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Household Heterogeneity and Monetary Policy Amplification in Austria*

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Abstract

We extend the sufficient-statistics decomposition of the consumption response to monetary policy developed by Auclert (2019) to an open economy in which households hold foreign assets and liabilities. Using Austrian household survey data, we find that redistribution raises the consumption response to a rate cut by 18 percent relative to a redistribution-free benchmark, mostly through households with variable rate mortgages. Despite steeply declining income–GDP elasticities, the weak relationship between marginal propensities to consume (MPCs) and income limits the earnings-heterogeneity channel to about 3 percent of the consumption response with profiles based on personal gross earnings, and less than 1 percent with profiles based on household income. In an illustrative calibration, the foreign channels add about 13 percent to the domestic response, mostly as a level effect from the revaluation of net foreign assets.

Keywords: MPC, Household balance sheets, Monetary policy transmission, Consumption dynamics, Open economy, Net foreign assets

JEL: D12, D31, E12, F41

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1. Introduction

Households do not respond uniformly to monetary policy. They vary in their consumption behavior, as well as in the level and composition of their income, assets, and liabilities. These balance-sheet positions are unequally exposed to policy shocks. The effect of monetary policy therefore depends not only on the magnitude of the aggregate change in income or wealth, but also on which households experience that change and their response to it. How strongly a household's consumption responds to an additional unit of income or wealth is measured by its marginal propensity to consume (MPC). Using the ECB Household Finance and Consumption Survey (HFCS), Albacete et al. (2025) measure self-reported MPCs in European countries, and show that they decrease systematically with cash-on-hand, so that the same aggregate stimulus has different effects depending on where it lands in the distribution.

When households differ, monetary policy has redistribution effects. The role of redistribution has long been recognized (e.g. Blinder, 1975; Tobin, 1982), but it has only recently been incorporated into general equilibrium models of monetary transmission. In New Keynesian representative-agent (RA) models, redistribution between households is absent by design. Two-agent New Keynesian (TANK) models take a step toward heterogeneity, grouping households into savers and spenders with MPCs of near zero and one. This dichotomy collapses the distribution of MPCs to two points (Galí et al., 2007).

Heterogeneous-agent New Keynesian (HANK) models take this further by embedding a full incomplete-markets structure, in which households face uninsurable idiosyncratic income risk and borrowing constraints. The distribution of MPCs across households emerges endogenously. Auclert et al. (2024) show that the observed dynamics of intertemporal MPCs are inconsistent with both representative-agent and standard two-agent models, but can be matched by certain heterogeneous-agent models and by a two-agent model with bonds in the utility function. Two results from this literature are central to our analysis. First, the indirect general-equilibrium effects of monetary policy dominate the direct intertemporal substitution effect that carries the transmission in the RA benchmark (Kaplan et al., 2018). Second, because households differ in their exposure to interest rate and price changes, monetary policy redistributes income and wealth between them, and this redistribution affects aggregate consumption through the covariance between exposures and MPCs (Auclert, 2019).

The sufficient-statistics decomposition by Auclert (2019) expresses the consumption response in terms of observable moments, such as the distribution of household balance-sheet exposures, the associated MPCs, and several aggregate elasticities, and allows quantifying the effects of a monetary shock without specifying and solving a HANK model. Auclert (2019) develops the closed-economy benchmark and identifies aggregate exposure effects in an open-economy extension (see the discussion in Section II.D of that paper). He notes that in an open economy his market-clearing conditions no longer hold, so that price-level and interest rate changes redistribute between domestic households and the rest of the world, and that the resulting effect on consumption scales with the average MPC. We extend this point to a general menu of foreign assets and liabilities. The cross-sectional mean of foreign exposures does not net out against domestic counterparties (the government and consolidated firms) but equals the household sector's aggregate foreign exposure. In a closed economy, the aggregate exposures of households are absorbed by these counterparties and net to zero, so that

only distributional covariances survive. In an open economy, by contrast, movements in the exchange rate, foreign prices and foreign interest rates have level effects scaled by the average MPC, in addition to covariance effects. The open-economy decomposition therefore acquires three additional balance-sheet channels, each with a level and a redistribution component: exchange rate revaluation, foreign interest rate exposure, and the foreign Fisher channel. A fourth channel operates through the earnings of households employed in the traded sector. We assume that its level term is already contained in the calibrated income response.

This paper builds on Pekanov (2024a), who applies the sufficient-statistics approach of Auclert (2019) to the euro area. We extend this approach to a small open economy. We evaluate how differences in household income, assets, liabilities, and interest rate exposures, together with heterogeneous MPCs, shape the transmission of monetary policy in Austria. We allow the elasticity of earnings to aggregate income to vary across households and calibrate heterogeneous earnings elasticities from quantile regressions of income on GDP. Combining HFCS with national sources of aggregate data, we quantify the contribution of these channels in Austria and compare the results in closed- and open-economy settings.

We find that, relative to a redistribution-free benchmark, household heterogeneity amplifies the closed-economy response to a rate cut by 18 percent in Austria, mostly through the unhedged interest rate exposure channel. The Fisher channel turns out to be small. Relative to proportional incidence, allowing earnings elasticities to vary across the income distribution raises the earnings-heterogeneity channel from zero to about 3 percent of the response with a profile based on personal gross earnings. The channel is small although the estimated incidence is steep. What limits the channel is that the MPCs of the households that receive more of the income gain than under proportional incidence are only slightly higher than those of the households that receive less. In aggregate, the households in our sample hold positive net foreign assets. Treating these exposures, which we impute from residency-based assets and foreign-currency liabilities, as exposed to the euro's external value, we find that in an illustrative calibration the foreign channels add about 13 percent to the response of the domestic block, mainly through their revaluation when the euro depreciates in real terms, while the foreign Fisher channel is negligible. A representative household holding the same foreign position would experience this level effect as well. Compared to a redistribution-free open-economy benchmark, heterogeneity amplifies the response by 17.5 percent.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. Section 3 presents the sufficient-statistics framework of Auclert (2019) and derives our open-economy