rather than from a fixed intercept alone.

5 Comparative Statics

5.1 Demand Deposit Channel: $\partial \ln(B_L/D_d)/\partial r_{policy}$

In this section, we formally derive the demand deposit channel in the economy. To be precise $\partial \ln(B_L/D_d)/\partial r_{policy}$ is the semi-elasticity of the change in the bonds to demand deposit ratio when the policy rate changes.

Since we have two household types,

$$\frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} = \lambda \frac{\partial \ln(B_L/D_d)^{active}}{\partial r_{policy}} + (1 - \lambda) \frac{\partial \ln(B_L/D_d)^{passive}}{\partial r_{policy}} \quad (27)$$

Since $B_L = 0$ for the passive households,

$$\frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} = \lambda \frac{\partial \ln(B_L/D_d)^{active}}{\partial r_{policy}} \quad (28)$$

By Tier-3 Cobb–Douglas cost minimization, $B_L^{active} = \mu P_B B^a / \pi_{BL}$ and $D_d = \gamma P_D D^a / \pi_{Dd}$ (active households). Forming the ratio:

$$\ln\left(\frac{B_L}{D_d}\right) = \ln\left[\frac{\mu P_B / \pi_{BL} B^a}{\gamma P_D / \pi_{Dd} D^a}\right] \quad (29)$$

Using the Tier-2 CES demands $B_L^{active} = \alpha_B (P_B/P_F)^{-\phi} F^a$ and $D^{active} = \alpha_D (P_D/P_F)^{-\phi} F^a$, the common factor F^a and $(P_F)^{-\phi}$, will simplify to,

$$\frac{B_L}{D_d} = \frac{\mu \alpha_B}{\gamma \alpha_D} \cdot \frac{P_B^{1-\phi}}{P_D^{1-\phi}} \cdot \frac{\pi_{Dd}}{\pi_{BL}} \quad (30)$$

Taking logs:

$$\ln\left(\frac{B_L}{D_d}\right) = \ln\left(\frac{\mu \alpha_B}{\gamma \alpha_D}\right) + (1 - \phi) \ln\left(\frac{P_B}{P_D}\right) + \ln \pi_{Dd} - \ln \pi_{BL} \quad (31)$$

Solving it further using $P_D = \pi_{Dd}^\gamma \pi_{Df}^{1-\gamma}$ and $P_B = \pi_{BL}^\mu \pi_{BN}^{1-\mu}$ and differentiating with respect to r_{policy} , we get¹⁰

$$\frac{\partial}{\partial r_{policy}} \ln\left(\frac{B_L}{D_d}\right) = \frac{1}{\pi_{BL}} \left[(1 - \phi) \mu - 1 \right] \frac{\partial \pi_{BL}}{\partial r_{policy}} + \frac{1}{\pi_{Dd}} \left[1 - (1 - \phi) \gamma \right] \frac{\partial \pi_{Dd}}{\partial r_{policy}} \quad (32)$$

$$+ \frac{(1 - \mu)(1 - \phi)}{\pi_{BN}} \frac{\partial \pi_{BN}}{\partial r_{policy}} - \frac{(1 - \gamma)(1 - \phi)}{\pi_{Df}} \frac{\partial \pi_{Df}}{\partial r_{policy}} \quad (33)$$

¹⁰For detailed derivation see Technical Appendix B

Assuming, $r_k = \bar{r}_k + \beta_k r_{policy}$ and envelope rate $r = \bar{r} + \beta_r r_{policy}$, with $\pi_k = (r - r_k)/(1 + r)$, $dr/dr_{policy} = \beta_r$ and $dr_k/dr_{policy} = \beta_k$:

$$\frac{\partial \pi_k}{\partial r_{policy}} = \frac{(\beta_r - \beta_k) - \beta_r \pi_k}{1 + r} \quad (34)$$

$$\frac{\partial \pi_k}{\partial r_{policy}} \frac{1}{\pi_k} = \frac{1}{(1 + r)} \left[\frac{(\beta_r - \beta_k)}{\pi_k} - \beta_r \right] \quad (35)$$

Substituting back (34)–(35) to each of the four rates $k \in \{B_L, D_d, B_N, D_f\}$ in (33):

$$\frac{\partial}{\partial r_{policy}} \ln \left(\frac{B_L}{D_d} \right) = \frac{\lambda}{1 + r} \Psi \quad (36)$$

where,

$$\Psi \equiv [1 + (\phi - 1)\gamma] X_{Dd} - [1 + (\phi - 1)\mu] X_{BL} - (1 - \mu)(\phi - 1) X_{BN} + (1 - \gamma)(\phi - 1) X_{Df}$$

and $X_k \equiv \frac{\beta_r - \beta_k}{\pi_k} - \beta_r$ for $k \in \{Dd, Df, BL, BN\}$. Equation (A45) shows that the liquid bond-to-demand deposit ratio's sensitivity to the policy rate is a weighted combination of *four* pass-through gaps $(\beta_r - \beta_{BL})$, $(\beta_r - \beta_{Dd})$, $(\beta_r - \beta_{BN})$, $(\beta_r - \beta_{Df})$, with weights set by the Tier 2 substitution elasticity ϕ and the Tier 3 Cobb–Douglas shares μ, γ . The term $[(1 - \phi)\mu - 1]$ multiplying the B_L gap is generally negative for $\phi > 0$, $\mu \in (0, 1)$, while $[1 - (1 - \phi)\gamma]$ multiplying the D_d gap is generally positive, consistent with the ratio rising (more liquid bond heavy) when the demand deposit pass-through gap widens relative to the liquid bond gap, as the deposit channel predicts.

The above elasticity captures the *extensive margin*: how a policy rate change shifts deposits into or out of bonds. In the next comparative static, we study the *intensive margin*: how a change in the policy rate affects the composition of demand and term (fixed) deposits held by households.

5.2 Compositional Shift in Deposits: $\partial \ln(D_f/D_d)/\partial r_{policy}$

For each type of household, Tier 3 Cobb–Douglas cost minimization gives $D_f = (1 - \gamma) P_D D^a / \pi_{Df}$ and $D_d = \gamma P_D D^a / \pi_{Dd}$. Forming the ratio and taking logs,

$$\ln \left(\frac{D_f}{D_d} \right) = \ln \left(\frac{1 - \gamma}{\gamma} \right) + \ln \pi_{Dd} - \ln \pi_{Df} \quad (37)$$

Differentiating with respect to r_{policy} and using $\frac{\partial \pi_k}{\partial r_{policy}} = \frac{(\beta_r - \beta_k) - \beta_r \pi_k}{1 + r}$,

$$\frac{\partial}{\partial r_{policy}} \ln \left(\frac{D_f}{D_d} \right) = \frac{1}{1 + r} \left[\left(\frac{\beta_r - \beta_{Dd}}{\pi_{Dd}} - \beta_r \right) - \left(\frac{\beta_r - \beta_{Df}}{\pi_{Df}} - \beta_r \right) \right] \quad (38)$$

Simplifying further and using $\pi_k(1+r) = r - r_k$,

$$\frac{\partial}{\partial r_{policy}} \ln \left(\frac{D_f}{D_d} \right) = \frac{\beta_r - \beta_{Dd}}{r - r_{Dd}} - \frac{\beta_r - \beta_{Df}}{r - r_{Df}} \quad (39)$$

The semi-elasticity of fixed deposit to demand deposit holdings is not a function of the structural parameters and is therefore the same for both types of households, active and passive.

Equation (39) isolates the pure within-deposits substitution margin, cleanly stripped of the Tier 1 and Tier 2 effects that entered the B_L/D_d ratio derived previously, since both D_f and D_d sit at the same Cobb-Douglas tier and the Tier 3 share parameter γ does not appear in the final derivative. The sign is governed entirely by the relative size of the two pass-through gaps: if the demand deposit pass-through gap $(\beta_r - \beta_{Dd})$ exceeds the fixed deposit gap $(\beta_r - \beta_{Df})$ scaled by their respective rate differentials, the ratio D_f/D_d rises with r_{policy} , meaning households shift toward fixed deposits and away from demand deposits as the policy rate increases, consistent with the empirical spreads discussed in the stylized facts (savings and demand deposit spreads found to be wider than time deposit spreads in both the US and India).

5.3 The Financial vs. Non Financial (Gold) Margin: $\partial \ln(F/N)/\partial r_{policy}$

In this section, we study the effect of the policy rate on the change in the financial-to-non-financial asset holdings for active and passive households j . From the CES demand ratio, Equations 19 and 20, we get

$$\frac{F^j}{N^j} = \frac{\theta_{F,j}}{\theta_{N,j}} \left(\frac{P_F^j}{\pi_G} \right)^{-\eta_j}, \quad j \in \{active, passive\} \quad (40)$$

Taking logs,

$$\ln \left(\frac{F^j}{N^j} \right) = \ln \left(\frac{\theta_{F,j}}{\theta_{N,j}} \right) - \eta_j [\ln P_F^j - \ln \pi_G] \quad (41)$$

The constant $\theta_{F,j}/\theta_{N,j}$ does not depend on r_{policy} and vanishes under differentiation, exactly as γ_j did for the D_f/D_d margin:

$$\frac{\partial}{\partial r_{policy}} \ln \left(\frac{F^j}{N^j} \right) = -\eta_j \left[\frac{\partial \ln P_F^j}{\partial r_{policy}} - \frac{\partial \ln \pi_G}{\partial r_{policy}} \right] \quad (42)$$

Using $\partial \ln \pi_k / \partial r_{policy} = X_k / (1+r)$ throughout, with $X_k \equiv (\beta_r - \beta_k) / \pi_k - \beta_r$ for $k \in \{Dd, Df, BL, BN\}$ and, for gold ($\beta_G = 0$), $X_G \equiv \beta_r(1 - \pi_G) / \pi_G$. For Passive households, since they do not have bonds, $P_F^p \equiv P_D^p = \pi_{Dd}^{\gamma_p} \pi_{Df}^{1-\gamma_p}$ (Cobb-Douglas, fixed weights), so

$$\frac{\partial}{\partial r_{policy}} \ln \left(\frac{F^p}{N^p} \right) = -\frac{\eta_p}{1+r} [X_D^p - X_G] \quad (43)$$

For Active households, the financial composite P_F^a is the CES aggregate of deposits and bonds, so the expenditure share s_D^a is price-dependent rather than a fixed constant:

$$\frac{\partial \ln P_F^a}{\partial r_{policy}} = \frac{s_D^a X_D + s_B^a X_B}{1+r}, \quad X_D \equiv \gamma_a X_{Dd} + (1-\gamma_a) X_{Df}, \quad X_B \equiv \mu X_{BL} + (1-\mu) X_{BN} \quad (44)$$

where $s_D^a \equiv \alpha_D^a (P_D / P_F^a)^{1-\phi}$ and $s_B^a = 1 - s_D^a$, with

$$P_D = \pi_{Dd}^{\gamma_a} \pi_{Df}^{1-\gamma_a}, \quad P_B = \pi_{BL}^\mu \pi_{BN}^{1-\mu}, \quad s_D^a = \frac{\alpha_D^a P_D^{1-\phi}}{\alpha_D^a P_D^{1-\phi} + \alpha_B^a P_B^{1-\phi}} \quad (45)$$

Substituting $s_B^a = 1 - s_D^a$ and simplifying using (42),

$$\frac{\partial}{\partial r_{policy}} \ln \left(\frac{F^a}{N^a} \right) = -\frac{\eta_a}{1+r} \left[X_B + s_D^a (X_D - X_B) - X_G \right] \quad (46)$$

Both (43) and (46) are closed-form expressions in the model's primitive parameters — no household wealth, expenditure levels, or numerical root-finding is required, since P_D , P_B , and hence s_D^a , are explicit power-law functions of the primitive user costs. However, only the passive expression (43) reduces to a single algebraic line analogous to the D_f / D_d result; the active expression (46) requires computing the intermediate price levels P_D , P_B and the resulting share s_D^a before the final expression can be evaluated.

The two expressions also differ structurally, not just computationally. For passive households, the Tier-1 elasticity η_p operates in isolation: it scales a fixed combination of the deposit-related terms alone. For active households, the Tier-1 elasticity η_a scales a share-weighted blend of the deposit-related term X_D and the bond-related term X_B , with the blending weight s_D^a itself a function of the policy rate through P_D and P_B . This means the Tier-2 substitution elasticity ϕ enters the active household's Tier-1 sensitivity indirectly, through s_D^a — the two margins are not independent for active households, whereas they are entirely separate for passive households.

6 Calibration

We calibrate the model separately for the United States and India using a combination of household portfolio data, financial-market time series, and estimates from the existing literature. Table 3 summarizes the baseline calibration. Details of the variable construction and the calibration steps are relegated to Appendix C.

6.1 United States

Household types and portfolio composition. We use the 2019 Survey of Consumer Finances (SCF) to determine the household heterogeneity and baseline portfolio composition. We restrict the sample to households with positive deposit holdings. We classify a household as *Active* if it also holds non-deposit financial assets and as *Passive* if it holds deposits but no other financial assets. Thus, Active households have access to the deposit–bond substitution margin, whereas Passive households do not.

The resulting population shares are approximately

$$\lambda_a = 0.69, \quad \lambda_p = 0.31.$$

The U.S. counterpart of the non-financial asset N is defined as *investable non-financial wealth*. It comprises other residential real estate, nonresidential real-estate equity, private business wealth, and other substantial non-financial assets. We exclude the primary residence and vehicles so that N represents an alternative store of wealth rather than household consumption durables.

The CES distribution parameters are calibrated from survey-weighted asset holdings within each household type. This gives

$$(\theta_{F,a}, \theta_{N,a}) = (0.60, 0.40), \quad (\theta_{F,p}, \theta_{N,p}) = (0.21, 0.79),$$

and, within the financial portfolio,

$$(\alpha_D^a, \alpha_B^a) = (0.11, 0.89).$$

For Passive households, $\alpha_D^p = 1$ and $\alpha_B^p = 0$ by construction. The within-deposit parameter is approximately $\gamma_j = 0.82$ for both household types. For Active households, the liquid-bond share is $\mu_a = 0.40$, based on a government/Treasury-like versus corporate/other bond sub-portfolio chosen to match the return proxies used below.

Household resources and portfolio-service preferences. The model variable W^j is a period resource flow rather than a stock of wealth. We therefore measure it using normal annual household income in the 2019 SCF. The resulting type-specific means are

$$W^a = \$135,416, \quad W^p = \$48,315.$$

Given the model resource constraint, the preference weight on portfolio services is backed out from

$$\chi_j = \frac{P_S^j S^j}{W^j - P_S^j S^j}. \quad (47)$$

Evaluating portfolio-service expenditure at the observed SCF portfolio and the calibrated user costs gives

$$\chi_a = 0.14, \quad \chi_p = 0.06.$$

These magnitudes are consistent with the broader money-in-the-utility and liquidity-services literature, which generally finds a positive but modest utility value of monetary and financial services (Poterba and Rotemberg, 1987; Holman, 1998). In a recent quantitative model with cash, bank deposits, and CBDC, Burlon et al. (2024) calibrate a liquidity-services weight of 0.0541, close to our estimate for Pas-

sive U.S. households.

Substitution elasticities. We follow the broader household finance literature to set the U.S. elasticity of substitution parameters. For Active households, we set $\phi_a = 2.86$, based on the CES estimate in [Krishnamurthy and Li \(2023\)](#). Because Passive households do not hold the B bundle, ϕ_p is not defined.

The evidence on substitution between financial and non-financial wealth is less direct. Estimates based on housing and non-housing portfolios range from values below one to values close to unity ([Li et al., 2016](#); [Piazzesi et al., 2007](#); [Chetty et al., 2017](#)). We therefore set

$$\eta_a = \eta_p = 0.75$$

in the baseline and vary this parameter in the sensitivity analysis.

Asset returns and monetary-policy pass-through. For the United States, savings and time-deposit rates proxy r_{D_d} and r_{D_f} , the 3-month Treasury bill proxies the liquid bond return r_{B_L} , and Moody's Aaa corporate bond yield proxies the less-liquid bond return r_{B_N} . The benchmark return entering the Barnett user costs is constructed as

$$r_t = \max\{r_{D_d,t}, r_{D_f,t}, r_{B_L,t}, r_{B_N,t}\} + 0.01, \quad (48)$$

following the benchmark-rate convention used in the monetary-services literature ([Anderson et al., 1997](#); [Barnett, 1978, 1980](#)). In our U.S. sample, the Aaa yield is always the largest of these rates, so $r_t = r_{B_N,t} + 0.01$ and the average benchmark return is 0.0662.

We estimate the response of each asset return to the Federal Funds Rate using monthly time-series regressions. The resulting baseline pass-through coefficients are

$$\beta_{D_d} = 0.46, \quad \beta_{D_f} = 0.77, \quad \beta_{B_L} = 0.87, \quad \beta_{B_N} = 0.05.$$

The last coefficient is interpreted as a short-run sensitivity because the Aaa corporate yield does not exhibit a robust long-run relationship with the Federal Funds Rate over the calibration sample.

Return on the non-financial asset. The empirical counterpart of N differs across the two economies. For the United States, there is no single market return corresponding to the heterogeneous SCF bundle of investable non-financial wealth. We therefore use the capital appreciation of the national FHFA Purchase-Only House Price Index as a transparent and reproducible proxy. Over the U.S. calibration period, the implied average annual appreciation rate is approximately

$$\bar{r}_N^{US} = 0.030.$$

This should be interpreted as a parsimonious capital-gain proxy rather than as a measure of the total return on all components of N .

6.2 India

India's household-level parameters in Table 3 are constructed from the All India Debt and Investment Survey (AIDIS) 2019 microdata as follows.

Active and Passive households Households are classified as active or passive based on their reported asset holdings: a household is active if it holds both deposits and market financial instruments (mutual funds, shares, bonds, or small savings schemes); it is passive if it holds deposits but no such instruments. The active share λ is the resulting population proportion, adjusted for sample weights in the data.

Composition shares ($\gamma, \mu, \alpha_D, \alpha_B, \theta_F, \theta_N$). These are computed directly as sample expenditure shares from household-reported asset values. γ_j is the share of demand (savings) deposits to total deposit value held by households, computed separately for active and passive households. μ is the share of active households' liquid bond holdings. α_D and α_B are active households' expenditure shares on deposits and bonds, respectively, within total financial assets. θ_F, θ_N are the expenditure shares on financial assets to the total assets (non-financial + gold).

Wealth (W^j) and weight on the services parameter in utility (χ^j). W^j is average household wealth (financial plus non-financial assets) by type. χ^j is calibrated from the ratio of wealth to monthly consumption expenditure, using the closed-form relationship $\chi^j = W^j / c^j - 1$ implied by the model's log-utility mentioned in Equation 6.

Elasticities (ϕ, η). The substitution elasticities are estimated econometrically rather than read directly from AIDIS shares. We merge AIDIS household-level asset holdings with district-level deposit interest rates from the Reserve Bank of India's Basic Statistical Returns (BSR) ([Reserve Bank of India, 2016](#)) for 2016, matched on state and district. The resulting cross-sectional variation in district-level user costs identifies ϕ (deposits versus bonds, active households) and η (financial versus gold, by household type) via household-level regressions of asset ratios on relative user costs, with standard errors clustered at the district level.

Interest-rate pass-through. We calibrate the Indian pass-through coefficients β_k using monthly interest-rate data and the RBI repo rate as the monetary-policy instrument. For each asset rate $r_{k,t}$, where $k \in \{D_d, D_f, B_L, B_N\}$, we first examine whether the asset rate and the repo rate exhibit a stable long-run relationship using an ARDL error-correction specification and the associated bounds test. Since the evidence of a stable long-run relationship is not robust across all asset classes, we use a common short-run measure of pass-through, defined as the cumulative response of the asset rate over six months following

a change in the repo rate. Specifically, we estimate

$$\Delta r_{k,t} = a_k + \sum_{h=0}^6 b_{k,h} \Delta r_{\text{policy},t-h} + u_{k,t}, \quad \beta_k \equiv \sum_{h=0}^6 b_{k,h},$$

with Newey–West standard errors allowing for serial correlation. The savings deposit rate, term-deposit rate, 15–91 day Treasury bill yield, and 10-year Government of India security yield proxy for r_{D_d} , r_{D_f} , r_{B_L} , and r_{B_N} , respectively. We report estimates for both the baseline 2001m4–2013m12 sample and the extended 2001m4–2025m5 sample.

Table 3
Calibrated Parameters: United States and India, by Household Type

Notation	Description	United States		India	
		Active	Passive	Active	Passive
<i>Household composition</i>					
λ	Share of households of this type	0.69	0.31	0.22	0.78
W^j	Average Household wealth (USD)	135,416	48,315	9851.85	1167.51
<i>Top tier: consumption vs. services</i>					
χ^j	Relative taste weight on services S^j	0.14	0.06	49.32	7.94
<i>Tier 1: financial (F) vs. non-financial (N) assets</i>					
η_j	Elasticity of substitution, F – N	0.75	0.75	2.5	0.173
$\theta_{F,j}$	Share weight on F	0.60	0.20	0.84	0.31
$\theta_{N,j}$	Share weight on N / gold	0.40	0.79	0.16	0.69
<i>Tier 2: deposits (D) vs. bonds (B)</i>					
ϕ_j	Elasticity of substitution, D – B	2.86	—	1.45	—
α_D^j	Share weight on deposits	0.11	1.00	0.18	1.00
α_B^j	Share weight on bonds	0.89	—	0.82	—
<i>Tier 3: within-deposits and within-bonds composition</i>					
γ_j	Cobb–Douglas share, demand vs. fixed deposits	0.81	0.82	0.78	0.86
μ_j	Cobb–Douglas share, liquid vs. illiquid bonds	0.39	—	0.00	—
<i>Interest rate structure – common across types within a country</i>					
<i>India cell values [2001m4–2013m12] / [2001m4–2025m5]</i>					
$\bar{r}_{\text{policy}}$	Policy rate	0.02		0.07	
r	Envelope/benchmark rate (pure investment asset)	0.0662		0.0885/0.0857	
β_{policy}	Policy sensitivity of benchmark rate	0.05 [‡]		0.48/0.40	
$\bar{r}_{D_d}$	Mean rate, savings deposits	0.0133		0.0368/0.0351	
β_{D_d}	Pass-through coefficient, savings deposits	0.46		0.07/0.09	
$\bar{r}_{D_f}$	Mean rate, term deposits	0.0248		0.0747/0.0709	
β_{D_f}	Pass-through coefficient, term deposits	0.77		0.68/0.68	
$\bar{r}_{B_L}$	Mean rate, liquid bonds	0.0210		0.0630/0.0617	
β_{B_L}	Pass-through coefficient, liquid bonds	0.87		0.70/0.84	
$\bar{r}_{B_N}$	Mean rate, illiquid bonds	0.0562		0.0751/0.0736	
β_{B_N}	Pass-through coefficient, illiquid bonds	0.05 [†]		0.17/0.14	
$\bar{r}_N$	Baseline expected return, nonfinancial asset	0.03		0.08/0.07	

Notes: U.S. household-type and portfolio parameters are calibrated from the 2019 Survey of Consumer Finances using survey-weighted asset holdings. Active households hold deposits and other financial assets, while Passive households hold deposits but no other financial assets; hence $\alpha_D^p = 1$, $\alpha_B^p = 0$, and ϕ_p and μ_p are undefined. The U.S. non-financial bundle N consists of investable non-financial wealth. Interest-rate parameters are common across household types within each country and are reported in decimal form. For the United States, D_d , D_f , B_L , and B_N are proxied by savings deposits, time deposits, the 3-month Treasury bill, and Moody’s Aaa corporate bond yield, respectively. The benchmark return is $r_t = \max\{r_{D_d,t}, r_{D_f,t}, r_{B_L,t}, r_{B_N,t}\} + 0.01$. The return on the U.S. non-financial bundle is proxied by capital appreciation in the FHFA Purchase-Only House Price Index. For India, interest-rate parameters are reported for 2001m4–2013m12 and 2001m4–2025m5, separated by a slash. The non-financial asset is gold. Its baseline expected return is calibrated using the long-run real gold return in Barro and Misra (2016), converted to nominal terms using Indian inflation; realized gold-price movements are treated as innovations to ε_G . Asset returns satisfy $r_k = \bar{r}_k + \beta_k r_{\text{policy}}$, while $r_G = \bar{r}_G + \varepsilon_G$ with $\mathbb{E}[\varepsilon_G] = 0$.

7 Results

Lemma 1. For a fixed value of Ψ , that is, holding ϕ, γ, μ and the pass-through structure fixed, the aggregate semi-elasticity of $\ln(B_L/D_d)$ with respect to the policy rate, r_{policy} is directly proportional to the share of active households in the economy, λ . Using equation (49),

$$\frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} = \lambda \cdot \frac{\Psi}{1+r} \quad (49)$$

where Ψ depends on the substitution elasticity ϕ , the deposit and bond composition shares γ and μ , and the pass-through structure $(\beta_r, \beta_{Dd}, \beta_{Df}, \beta_{BL}, \beta_{BN})$, but does not depend on the active household share λ . Consequently, for fixed $\Psi > 0$, the channel is strictly increasing in λ .

Proof. Immediate, since λ enters (49) only as a scalar multiplier on Ψ , and Ψ as defined in (??) does not depend on λ . $\square$

Lemma 2. Assuming deposits and bonds are gross substitutes ($\phi > 1$), and the policy pass-through to the liquid-bond rate is higher than to the illiquid-bond rate ($X_{BN} \geq X_{BL}$), the aggregate semi-elasticity of $\ln(B_L/D_d)$ with respect to the policy rate, r_{policy} is weakly increasing in the liquid-bond share μ in the bond market:

$$\frac{\partial}{\partial \mu} \left[\frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} \right] = \frac{\lambda}{1+r} (\phi - 1) (X_{BN} - X_{BL}) \geq 0 \quad (50)$$

where $X_k \equiv \frac{\beta_r - \beta_k}{\pi_k} - \beta_r$ for $k \in \{BL, BN\}$.

Proof. By Lemma 1, $\frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} = \frac{\lambda}{1+r} \Psi$ with λ independent of μ , so

$$\frac{\partial}{\partial \mu} \left[\frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} \right] = \frac{\lambda}{1+r} \frac{\partial \Psi}{\partial \mu} \quad (51)$$

and

$$\frac{\partial \Psi}{\partial \mu} = -(\phi - 1)X_{BL} + (\phi - 1)X_{BN} = (\phi - 1)(X_{BN} - X_{BL}) \quad (52)$$

Since $\lambda > 0$ and $1 + r > 0$, and $(\phi - 1)(X_{BN} - X_{BL}) \geq 0$ under the maintained assumptions, the result follows. $\square$

Lemma 3. Assuming deposits and bonds are gross substitutes ($\phi > 1$), the semi-elasticity of the liquid-bond-to-demand-deposit $\ln(B_L/D_d)$ with respect to the policy rate is strictly decreasing in the pass-through of the policy rate to the saving/ demand deposit rate β_{Dd} . Formally:

$$\frac{\partial}{\partial \beta_{Dd}} \left[\frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} \right] = -\frac{\lambda}{1+r} \cdot \frac{1 + (\phi - 1)\gamma}{\pi_{Dd}} < 0 \quad (53)$$

Proof. By Lemma 1, $\frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} = \frac{\lambda}{1+r} \Psi$ with λ independent of β_{Dd} , so

$$\frac{\partial}{\partial \beta_{Dd}} \left[\frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} \right] = \frac{\lambda}{1+r} \frac{\partial \Psi}{\partial \beta_{Dd}} \quad (54)$$

Since $X_{Dd} = (\beta_r - \beta_{Dd})/\pi_{Dd} - \beta_r$, $\partial X_{Dd}/\partial \beta_{Dd} = -1/\pi_{Dd}$, and only the $[1 + (\phi - 1)\gamma] X_{Dd}$ term in Ψ involves β_{Dd} , so

$$\frac{\partial \Psi}{\partial \beta_{Dd}} = -\frac{1 + (\phi - 1)\gamma}{\pi_{Dd}} \quad (55)$$

Since $\lambda > 0$, $1 + r > 0$, $\pi_{Dd} > 0$, and $1 + (\phi - 1)\gamma > 0$ for $\phi > 1$, $\gamma \in [0, 1]$, the result follows. $\square$

Earlier evidence points to weak and heterogeneous transmission from policy rates to bank lending rates in low-income and emerging market economies (EMEs) (Mishra et al., 2012, 2014; Bhattacharya et al., 2011). More recent evidence suggests that monetary policy transmission through the liability side depends strongly on the availability of instruments of different types. Demand and savings deposit rates tend to be relatively rigid, whereas term-deposit rates adjust more closely to changes in policy and market rates (Caballero et al., 2023; Patra et al., 2024).¹¹

These differences in deposit pricing operate in financial systems where households' opportunities to rebalance their portfolios are highly uneven. In many EMEs, only a relatively small fraction of households holds market-based financial assets, while the portfolios of nonparticipants remain concentrated in deposits and nonfinancial wealth (Badarinza et al., 2016, 2017; Gomes et al., 2021). Such differences in financial participation can have direct implications for bank funding: Lin (2020) shows that deposit outflows following increases in stock-market returns are larger in areas with greater household stock-market participation. The household participation margin is reinforced by differences in financial-market development. Although domestic bond markets in EMEs have grown substantially over the past two decades, they remain, on average, smaller and less liquid than those in advanced economies and are often supported by narrower investor bases and less-developed hedging markets (Eichengreen and Luengnaruemitchai, 2004; Van Doornik et al., 2024; International Monetary Fund, 2025).¹² Taken together, these features limit the extent to which nondeposit financial assets provide a readily accessible alternative to bank deposits.

Taking Lemmas 1 through 3 together, Lemma 3 points in the opposite direction from Lemmas 1 and 2: weaker pass-through actually strengthens the household-level semi-elasticity, unlike the participation and bond market thickness channels, which weaken it. The deposits channel therefore need not be weak in an emerging market economy on this basis alone, since the delay in pass-through strengthens it rather than weakens it.

Whether the aggregate channel ends up weaker or stronger overall depends on the structural pa-

¹¹Recent cross-country evidence also documents incomplete deposit-rate pass-through across emerging and developing economies: increases in policy rates are associated with wider deposit spreads and slower deposit growth (Giraldo et al., 2026b).

¹²Corporate bond markets are typically even less liquid, and direct retail participation in these markets remains limited (Carvajal and Bebczuk, 2024).

rameters of the two economies being compared. The Proposition below formalizes this trade-off.

The Proposition combines all three lemmas into a single condition. It does not assume in advance that the participation and liquidity channels dominate the pass-through channel, but instead derives the exact threshold at which one dominates the other. Whether this condition holds is then a question that can be checked directly against the calibrated parameters for a given pair of economies, rather than assumed.

Proposition 1 (Structural weakness of the deposits channel in emerging market economies). *Consider two economies, an Emerging Market Economy (EME) and an Advanced Economy (AE), identical in γ and ϕ , differing in λ , μ , and β_{Dd} , with $\lambda^{EME} < \lambda^{AE}$, $\mu^{EME} \leq \mu^{AE}$, and $\beta_{Dd}^{EME} < \beta_{Dd}^{AE}$ (an EME has lower active-household participation, a thinner liquid-bond market, and weaker deposit-rate pass-through- all empirically documented features). Assume $\phi > 1$ and $X_{BN} \geq X_{BL}$. Then, evaluated at the steady state the demand deposit channel is stronger in the AE than EME,*

$$\left. \frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} \right|_{EME} < \left. \frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} \right|_{AE} \quad (56)$$

if and only if

$$(\lambda^{AE} - \lambda^{EME})\Psi^{AE} + \lambda^{EME}(\phi - 1)(X_{BN} - X_{BL})\Delta\mu > \lambda^{EME} \frac{1 + (\phi - 1)\gamma}{\pi_{Dd}} \Delta\beta_{Dd} \quad (57)$$

where $\Delta\mu \equiv \mu^{AE} - \mu^{EME}$ and $\Delta\beta_{Dd} \equiv \beta_{Dd}^{AE} - \beta_{Dd}^{EME}$.

Proof. By Lemma 1, $\left. \frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} \right|_i = \frac{\lambda^i}{1+r} \Psi^i$ for $i \in \{EME, AE\}$. Adding and subtracting $\lambda^{EME}\Psi^{AE}$:

$$\lambda^{AE}\Psi^{AE} - \lambda^{EME}\Psi^{EME} = (\lambda^{AE} - \lambda^{EME})\Psi^{AE} + \lambda^{EME}(\Psi^{AE} - \Psi^{EME}) \quad (58)$$

At the steady state, Ψ is exactly linear in μ and β_{Dd} (Lemmas 2 and 3), so

$$\Psi^{AE} - \Psi^{EME} = (\phi - 1)(X_{BN} - X_{BL})\Delta\mu - \frac{1 + (\phi - 1)\gamma}{\pi_{Dd}} \Delta\beta_{Dd} \quad (59)$$

Substituting and requiring the left side of the resulting expression to be positive gives condition (57), which is equivalent to (56). $\square$

We verify the dominance condition of Proposition 1 against the calibrated parameters described in Table 3. Since the Proposition holds ϕ , γ , and the remaining pass-through structure fixed across the two economies, letting only λ , μ , and β_{Dd} differ, a faithful numerical check cannot simply substitute the full, separately estimated United States and India calibrations, which differ in every parameter. We instead construct a counterfactual Advanced Economy (AE) that shares India's own $\phi = 1.394$, $\gamma = 0.78$, and pass-through structure ($\beta_{Df}, \beta_{BL}, \beta_{BN}, \beta_r$), differing from the Emerging Market Economy (EME, India) only in λ , μ , and β_{Dd} , set at the corresponding United States values from Tables 6 and 7.

Evaluated at the steady state, the two sides of the dominance condition in Proposition 1 give $LHS > RHS$, with a margin of 10.69. In simple words, A one percentage point increase in the policy rate induces roughly a 3.6 percent reallocation from demand deposits toward liquid bonds in the emerging market economy, compared to a 13.5 percent reallocation in the advanced economy — households in the advanced economy respond to the same policy move with almost four times the intensity. The participation and liquid bond-market thinness channels dominate the countervailing pass-through channel by a factor of approximately 5.6, confirming that the deposits channel is weaker in India than in the US, consistent with Proposition 1.

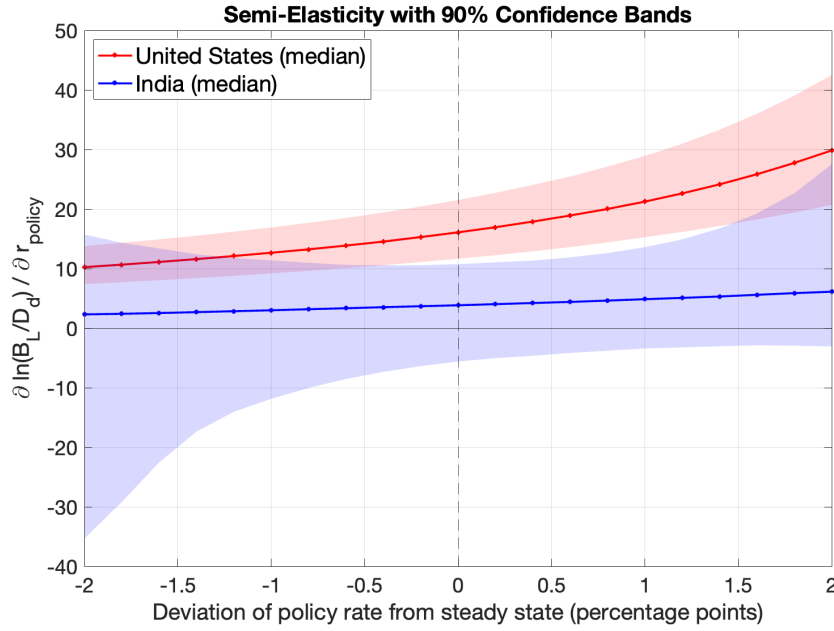
Figure 6 plots the semi-elasticity of the liquid bond-to-demand deposit ratio (B_L/D_d), derived in equation (36), for the US and India using the calibration described in Table 3. The blue line is for the US, and the red line is for India, with a Monte Carlo confidence band shown around each at the 90 percent level. The shaded area around each country's line shows the confidence band.¹³ Where the bands for the United States and India do not overlap, the difference between the two countries at that point is unlikely to be due to estimation noise. Where they do overlap, the difference cannot be clearly separated from noise. As the figure shows, the semi-elasticity for the US economy is positive and significantly different from zero throughout the range considered. This is not the case for India: at the calibrated steady state, the semi-elasticity is positive but not significantly different from zero, as its confidence band includes zero. The semi-elasticity for the US is approximately five times that of India at the steady state. We also observe that as the policy rate moves further from its average level, the gap between the two countries widens further, consistent with the amplifying effect that arises as the user cost of high pass-through assets shrinks toward zero at more extreme rate levels.

7.1 Intensive Margin: within deposits shifts: $\partial \ln(D_f/D_d)/\partial r_{policy}$

From above, we know that the semi-elasticity of the change in term deposits relative to demand deposits with respect to the policy rate, $\frac{\partial}{\partial r_{policy}} \ln \left(\frac{D_f^j}{D_d^j} \right)$, defined in equation (39), is independent of j : the household-level structural parameters drop out entirely. The type-specific parameter γ_j governs only the *level* of the ratio D_f^j/D_d^j , not its sensitivity to the policy rate. Equation (39) is therefore identical for active and passive households, and depends only on the pass-through coefficients $\beta_{Dd}, \beta_{Df}, \beta_r$. Figure 7 plots (39) against deviations of the policy rate from the United States' and India's calibrated steady state, together with 90 percent Monte Carlo confidence bands constructed from the standard errors on β_{Dd}, β_{Df} , and β_r . Because (39) is common to both household types, the figure applies equally to active and passive households; the only source of variation shown is the country.

¹³For the confidence bands, we use a parametric Monte Carlo simulation, also known as parametric bootstrap (Efron and Tibshirani, 1994). This approach is standard in applied work for building confidence intervals around elasticities computed from estimated coefficients (Krinsky and Robb, 1986a). For each country, we treat each pass-through coefficient as drawn from a normal distribution centered on its estimated value, with a spread equal to its standard error. We draw five thousand sets of coefficients this way and recompute the semi-elasticity for each set, across a range of policy rate levels from two percentage points below to two percentage points above the historical average. At each policy rate level, this gives five thousand possible values of the semi-elasticity. We take the middle value as the best estimate, and the values at the fifth and ninety-fifth percentiles as the lower and upper bounds of a ninety percent confidence band.

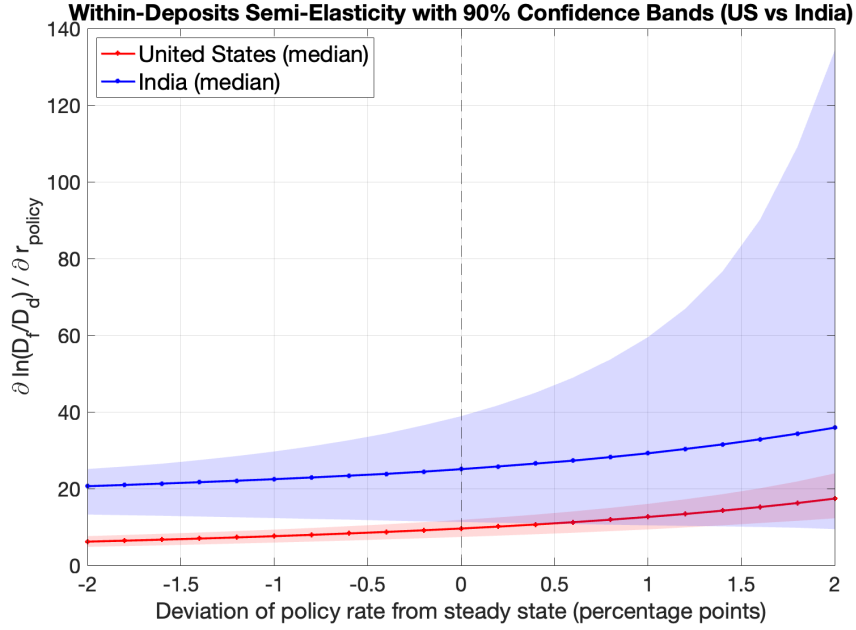
Figure 6
Semi-elasticity of B_L/D_d , US vs India, with 90% confidence bands.



Three features stand out from this figure. First, the semi-elasticity is positive for both countries, meaning the composition of deposits shifts toward term deposits and away from demand deposits as the policy rate rises. The confidence bands indicate that this response is positive and significantly different from zero. Second, India's semi-elasticity lies above the United States' throughout the range considered, roughly two to two and a half times as large depending on the deviation of the policy rate from its steady state. This indicates that Indian households reallocate from demand deposits to term deposits more sharply than United States households do, even though the corresponding external margin, reallocation from deposits into bonds, is comparatively muted, as shown in the results for B_L/D_d . Third, the confidence bands do not overlap for policy rate deviations below approximately -0.2 percentage points, indicating that the difference between the two countries is statistically distinguishable in this region. The bands begin to overlap from the steady state onward, so the gap becomes less clearly distinguishable at higher policy rate levels even though the point estimates continue to diverge.

This result is consistent with the rolling-regression evidence presented in Section 3.1. There, time-deposit rates were found to adjust more strongly to the policy rate than savings-deposit rates in both countries, so that part of the response to monetary tightening takes place within the banking system, through substitution from more liquid deposits toward higher-yielding term deposits, rather than through an outright decline in total deposits. The same evidence also showed that this within-banking-system reallocation is comparatively more pronounced in India, where the rolling coefficients for core (liquid) deposits are less consistently negative than in the United States, and where households hold a smaller share of marketable non-deposit assets to reallocate into. The calibrated model formalizes this pattern: it is precisely because D_f/D_d does not depend on the substitution elasticity ϕ , the bond

Figure 7
Semi-elasticity of D_f/D_d , US vs India, with 90% confidence bands.



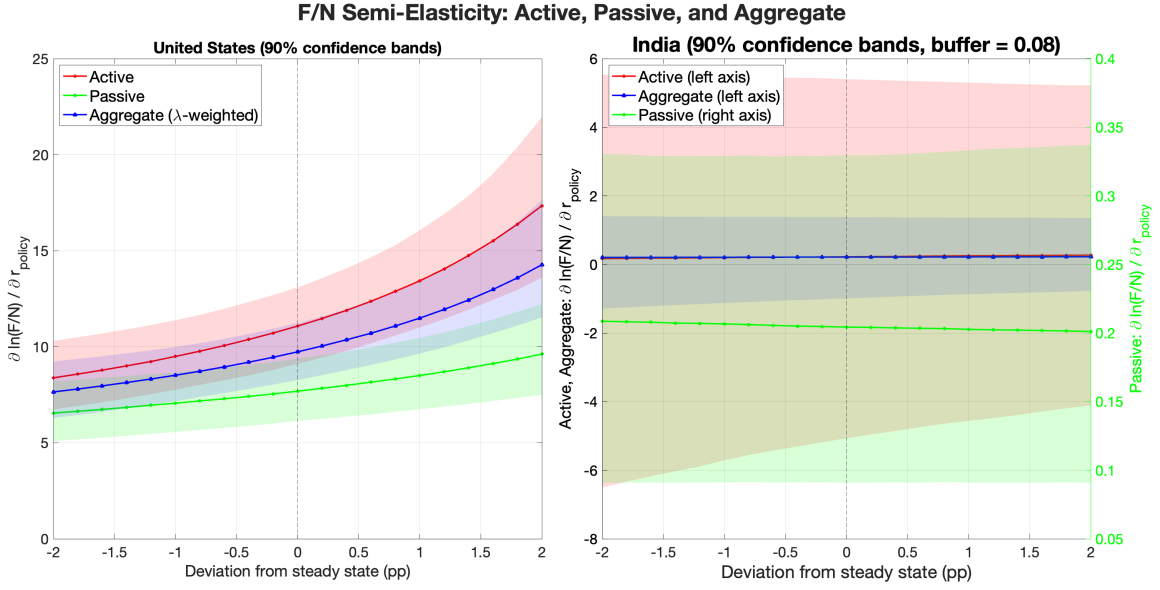
composition share μ , or the active household share λ , that the within-deposits margin remains active in India even where the external, bond-market margin is muted.

Taken together, this result qualifies the paper's central finding. The deposits channel in India is not uniformly weak: it is muted on the external margin, reallocation out of the banking system into bonds, but comparatively strong on the internal margin, reallocation within the banking system between demand and fixed deposits. This is consistent with India's calibrated pass-through structure, in which the savings deposit rate is markedly sticky ($\beta_{Dd} = 0.09$) while the fixed deposit rate is considerably more responsive to policy ($\beta_{Df} = 0.68$), generating a wide and policy-sensitive spread between the two instruments even in the absence of a well-developed external bond market, and matching directly the reduced-form pattern documented empirically in Section 3.1. Figure 8 plots the semi-elasticity of the financial-to-non-financial (gold) asset ratio, F/N , derived in equations (43) and (46), separately for active households, passive households, and the λ -weighted aggregate, for the United States and India.

For passive households, equation (43) shows that $\partial \ln(F^p/N^p)/\partial r_{policy}$ depends only on η_p and the fixed combination $X_D^{(p)} - X_G$, with no dependence on the substitution elasticity ϕ or the bond composition share μ , since passive households hold no bonds. For active households, equation (46) shows that $\partial \ln(F^a/N^a)/\partial r_{policy}$ scales η_a against a share-weighted blend of the deposit-related term X_D and the bond-related term X_B , with the blending weight s_D^a itself a function of the policy rate through the Tier-2 price levels P_D and P_B . Because s_D^a depends on ϕ , the active-household result inherits the imprecision of ϕ , whereas the passive-household result, being free of ϕ entirely, does not.

This structural asymmetry is directly visible in the figure. For the United States, both the active and passive semi-elasticities are estimated with reasonably tight confidence bands, with active house-

Figure 8
Semi-elasticity of F/N , active, passive, and aggregate, US and India.



holds showing a somewhat larger and steeper response than passive households as the policy rate moves away from its steady state. For India, the contrast is sharper. The passive-household semi-elasticity is small, positive, and precisely estimated throughout the range considered. By contrast, the active-household semi-elasticity has a wide confidence band that includes zero throughout most of the range. The weighted aggregate for India lies close to the passive-household line, since the active household share λ is small; the aggregate confidence band is correspondingly narrow relative to the active-household band alone, though it still shows a modest widening relative to the passive-household band by itself.

8 Conclusion and Policy Implication

This paper revisits the deposit channel of monetary policy by studying household heterogeneity and focusing on the available investment instruments. The conventional mechanism emphasizes that, when monetary tightening widens the spread between market rates and deposit rates, households move funds out of banks and into higher-yielding securities. Our results show that this response varies across financial systems. It depends on whether households participate in financial markets, which alternative assets they can access, and how readily those assets substitute for bank deposits. In the calibrated model, the *external reallocation* from liquid deposits toward market-based financial assets is substantially stronger in the United States than in India. The *intensive margin*, by contrast, is more pronounced in India: households respond to the differential repricing of savings and term deposits by changing the composition of their deposits within the banking system. Monetary tightening may therefore cause deposits to leave the banking system in one economy while primarily recomposing bank funding in another.

These differences result from structural factors in an economy that differ from banks' market power

over deposit rates. Sluggish adjustment of savings-deposit rates increases the opportunity cost of holding liquid deposits and, when suitable alternative investment options exist, strengthens households' incentives to reallocate their funds. However, whether this incentive leads to actual deposit outflows depends on the availability of alternative assets. In environments with limited financial participation, thin bond markets, and household wealth concentrated in deposits and nonfinancial investment avenues, households typically cannot respond to a widening deposit spread by reallocating their funds to alternative liquid marketable securities. Instead, they may shift funds from savings deposits to higher-yielding term deposits. Consequently, weak deposit-rate pass-through can coexist with a subdued external deposit channel, as the price incentive remains strong but the relevant substitution margin is constrained.

A key contribution of the paper is a simple way to assess the strength of the deposit channel across economies. Proposition 1 combines these structural parameters into a single *sufficient-statistic* condition based on household participation, bond-market depth, portfolio composition, asset substitutability, and interest-rate pass-through. Once these parameters are estimated, the condition can be used to compare the strength of the deposit channel across economies. Importantly, the proposition does not imply that the channel is always weaker in emerging markets; it identifies the conditions under which this occurs. This also makes the framework testable in other countries using household portfolio and interest-rate data.

The results of this paper also have direct implications for monetary policy. Assessing the deposit channel requires looking beyond bank concentration, market power, and deposit-rate pass-through to the investment choices available to households. Deeper financial markets, lower participation costs, and broader access to safe, liquid securities strengthen households' outside options and incentivize banks to offer more responsive deposit rates. However, these alternatives may also increase the sensitivity of deposit outflows to monetary tightening. Consequently, financial deepening can increase interest-rate pass-through while raising the sensitivity of banks' funding, improving monetary policy transmission.

As the financial payments system evolves with the growth of digital finance, these issues matter even more. Central Bank Digital Currencies, Stablecoins, and digital investment platforms make it easier for households to access alternatives to bank deposits. This competition could push banks to align deposit rates more closely with policy rates, thereby improving the transmission (Gupta and Mandal, 2026). On the other hand, easier access means households can move money faster when market rates rise, which could lead to more deposit outflows and greater funding volatility. The overall impact will depend on factors like how these products are paid, how easily they can be converted, holding limits, transaction costs, and access. Digital finance could help interest rates pass through more effectively by increasing competition, but it may also make bank funding more sensitive to monetary policy changes.

Overall, our findings suggest that improving monetary transmission through the deposit channel means looking at both sides of the deposit market. Bank competition and deposit pricing matter, but so

do the financial options households can choose from. When creating policies to expand financial markets or introduce new digital assets, consider how these changes affect both interest-rate pass-through and the stability of bank funding. The main takeaway is that whether monetary tightening leads to deposits leaving banks or just changes how they are held depends on how household portfolios are structured and what choices people have.

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Do Deposits Leave the Bank? Household Heterogeneity and the Deposit Channel of Monetary Policy

Online Appendix

A Data Appendix

This appendix provides additional details on the construction and harmonization of the data used in the quantitative exercise. The main text focuses on the economic interpretation of the empirical moments, while the discussion here records the choices used to map the underlying household surveys and interest-rate series into the objects appearing in the model.

Cross-country harmonization. An important feature of the calibration is that the underlying household surveys were designed for different statistical systems and therefore do not contain perfectly identical asset classifications. We consequently harmonize the data according to the economic role of an asset in the model rather than requiring literal equivalence of survey labels across countries. In particular, the financial bundle F contains bank deposits together with alternative financial assets, while the non-financial bundle N is intended to capture an important store-of-value alternative outside the formal financial portfolio. For India, this role is played by household gold holdings. For the United States, where gold is quantitatively much less important for household balance sheets, the baseline N measure instead consists of investable non-financial wealth. The latter includes other residential real estate, nonresidential real estate equity, private business wealth, and other substantial non-financial assets, while excluding the primary residence and consumer durables.

Household types. Households are classified according to their access to the broader financial menu. In the U.S. calibration, which uses the 2019 Survey of Consumer Finances (SCF), Active households are deposit-holding households with positive holdings of non-deposit financial assets, whereas Passive households hold deposits but no such alternative financial assets. The same economic criterion is applied to the Indian household data as closely as the survey classification permits. This definition is deliberately based on observed portfolio participation rather than income or wealth percentiles, since the model's central distinction concerns access to financial substitution margins. All household-level moments are computed using the corresponding survey weights.

Asset shares and portfolio parameters. The parameters governing portfolio composition are constructed from survey-weighted asset values within each household type. Thus, the upper-tier weights $\theta_{F,j}$ and $\theta_{N,j}$ reflect the relative value of financial and non-financial asset holdings, while α_D^j and α_B^j describe the split between deposits and other financial assets. The parameter γ_j is based on the allocation of deposit balances between liquid demand/savings deposits and fixed or term deposits. For Active U.S. households, μ_j is constructed from a bond sub-portfolio that distinguishes government/Treasury-like securities from corporate and other less-liquid bond holdings. Passive households have no bond-market margin, so $\alpha_B^p = 0$ and the corresponding bond-composition parameters are not defined.

Resource flows and user costs. The model budget constraint is written in terms of a period resource flow, rather than a stock of household wealth. Accordingly, the U.S. object W^j is constructed from normal annual household income in the SCF, using the survey’s normal-income information and household weights. Asset stocks enter separately through the service aggregate. Following the user-cost approach, the price of the services provided by asset k is measured by the opportunity-cost differential

$$\pi_k = \frac{r - r_k}{1 + r},$$

where r is the benchmark return and r_k is the return on the asset. This treatment avoids counting the entire market value of an asset as a current-period expenditure.

Non-financial-asset returns. For India, the return on N is the return on gold. Realized movements in the domestic gold price are interpreted as innovations around the expected gold return rather than as the steady-state return itself. For the United States, the baseline return on the non-financial bundle is proxied using capital appreciation in the FHFA Purchase-Only House Price Index. This is not intended to imply that the entire U.S. non-financial bundle consists of housing; rather, the index provides a transparent and consistently measured market-price proxy for the return on an illiquid non-financial store of value. Alternative return proxies can therefore be considered as robustness checks.

Interest-rate samples. The interest-rate calibration is performed separately by country using the sample periods reported in Table A1. Asset-specific returns are mapped into savings deposits, term deposits, liquid bonds, and less-liquid bonds, and their policy-rate sensitivities are estimated using the corresponding monetary-policy rate. Because the purpose of these parameters is to identify relative user costs, the emphasis is on obtaining consistent pass-through measures across asset classes within a country rather than imposing identical financial instruments across the United States and India.

Table A1
Data Sources and Empirical Series Used in the Calibration

Model object / use	Source and empirical series	Frequency	Sample / reference period
<i>United States</i>			
Deposit rates	Drechsler–Savov–Schnabl replication data: savings, checking, and time-deposit rates	Weekly	1997W1–2013W1; checking from 1999W4
Deposit quantities	Federal Reserve H.6 Money Stock Measures: demand, savings, and small time deposits	Monthly	Common DSS overlap
r_{policy}	Effective Federal Funds Rate (FEDFUNDS), FRED	Monthly	U.S. calibration sample
r_{B_L}	3-month Treasury bill secondary-market rate (TB3MS), FRED	Monthly	U.S. calibration sample
r_{B_N}	Moody’s Seasoned Aaa Corporate Bond Yield (AAA), FRED	Monthly	U.S. calibration sample
Household portfolios and $\lambda_j, \theta_j, \alpha_j, \gamma_j, \mu_j, W^j$	2019 Survey of Consumer Finances, full public-use file	Cross-sec.	2019
Aggregate household portfolio composition	Federal Reserve Financial Accounts, household balance-sheet tables	Quarterly	2019
$\bar{r}_N$	FHFA national Purchase-Only House Price Index	Monthly	U.S. calibration sample
<i>India</i>			
Deposit quantities and rates	CEIC, using underlying Reserve Bank of India series	Monthly	1999 onward
r_{policy}	RBI repo rate, obtained through CEIC	Monthly	2001m4–2025m5
r_{D_d}	RBI savings-deposit rate	Monthly	2001m4–2025m5
r_{D_f}	Midpoint of major-bank term-deposit rate range	Monthly	2001m4–2025m5
r_{B_L}	RBI yield on SGL Treasury-bill transactions, 15–91 days residual maturity	Monthly	2001m4–2025m5
r_{B_N}	10-year Government of India security yield	Monthly	2001m4–2025m5
Household portfolios and model shares	All India Debt and Investment Survey (AIDIS)	Cross-sec.	2019
$\bar{r}_G$	Long-run real gold-price appreciation from Barro and Misra (2016), converted to nominal terms using Indian CPI inflation	Annual	Long-run benchmark
$\varepsilon_{G,t}$	RBI monthly average price of Standard Gold, Mumbai	Monthly	Corresponding calibration windows

Notes: The baseline Indian pass-through calibration uses 2001m4–2013m12, while the extended calibration uses 2001m4–2025m5. U.S. deposit-rate series from the Drechsler–Savov–Schnabl replication data are aggregated to monthly frequency when combined with monthly market-rate series.

The FHFA Purchase-Only House Price Index is used as a transparent proxy for the capital-gain component of the broader U.S. investable nonfinancial asset bundle N ; it is not intended to measure the return on every component of that bundle. For India, N corresponds to gold. The steady-state gold return $\bar{r}_G$ is based on the long-run expected real appreciation of gold from Barro and Misra (2016), converted to nominal terms using Indian CPI inflation. Realized RBI gold-price movements are instead interpreted as innovations to $\varepsilon_{G,t}$.

B Technical Appendix

B.1 Optimal consumption and asset services

The household maximizes (6) subject to (7). The Lagrangian is

$$\mathcal{L}^j = \ln c^j + \chi^j \ln S^j + \lambda^j (W^j - c^j - P_S^j S^j) \quad (\text{A1})$$

with first-order conditions

$$\frac{1}{c^j} = \lambda^j \quad (\text{A2})$$

$$\frac{\chi^j}{S^j} = \lambda^j P_S^j \quad (\text{A3})$$

Dividing (A3) by (A2) eliminates λ^j :

$$S^j = \chi^j \frac{c^j}{P_S^j} \quad (\text{A4})$$

Substituting (A4) into the budget constraint (7):

$$c^j + P_S^j \left(\chi^j \frac{c^j}{P_S^j} \right) = W^j \implies c^j (1 + \chi^j) = W^j \quad (\text{A5})$$

which gives the closed-form solution

$$c^{j*} = \frac{1}{1 + \chi^j} W^j, \quad P_S^j S^{j*} = \frac{\chi^j}{1 + \chi^j} W^j \quad (\text{A6})$$

Consumption and total service expenditure are therefore constant shares of W^j — $1/(1 + \chi^j)$ and $\chi^j/(1 + \chi^j)$ respectively — independent of P_S^j . This is the expected Cobb–Douglas property: log utility implies unit elasticity of substitution between c^j and S^j , so the expenditure share on services does not respond to changes in its own price. Any sensitivity of $\mathcal{E}(r)$ to a policy-rate change under log utility therefore operates entirely through the lower-tier CES nests (Tiers 1–3), not through the consumption–services margin itself.

B.1.1 Optimal Demand functions for financial and non-financial assets

Given S^{j*} from (18), minimizing $P_F^j F^j + P_N^j N^j$ subject to (8) yields the standard CES demands. Following is the derivation:

$$\min_{F^j, N^j} P_F^j F^j + P_N^j N^j \quad (\text{A7})$$

subject to the CES technology constraint

$$S^j = \left(\theta_{F,j}^{1/\eta_j} (F^j)^{\frac{\eta_j-1}{\eta_j}} + \theta_{N,j}^{1/\eta_j} (N^j)^{\frac{\eta_j-1}{\eta_j}} \right)^{\frac{\eta_j}{\eta_j-1}} \quad (\text{A8})$$

Following is the Lagrangian:

$$\mathcal{L} = P_F^j F^j + P_N^j N^j + \mathcal{M}^j \left[S^j - \left(\theta_{F,j}^{1/\eta_j} (F^j)^{\frac{\eta_j-1}{\eta_j}} + \theta_{N,j}^{1/\eta_j} (N^j)^{\frac{\eta_j-1}{\eta_j}} \right)^{\frac{\eta_j}{\eta_j-1}} \right] \quad (\text{A9})$$

FOC w.r.t. F^j :

$$P_F^j = \mathcal{M}^j \cdot \frac{\eta_j}{\eta_j-1} (S^j)^{\frac{\eta_j}{\eta_j-1}-1} \cdot \theta_{F,j}^{1/\eta_j} \cdot \frac{\eta_j-1}{\eta_j} (F^j)^{\frac{\eta_j-1}{\eta_j}-1} \quad (\text{A10})$$

Simplifying,

$$P_F^j = \mathcal{M}^j \theta_{F,j}^{1/\eta_j} (S^j)^{1/\eta_j} (F^j)^{-1/\eta_j} \quad (\text{A11})$$

FOC w.r.t. N^j , by the symmetric argument:

$$P_N^j = \mathcal{M}^j \theta_{N,j}^{1/\eta_j} (S^j)^{1/\eta_j} (N^j)^{-1/\eta_j} \quad (\text{A12})$$

Combining (25) and (26),

$$\frac{P_F^j}{P_N^j} = \frac{\mathcal{M}^j \theta_{F,j}^{1/\eta_j} (S^j)^{1/\eta_j} (F^j)^{-1/\eta_j}}{\mathcal{M}^j \theta_{N,j}^{1/\eta_j} (S^j)^{1/\eta_j} (N^j)^{-1/\eta_j}} \quad (\text{A13})$$

$$\frac{P_F^j}{P_N^j} = \frac{\theta_{F,j}^{1/\eta_j} (F^j)^{-1/\eta_j}}{\theta_{N,j}^{1/\eta_j} (N^j)^{-1/\eta_j}} \quad (\text{A14})$$

$$\left(\frac{P_F^j}{P_N^j} \right)^{-\eta_j} = \frac{\theta_{N,j} P_F^j F^j}{\theta_{F,j} P_N^j N^j} \quad (\text{A15})$$

$$\left(\frac{P_F^j}{P_N^j} \right)^{1-\eta_j} = \frac{\theta_{N,j} P_F^j F^j}{\theta_{F,j} P_N^j N^j} \quad (\text{A16})$$

Substituting for $P_F^j F^j$ into the total expenditure, $P_F^j F^j + P_N^j N^j = \mathcal{Z}^j$,

$$\left(\frac{P_F^j}{P_N^j} \right)^{1-\eta_j} \frac{\theta_{F,j}}{\theta_{N,j}} P_N^j N^j + P_N^j N^j = \mathcal{Z}^j \quad (\text{A17})$$

$$P_N^j N^j \left[\frac{P_F^{j1-\eta_j} \theta_{F,j} + P_N^{j1-\eta_j} \theta_{N,j}}{P_N^{j1-\eta_j} \theta_{N,j}} \right] = \mathcal{Z}^j \quad (\text{A18})$$

Using the CES dual price index,

$$\theta_{F,j} (P_F^j)^{1-\eta_j} + \theta_{N,j} (P_N^j)^{1-\eta_j} = (P_S^j)^{1-\eta_j} \quad (\text{A19})$$

$$P_N^j N^j \left[\frac{P_S^{j1-\eta_j}}{P_N^{j1-\eta_j} \theta_{N,j}} \right] = \mathcal{Z}^j \quad (\text{A20})$$

$$N^j = \mathcal{Z}^j \theta_{N,j} \frac{1}{P_N^j} \left(\frac{P_N^j}{P_S^j} \right)^{1-\eta_j} \quad (\text{A21})$$

Similarly solve for F^j and substitute N^j and F^j into equation (22),

$$S^j = \left(\theta_{F,j}^{1/\eta_j} \left(\mathcal{Z}^j \theta_{F,j} \frac{1}{P_F^j} \left(\frac{P_F^j}{P_S^j} \right)^{1-\eta_j} \right)^{\frac{\eta_j-1}{\eta_j}} + \theta_{N,j}^{1/\eta_j} \left(\mathcal{Z}^j \theta_{N,j} \frac{1}{P_N^j} \left(\frac{P_N^j}{P_S^j} \right)^{1-\eta_j} \right)^{\frac{\eta_j-1}{\eta_j}} \right)^{\frac{\eta_j}{\eta_j-1}} \quad (\text{A22})$$

Simplifying the above equation,

$$S^j P_S^j = \mathcal{Z}^j \left(\theta_{F,j} \left(\left(\frac{P_F^j}{P_S^j} \right)^{-\eta_j} \right)^{\frac{\eta_j-1}{\eta_j}} + \theta_{N,j} \left(\left(\frac{P_N^j}{P_S^j} \right)^{-\eta_j} \right)^{\frac{\eta_j-1}{\eta_j}} \right)^{\frac{\eta_j}{\eta_j-1}} \quad (\text{A23})$$

Using equation (33), $P_S^j = \left[\theta_{F,j} (P_F^j)^{1-\eta_j} + \theta_{N,j} (P_N^j)^{1-\eta_j} \right]^{\frac{1}{1-\eta_j}}$

$$S^j P_S^j = \mathcal{Z}^j \quad (\text{A24})$$

Substituting this into equation (35), we get

$$N^{j*} = \theta_{N,j} \left(\frac{P_N^j}{P_S^j} \right)^{-\eta_j} S^j \quad (\text{A25})$$

Similarly for F^j

$$F^{j*} = \theta_{F,j} \left(\frac{P_F^j}{P_S^j} \right)^{-\eta_j} S^j \quad (\text{A26})$$

B.1.2 Demand functions for deposits and bonds

Given F^{j*} from (6), minimizing $P_D^j D^j + P_B^j B^j$ subject to (10) yields

$$D^{j*} = \alpha_D^j \left(\frac{P_D^j}{P_F^j} \right)^{-\phi_j} F^{j*} \quad (\text{A27})$$

$$B^{j*} = \alpha_B^j \left(\frac{P_B^j}{P_F^j} \right)^{-\phi_j} F^{j*} \quad (\text{A28})$$

$$\text{where, } P_F^j = \left[\alpha_{D,j} \left(P_D^j \right)^{1-\phi_j} + \alpha_{B,j} \left(P_B^j \right)^{1-\phi_j} \right]^{\frac{1}{1-\phi_j}}.$$

B.1.3 Demand functions for liquid/ illiquid deposits and Bond assets

Cobb–Douglas cost minimization gives constant expenditure shares of $P_D^j D^{j*}$ and $P_B^j B^{j*}$:

$$D_d^{j*} = \gamma_j \frac{P_D^j}{\pi_{Dd}} D^{j*}, \quad D_f^{j*} = (1 - \gamma_j) \frac{P_D^j}{\pi_{Df}} D^{j*} \quad (\text{A29})$$

$$B_L^{j*} = \mu^j \frac{P_B^j}{\pi_{BL}} B^{j*}, \quad B_{NL}^{j*} = (1 - \mu^j) \frac{P_B^j}{\pi_{BNL}} B^{j*} \quad (\text{A30})$$

where, $P_D^j = \pi_{Dd}^{\gamma_j} \pi_{Df}^{1-\gamma_j}$ and $P_B^j = \pi_{BL}^{\mu_j} \pi_{BN}^{1-\mu_j}$.

B.2 Interest rates structure

r_{D_d} is the deposit interest rate for saving deposits. r_{D_f} is the deposit interest rate for the term deposits. r is the envelop or the benchmark rate from the pure illiquid asset. r_{policy} is the policy rate. r_G is the returns from investing in gold. r_{B_L} and r_{B_N} is the return from liquid and illiquid bonds, respectively.

Each asset-specific rate is modeled as a mean rate plus partial pass-through from the policy rate. For $k \in \{D_d, D_f, B_L, B_N\}$,

$$r_k = \bar{r}_k + \beta_k r_{policy} \quad (\text{A31})$$

where $\bar{r}_k$ is the asset-specific mean (intercept) rate and $\beta_k \in [0, 1]$ is the pass-through coefficient, both calibrated parameters. $\beta_k = 1$ corresponds to full pass-through (the asset rate moves one-for-one with the policy rate); $\beta_k = 0$ corresponds to no pass-through (the rate is fixed at its mean regardless of policy).

Gold is the exception: its return does not respond to the policy rate at all, but instead follows an idiosyncratic shock uncorrelated with monetary policy,

$$r_G = \bar{r}_G + \epsilon_G, \quad \mathbb{E}[\epsilon_G] = 0 \quad (\text{A32})$$

Equation (26) is the limiting case $\beta_G = 0$ of (25), but is written separately to emphasize that the fluctuation in r_G comes from an independent shock (e.g., global gold-price movements) rather than from a fixed intercept alone.

B.3 Comparative Statics: $\partial \ln(B_L/D_d)/\partial r_{policy}$

In order to see the impact of a change in the policy rate on the substitution between liquid bonds and savings deposits, we start with the Tier-3 Cobb–Douglas cost minimization, which gives us $B_L = \mu P_B B^a / \pi_{BL}$ and $D_d = \gamma P_D D^a / \pi_{Dd}$ (active households; the type superscript a is suppressed below for readability). Forming the ratio:

$$\ln \left(\frac{B_L}{D_d} \right) = \ln \left[\frac{\mu P_B / \pi_{BL} B^a}{\gamma P_D / \pi_{Dd} D^a} \right] \quad (A33)$$

Using the Tier-2 CES demands $B^a = \alpha_B (P_B/P_F)^{-\phi} F^a$ and $D^a = \alpha_D (P_D/P_F)^{-\phi} F^a$, the common factor F^a and $(P_F)^{-\phi}$ cancel in the ratio B^a/D^a , leaving

$$\frac{B_L}{D_d} = \frac{\mu \alpha_B}{\gamma \alpha_D} \cdot \frac{P_B^{1-\phi}}{P_D^{1-\phi}} \cdot \frac{\pi_{Dd}}{\pi_{BL}} \quad (A34)$$

Taking logs:

$$\ln \left(\frac{B_L}{D_d} \right) = \ln \left(\frac{\mu \alpha_B}{\gamma \alpha_D} \right) + (1-\phi) \ln \left(\frac{P_B}{P_D} \right) + \ln \pi_{Dd} - \ln \pi_{BL} \quad (A35)$$

With $P_D = \pi_{Dd}^\gamma \pi_{Df}^{1-\gamma}$ and $P_B = \pi_{BL}^\mu \pi_{BN}^{1-\mu}$,

$$\ln \left(\frac{P_B}{P_D} \right) = \mu \ln \pi_{BL} + (1-\mu) \ln \pi_{BN} - \gamma \ln \pi_{Dd} - (1-\gamma) \ln \pi_{Df} \quad (A36)$$

Substituting into (31):

$$\begin{aligned} \ln \left(\frac{B_L}{D_d} \right) &= \ln \left(\frac{\mu \alpha_B}{\gamma \alpha_D} \right) \\ &+ (1-\phi) \left[\mu \ln \pi_{BL} + (1-\mu) \ln \pi_{BN} - \gamma \ln \pi_{Dd} - (1-\gamma) \ln \pi_{Df} \right] \\ &+ \ln \pi_{Dd} - \ln \pi_{BL} \end{aligned} \quad (A37)$$

The leading constant $\ln(\mu \alpha_B / \gamma \alpha_D)$ drops out. Differentiating (A37) term by term with respect to r_{policy} :

$$\begin{aligned} \frac{\partial}{\partial r_{policy}} \ln \left(\frac{B_L}{D_d} \right) &= (1-\phi) \mu \frac{1}{\pi_{BL}} \frac{\partial \pi_{BL}}{\partial r_{policy}} + (1-\mu)(1-\phi) \frac{1}{\pi_{BN}} \frac{\partial \pi_{BN}}{\partial r_{policy}} \\ &- (1-\phi) \gamma \frac{1}{\pi_{Dd}} \frac{\partial \pi_{Dd}}{\partial r_{policy}} - (1-\gamma)(1-\phi) \frac{1}{\pi_{Df}} \frac{\partial \pi_{Df}}{\partial r_{policy}} \\ &+ \frac{1}{\pi_{Dd}} \frac{\partial \pi_{Dd}}{\partial r_{policy}} - \frac{1}{\pi_{BL}} \frac{\partial \pi_{BL}}{\partial r_{policy}} \end{aligned} \quad (A38)$$

Collecting terms by common π_k :

$$\frac{\partial}{\partial r_{policy}} \ln \left(\frac{B_L}{D_d} \right) = \frac{1}{\pi_{BL}} \left[(1 - \phi)\mu - 1 \right] \frac{\partial \pi_{BL}}{\partial r_{policy}} + \frac{1}{\pi_{Dd}} \left[1 - (1 - \phi)\gamma \right] \frac{\partial \pi_{Dd}}{\partial r_{policy}} \quad (A39)$$

$$+ \frac{(1 - \mu)(1 - \phi)}{\pi_{BN}} \frac{\partial \pi_{BN}}{\partial r_{policy}} - \frac{(1 - \gamma)(1 - \phi)}{\pi_{Df}} \frac{\partial \pi_{Df}}{\partial r_{policy}} \quad (A40)$$

For any primitive rate $r_k = \bar{r}_k + \beta_k r_{policy}$ and envelope rate $r = \bar{r} + \beta_r r_{policy}$, with $\pi_k = (r - r_k)/(1 + r)$, $dr/dr_{policy} = \beta_r$ and $dr_k/dr_{policy} = \beta_k$:

$$\frac{\partial \pi_k}{\partial r_{policy}} = \left(\frac{\partial r}{\partial r_{policy}} - \frac{\partial r_k}{\partial r_{policy}} \right) \frac{1}{1 + r} - \frac{(r - r_k)}{(1 + r)^2} \frac{\partial r}{\partial r_{policy}} \quad (A41)$$

$$= \frac{\beta_r - \beta_k}{1 + r} - \frac{(r - r_k) \beta_r}{(1 + r)^2} = \frac{(\beta_r - \beta_k)(1 + r) - \beta_r(r - r_k)}{(1 + r)^2} \quad (A42)$$

which can equivalently be written, dividing the numerator and denominator by $(1 + r)$ and using $\pi_k = (r - r_k)/(1 + r)$, as

$$\boxed{\frac{\partial \pi_k}{\partial r_{policy}} = \frac{(\beta_r - \beta_k) - \beta_r \pi_k}{1 + r}} \quad (A43)$$

$$\frac{\partial \pi_k}{\partial r_{policy}} \frac{1}{\pi_k} = \frac{1}{(1 + r)} \left[\frac{(\beta_r - \beta_k)}{\pi_k} - \beta_r \right] \quad (A44)$$

Applying (34)–(35) to each of the four rates $k \in \{B_L, D_d, B_N, D_f\}$ in (33):

$$\begin{aligned} \frac{\partial}{\partial r_{policy}} \ln \left(\frac{B_L}{D_d} \right) = \frac{1}{1 + r} \left\{ \right. & \left[1 - (1 - \phi)\gamma \right] \left[\frac{\beta_r - \beta_{Dd}}{\pi_{Dd}} - \beta_r \right] \\ & - \left[1 - (1 - \phi)\mu \right] \left[\frac{\beta_r - \beta_{BL}}{\pi_{BL}} - \beta_r \right] \\ & + (1 - \mu)(1 - \phi) \left[\frac{\beta_r - \beta_{BN}}{\pi_{BN}} - \beta_r \right] \\ & \left. - (1 - \gamma)(1 - \phi) \left[\frac{\beta_r - \beta_{Df}}{\pi_{Df}} - \beta_r \right] \right\} \quad (A45) \end{aligned}$$

Interpretation Equation (A45) shows that the liquid-bond-to-demand-deposit ratio's sensitivity to the policy rate is a weighted combination of *four* pass-through gaps $(\beta_r - \beta_{BL})$, $(\beta_r - \beta_{Dd})$, $(\beta_r - \beta_{BN})$, $(\beta_r - \beta_{Df})$, with weights set by the Tier-2 substitution elasticity ϕ and the Tier-3 Cobb–Douglas shares μ, γ . The term $[(1 - \phi)\mu - 1]$ multiplying the B_L gap is generally negative for $\phi > 0$, $\mu \in (0, 1)$, while $[1 - (1 - \phi)\gamma]$ multiplying the D_d gap is generally positive — consistent with the ratio rising (more liquid-bond-heavy) when the demand-deposit pass-through gap widens relative to the liquid-bond gap, as the deposit channel predicts.

B.4 Comparative Statics: $\partial \ln(D_f/D_d)/\partial r_{policy}$

How does the intensive margin within deposits respond to changes in the policy rate? Following similar steps as in the previous subsection, we start with the Tier-3 Cobb–Douglas cost minimization, $D_f = (1 - \gamma) P_D D^a / \pi_{Df}$ and $D_d = \gamma P_D D^a / \pi_{Dd}$. Forming the ratio, the common factors $P_D D^a$ cancel:

$$\frac{D_f}{D_d} = \frac{(1 - \gamma) P_D / \pi_{Df}}{\gamma P_D / \pi_{Dd}} = \frac{(1 - \gamma)}{\gamma} \cdot \frac{\pi_{Dd}}{\pi_{Df}} \quad (\text{A46})$$

Taking logs:

$$\ln\left(\frac{D_f}{D_d}\right) = \ln\left(\frac{1 - \gamma}{\gamma}\right) + \ln \pi_{Dd} - \ln \pi_{Df} \quad (\text{A47})$$

Now take the derivative with respect to r_{policy} . The leading constant $\ln[(1 - \gamma)/\gamma]$ drops out, leaving

$$\frac{\partial}{\partial r_{policy}} \ln\left(\frac{D_f}{D_d}\right) = \frac{1}{\pi_{Dd}} \frac{\partial \pi_{Dd}}{\partial r_{policy}} - \frac{1}{\pi_{Df}} \frac{\partial \pi_{Df}}{\partial r_{policy}} \quad (\text{A48})$$

Using $\frac{\partial \pi_k}{\partial r_{policy}} = \frac{(\beta_r - \beta_k) - \beta_r \pi_k}{1 + r}$ (derived previously) for $k \in \{D_d, D_f\}$, we get:

$$\frac{\partial}{\partial r_{policy}} \ln\left(\frac{D_f}{D_d}\right) = \frac{1}{1 + r} \left[\frac{(\beta_r - \beta_{Dd}) - \beta_r \pi_{Dd}}{\pi_{Dd}} - \frac{(\beta_r - \beta_{Df}) - \beta_r \pi_{Df}}{\pi_{Df}} \right] \quad (\text{A49})$$

$$= \frac{1}{1 + r} \left[\left(\frac{\beta_r - \beta_{Dd}}{\pi_{Dd}} - \beta_r \right) - \left(\frac{\beta_r - \beta_{Df}}{\pi_{Df}} - \beta_r \right) \right] \quad (\text{A50})$$

The two $-\beta_r$ terms cancel:

$$\frac{\partial}{\partial r_{policy}} \ln\left(\frac{D_f}{D_d}\right) = \frac{1}{1 + r} \left[\frac{\beta_r - \beta_{Dd}}{\pi_{Dd}} - \frac{\beta_r - \beta_{Df}}{\pi_{Df}} \right] \quad (\text{A51})$$

Using $\pi_k(1 + r) = r - r_k$, so that $\frac{1}{1 + r} \cdot \frac{1}{\pi_k} = \frac{1}{r - r_k}$, equation (A51) simplifies to

$$\boxed{\frac{\partial}{\partial r_{policy}} \ln\left(\frac{D_f}{D_d}\right) = \frac{\beta_r - \beta_{Dd}}{r - r_{Dd}} - \frac{\beta_r - \beta_{Df}}{r - r_{Df}}} \quad (\text{A52})$$

Interpretation Equation (39) isolates the pure within-deposits substitution margin, cleanly stripped of the Tier-1 and Tier-2 effects that entered the B_L/D_d ratio derived previously — since both D_f and D_d sit at the same Cobb–Douglas tier, the Tier-3 share parameter γ itself does not appear in the final derivative. The sign is governed entirely by the relative size of the two pass-through gaps: if the demand-deposit pass-through gap $(\beta_r - \beta_{Dd})$ exceeds the fixed-deposit gap $(\beta_r - \beta_{Df})$ scaled by their respective rate differentials, the ratio D_f/D_d rises with r_{policy} — i.e., households shift toward fixed deposits and away from demand deposits as the policy rate increases, consistent with the empirical spreads discussed in

the stylized facts (savings/demand deposit spreads found to be wider than time-deposit spreads in both the US and India).

B.5 Monte Carlo Method for confidence bands: Steps and Formulas

This appendix describes the parametric Monte Carlo procedure used to quantify uncertainty surrounding the model-implied comparative statics. The object of interest is the semi-elasticity of the substitutable instruments ratio (e.g., liquid-bond-to-demand-deposit ratio) with respect to the policy rate. Because this semi-elasticity is a nonlinear function of the policy pass-through coefficients, substitution parameters, portfolio shares, and the associated user costs, its sampling uncertainty is not conveniently summarized by the standard errors of the individual parameters. We therefore follow a simulation-based approach in the spirit of [Krinsky and Robb \(1986b\)](#) and [King et al. \(2000\)](#). For each simulation draw, we sample the underlying parameters from their approximated sampling distributions, recompute the complete nonlinear comparative-static expression over the policy-rate grid, and summarize the resulting distribution using pointwise percentiles. This method transfers uncertainty in the calibrated and estimated parameters to the uncertainty associated with the model predictions. We formalize the procedure in the steps mentioned below.

Step 1: Object of interest

The quantity being simulated is the semi-elasticity itself, for example:

$$E(r_{policy}) \equiv \frac{\partial \ln(B_L/D_d)}{\partial r_{policy}} = \frac{\lambda}{1+r} \Psi \quad (\text{A53})$$

$$\Psi = [1 + (\phi - 1)\gamma] X_{Dd} - [1 + (\phi - 1)\mu] X_{BL} - (1 - \mu)(\phi - 1) X_{BN} + (1 - \gamma)(\phi - 1) X_{Df} \quad (\text{A54})$$

$$X_k \equiv \frac{\beta_r - \beta_k}{\pi_k} - \beta_r, \quad \pi_k = \frac{r - r_k}{1 + r}, \quad r_k = \bar{r}_k + \beta_k(r_{policy} - \bar{r}), \quad r = \bar{r} + \beta_r(r_{policy} - \bar{r}) \quad (\text{A55})$$

Step 2: Stochastic inputs

$E(r_{policy})$ is a function of eight underlying parameters $\theta = (\beta_{Dd}, \beta_{Df}, \beta_{BL}, \beta_{BN}, \beta_r, \phi, \gamma, \lambda)$, each with a point estimate $\hat{\theta}_i$ and standard error $SE(\hat{\theta}_i)$. μ and the mean rates $\bar{r}_k$ are held fixed at their point estimates (no standard error currently available).

Step 3: Sampling distribution

Each parameter is assumed approximately normally distributed around its point estimate:

$$\theta_i^{(s)} \sim N(\hat{\theta}_i, SE(\hat{\theta}_i)^2), \quad i = 1, \dots, 8. \quad (\text{A56})$$

We approximate the sampling distribution of each uncertain parameter by a normal distribution centered at its point estimate. In the absence of a jointly estimated covariance matrix, the parameters

are drawn independently. This independence assumption is an approximation and may understate or overstate the uncertainty in the resulting semi-elasticity when the underlying parameter estimates are correlated.

Step 4: Draw and recompute

For $s = 1, \dots, S$ (with $S = 5,000$ draws):

$$\theta_i^{(s)} = \hat{\theta}_i + SE(\hat{\theta}_i) \cdot z_i^{(s)}, \quad z_i^{(s)} \sim N(0, 1) \quad (\text{A57})$$

For each draw s and each point on the policy-rate grid $r_{policy} \in [\bar{r} - 0.02, \bar{r} + 0.02]$, recompute

$$E^{(s)}(r_{policy}) = \frac{\lambda^{(s)}}{1 + r^{(s)}} \Psi^{(s)}(r_{policy}) \quad (\text{A58})$$

using $\theta^{(s)}$ in place of the point estimates. Draws for which any $\pi_k^{(s)} \leq 0$ at a given grid point (envelope dominance violated) are discarded at that point.

Step 5: Summarizing the simulated distribution

At each grid point, the empirical percentiles of $\{E^{(1)}(r_{policy}), \dots, E^{(S)}(r_{policy})\}$ are computed:

$$\hat{E}_{lo} = 5\text{th percentile}, \quad \hat{E}_{med} = 50\text{th percentile}, \quad \hat{E}_{hi} = 95\text{th percentile} \quad (\text{A59})$$

The interval $[\hat{E}_{lo}(r_{policy}), \hat{E}_{hi}(r_{policy})]$ is reported as a 90% pointwise Monte Carlo confidence band. It quantifies uncertainty at each policy-rate value separately and should not be interpreted as a simultaneous confidence band for the entire comparative-static curve. The simulated median is reported as the central line.

Step 6: Cross-country comparison

At each grid point, we compute

$$\text{Overlap}(r_{policy}) = [\hat{E}_{lo}^{US} < \hat{E}_{hi}^{IN}] \wedge [\hat{E}_{lo}^{IN} < \hat{E}_{hi}^{US}] \quad (\text{A60})$$

No overlap at a given point indicates the cross-country difference is not attributable to sampling noise in θ , at the 90% level.

C Calibration Details

This appendix documents the construction of the household-level calibration moments and the estimation of the interest-rate parameters used in Table 3.

C.1 United States

C.1.1 Survey weights and multiple imputations

We use the 2019 Survey of Consumer Finances (SCF). All household-level statistics use the SCF household weight. The public-use SCF contains five completed-data implicates for each sampled family. We therefore calculate each weighted statistic separately within implicate $m = 1, \dots, 5$ and report the simple average of the five resulting point estimates. This avoids treating the five imputed observations for a given household as five independent families.

C.1.2 Active and Passive households

Deposits are defined as

$$D_i = D_{d,i} + D_{f,i}, \quad (\text{A61})$$

where $D_{d,i}$ contains checking accounts, traditional savings accounts, and money-market deposit accounts held at depository institutions, while $D_{f,i}$ contains certificates of deposit. Money-market mutual funds held outside depository institutions are classified as non-deposit financial assets.

The model population consists of households satisfying $D_i > 0$. We construct a broad non-deposit financial bundle B_i containing money-market mutual funds, other mutual funds and ETFs, U.S. savings bonds, directly held stocks and bonds, cash-value life insurance, annuities and trusts, retirement wealth, and other miscellaneous financial assets.

We define

$$\text{Active}_i = \mathbf{1}\{D_i > 0, B_i > 0\}, \quad (\text{A62})$$

and

$$\text{Passive}_i = \mathbf{1}\{D_i > 0, B_i = 0\}. \quad (\text{A63})$$

Thus, Active refers to participation in a broader financial portfolio beyond bank deposits rather than participation only in directly held bonds.

Within each implicate m , the share of Active households is

$$\lambda_{a,m} = \frac{\sum_i w_{im} \mathbf{1}\{D_{im} > 0, B_{im} > 0\}}{\sum_i w_{im} \mathbf{1}\{D_{im} > 0\}}. \quad (\text{A64})$$

Taking the average value across the implicates

$$\lambda_a = \frac{1}{5} \sum_{m=1}^5 \lambda_{a,m}, \quad \lambda_p = 1 - \lambda_a. \quad (\text{A65})$$

gives

$$\lambda_a = 0.6873, \quad \lambda_p = 0.3127.$$

C.1.3 Non-financial wealth

The baseline U.S. non-financial asset is investment-oriented non-financial wealth,

$$N_i = N_i^{\text{oresre}} + N_i^{\text{nnresre}} + N_i^{\text{bus}} + N_i^{\text{othnfin}}, \quad (\text{A66})$$

where the components are other residential real estate, nonresidential real-estate net equity, private business wealth, and other substantial non-financial assets. The primary residence and vehicles are excluded.

This definition is chosen to make N an investable store-of-wealth alternative to the financial portfolio. It is not intended to measure total household physical wealth.

C.1.4 Portfolio weights

The upper-tier CES weights are calculated as ratios of survey-weighted aggregate asset values:

$$\theta_{F,j} = \frac{\sum_i w_i \mathbf{1}\{i \in j\} F_i}{\sum_i w_i \mathbf{1}\{i \in j\} (F_i + N_i)}, \quad \theta_{N,j} = 1 - \theta_{F,j}. \quad (\text{A67})$$

This produces

$$(\theta_{F,a}, \theta_{N,a}) = (0.5977, 0.4023),$$

and

$$(\theta_{F,p}, \theta_{N,p}) = (0.2050, 0.7950).$$

Within the financial portfolio,

$$\alpha_D^j = \frac{\sum_i w_i \mathbf{1}\{i \in j\} D_i}{\sum_i w_i \mathbf{1}\{i \in j\} (D_i + B_i)}, \quad \alpha_B^j = 1 - \alpha_D^j. \quad (\text{A68})$$

For Active households,

$$\alpha_D^a = 0.1120, \quad \alpha_B^a = 0.8880.$$

For Passive households,

$$\alpha_D^p = 1, \quad \alpha_B^p = 0.$$

The deposit share parameter is

$$\gamma_j = \frac{\sum_i w_i \mathbf{1}\{i \in j\} D_{d,i}}{\sum_i w_i \mathbf{1}\{i \in j\} (D_{d,i} + D_{f,i})}. \quad (\text{A69})$$

The resulting values are approximately

$$\gamma_a = 0.817, \quad \gamma_p = 0.818.$$

For μ_a , we use a narrower bond subportfolio chosen to correspond to the empirical return proxies. The liquid component consists of government and Treasury-like direct holdings and government bond funds. The less-liquid component contains corporate and other bond holdings and the corresponding bond funds. We therefore calculate

$$\mu_a = \frac{B_L^a}{B_L^a + B_N^a}, \quad (\text{A70})$$

which gives

$$\mu_a = 0.3975.$$

The parameter is undefined for Passive households because their financial portfolio does not consist of bonds.

C.1.5 Household resources and χ_j

The model resource variable W^j is a flow. We therefore do not use the SCF stock of financial and non-financial assets as its empirical counterpart. Instead, we use the SCF normal-income measure (NORMINC), which replaces unusually high or low survey-year income with the household's reported normal income.

Following the Federal Reserve's construction, the income measure includes the relevant pension and retirement-account withdrawals and is expressed in 2019 dollars. Within each SCF implicate, we calculate

$$W_m^j = \frac{\sum_i w_{im} \mathbf{1}\{i \in j\} \text{NORMINC}_{im}}{\sum_i w_{im} \mathbf{1}\{i \in j\}}, \quad (\text{A71})$$

and set

$$W^j = \frac{1}{5} \sum_{m=1}^5 W_m^j. \quad (\text{A72})$$

This gives

$$W^a = 135,416, \quad W^p = 48,315.$$

For log utility,

$$U(c^j, S^j) = \log c^j + \chi_j \log S^j,$$

together with

$$c^j + P_S^j S^j = W^j,$$

the first-order condition gives

$$\chi_j = \frac{P_S^j S^j}{W^j - P_S^j S^j}. \quad (\text{A73})$$

We evaluate $P_S^j S^j$ at the baseline household portfolio using the user-cost prices

$$\pi_k = \frac{r - r_k}{1 + r}. \quad (\text{A74})$$

The resulting preference weights are

$$\chi_a = 0.14, \quad \chi_p = 0.06.$$

These magnitudes are in the range suggested by models in which monetary or financial assets provide direct services (Poterba and Rotemberg, 1987; Holman, 1998; Burlon et al., 2024).

C.1.6 Substitution elasticities

The SCF does not identify the substitution elasticities from a single cross-section. We therefore calibrate these parameters using the literature.

For the deposit–bonds financial margin, Krishnamurthy and Li (2023) report a CES curvature parameter of approximately $\rho = 0.65$. Under our parameterization,

$$\phi_a = \frac{1}{1 - \rho} = \frac{1}{1 - 0.65} \simeq 2.86. \quad (\text{A75})$$

We use $\phi_a = 2.86$ in the baseline and consider

$$\phi_a \in \{2, 3, 4\}$$

as a sensitivity range.

For the upper F – N margin, there is no estimate corresponding exactly to our asset definitions. Li et al. (2016) obtain an elasticity of about 0.49 for housing versus non-housing allocations, while Piazzesi et al. (2007) consider elasticities close to unity. Related evidence in Chetty et al. (2017) shows that housing positions materially affect financial portfolios. We therefore use

$$\eta_a = \eta_p = 0.75$$

and consider

$$\eta_j \in \{0.50, 1.00, 1.25\}.$$

C.1.7 Interest rates and pass-through

The U.S. return series are selected to correspond as closely as possible to the model assets. We use the savings-deposit rate for r_{D_d} , the time-deposit rate for r_{D_f} , the 3-month Treasury bill yield for r_{B_L} , and Moody's Aaa corporate bond yield for r_{B_N} .

The benchmark return is constructed month by month as

$$r_t = \max\{r_{D_d,t}, r_{D_f,t}, r_{B_L,t}, r_{B_N,t}\} + 0.01. \quad (\text{A76})$$

This follows the benchmark convention used in the St. Louis monetary-services literature (Anderson et al., 1997). Over our sample, the Aaa corporate bond yield is the largest component in every month, so

$$r_t = r_{B_N,t} + 0.01.$$

For each asset k , policy pass-through is estimated using an autoregressive distributed-lag specification,

$$r_{k,t} = a_k + \sum_{h=1}^{p_k} \rho_{k,h} r_{k,t-h} + \sum_{\ell=0}^{q_k} \delta_{k,\ell} i_{t-\ell} + u_{k,t}, \quad (\text{A77})$$

where i_t is the Federal Funds Rate.

When the ARDL bounds test supports a stable long-run relationship, we use the long-run multiplier

$$\hat{\beta}_k = \frac{\sum_{\ell=0}^{q_k} \hat{\delta}_{k,\ell}}{1 - \sum_{h=1}^{p_k} \hat{\rho}_{k,h}}. \quad (\text{A78})$$

When the evidence for cointegration is weak, we instead use the cumulative short-run response over six months. This is the case for the Aaa corporate bond yield. The baseline estimates are

$$\beta_{D_d} = 0.46, \quad \beta_{D_f} = 0.77, \quad \beta_{B_L} = 0.87, \quad \beta_{B_N} = 0.05.$$

Since the benchmark rate equals the Aaa yield plus a constant in the U.S. sample,

$$\beta_{\text{policy}} = 0.05.$$

C.1.8 Return on non-financial wealth

The SCF measure of N combines several forms of non-financial wealth, for which no single market return is available. For the baseline calibration we therefore use the national, seasonally adjusted FHFA Purchase-Only House Price Index as a transparent proxy for capital appreciation on non-financial wealth. The data are available from the Federal Housing Finance Agency.¹⁴

Let HPI_t denote the index. We calculate average annualized capital appreciation over the U.S.

¹⁴See <https://www.fhfa.gov/data/hpi>

calibration sample as

$$\bar{r}_N^{US} = \frac{12}{T} \log \left(\frac{HPI_T}{HPI_0} \right). \quad (\text{A79})$$

The resulting value is approximately

$$\bar{r}_N^{US} = 0.030.$$

Because the FHFA series captures property-price appreciation rather than the full return on private businesses and real estate, we interpret this value as a reduced-form capital-gain proxy for the N bundle.

India. For India, N corresponds directly to household gold. A natural empirical measure of the realized financial return on gold is the capital gain in the domestic gold price. RBI gold-price data, however, show substantial realized appreciation over our calibration period. Using this realized sample mean as the steady-state return would imply

$$\bar{r}_G > \bar{r},$$

and therefore a negative Barnett user cost,

$$\pi_G = \frac{r - r_G}{1 + r} < 0.$$

Such a value is incompatible with the user-cost interpretation used in the portfolio aggregator.

We therefore distinguish between the long-run expected financial return on gold, and transitory realized gold-price movements. We specify

$$r_{G,t} = \bar{r}_G + \varepsilon_{G,t}, \quad E[\varepsilon_{G,t}] = 0. \quad (\text{A80})$$

To calibrate the steady-state component, we use the long-run evidence in [Barro and Misra \(2016\)](#). They estimate average real gold-price appreciation of approximately 1.1 percent per year over 1836–2011. Their distinction between the financial return to gold and the service or convenience value of holding gold is particularly useful in our setting: the former enters r_G , whereas the latter is already represented through the portfolio service aggregate S .

Because the remaining model returns are nominal, we convert the long-run real capital gain into a nominal return using average Indian CPI inflation:

$$1 + \bar{r}_G^{IN} = (1 + 0.011)(1 + \bar{\pi}^{IN}). \quad (\text{A81})$$

This gives

$$\bar{r}_G^{IN} = 0.082$$

for 2001m4–2013m12 and

$$\bar{r}_G^{IN} = 0.074$$

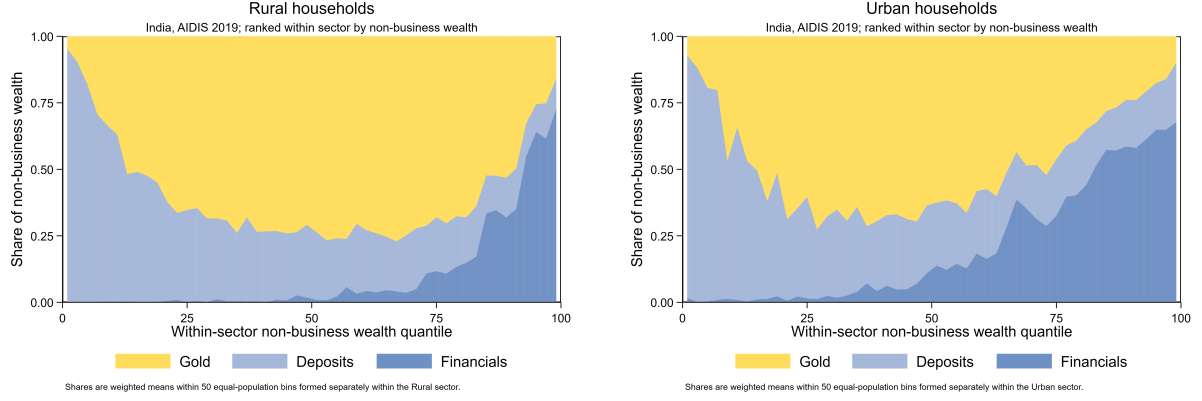
for 2001m4–2025m5.

The RBI gold-price series is therefore not discarded. Instead, realized gold-price fluctuations are interpreted as empirical counterparts of the innovation $\varepsilon_{G,t}$ around the long-run expected return.

D Stylized Facts

D.1 Urban vs Rural

Figure A1
Composition of non-business wealth in rural and urban India



(a) Rural households

(b) Urban households

Notes: The figure uses household-level data from the 2019 All India Debt and Investment Survey (AIDIS). Households are ranked separately within the rural and urban samples according to their total non-business wealth and assigned to survey-weighted, equal-population wealth bins. The horizontal axis reports the household's position in the corresponding rural or urban non-business wealth distribution, while the vertical axis reports the average share of non-business wealth held in each asset category within a bin. Non-business wealth is defined as $W_i^{NB} = G_i + D_i + F_i$, where G_i denotes gold holdings, D_i denotes deposits, and F_i denotes other financial assets. Gold includes bullion and ornaments. Deposits include bank and post-office accounts, fixed and term deposits, and other deposit-like savings instruments. Other financial assets include shares, debentures, mutual funds, insurance-related savings, annuities, and receivables. The three reported portfolio shares sum to one within each wealth bin.

Figure A1 reveals a broadly similar pattern across rural and urban households at the lower and middle parts of the non-business wealth distribution. Deposits dominate at the very bottom, while gold rapidly becomes the largest component as households move up the distribution.

The main rural–urban divergence emerges toward the upper tail. Financial assets become important considerably earlier and more strongly among urban households, accompanied by a pronounced decline in the gold share. Among rural households, by contrast, gold remains the dominant component over a larger portion of the distribution, and the sharp increase in financial assets is concentrated much closer to the very top. This suggests a non-business portfolio diverted more towards financial holdings among relatively wealthy urban households, whereas gold retains a greater role among comparable positions in the rural wealth distribution.

D.1.1 Decomposing the full calibrated gap

The counterfactual channel strengths implied by this exercise are:

$$\text{Channel}^{EME} = 3.60, \quad \text{Channel}^{AE} = 13.46 \quad (\text{A82})$$

These can be compared to the corresponding values under the full, separately calibrated United States and India parameters used in Figure 6:

$$\text{Channel}_{\text{full calibration}}^{\text{India}} = 3.57, \quad \text{Channel}_{\text{full calibration}}^{\text{US}} = 16.22 \quad (\text{A83})$$

The India counterfactual and the full-calibration value coincide closely (3.60 versus 3.57), as expected, since the counterfactual is constructed using India's own ϕ and γ throughout. The United States counterfactual (13.46) falls short of the full-calibration United States value (16.22) by 2.76.

This residual of 2.76 is the portion of the full United States–India gap not explained by the mechanisms formalized in Proposition 1. It reflects the difference between the two countries' own substitution elasticities ($\phi^{\text{US}} = 2.86$ versus $\phi^{\text{India}} = 1.394$) and deposit composition shares ($\gamma^{\text{US}} = 0.85$ versus $\gamma^{\text{India}} = 0.78$), both of which the Proposition holds fixed by construction in order to isolate the participation and market-depth channels. of the full 12.65-point gap between the United States and India semi-elasticities at steady state, approximately 9.89 points (78 percent) is explained by the participation (λ) and liquidity-composition (μ) channels formalized in Proposition 1, holding the substitution elasticity and remaining pass-through structure fixed at India's calibrated values. The residual 2.76 points (22 percent) reflects the difference in ϕ and γ between the two economies, which falls outside the scope of the Proposition and is not currently attributed to a specific formalized mechanism in this paper.

	India (EME)	United States (AE)
Full calibration (own ϕ, γ)	3.57	16.22
Proposition counterfactual (India's ϕ, γ throughout)	3.60	13.46

Table A2
Semi-elasticity at steady state: full calibration versus the Proposition's ceteris paribus counterfactual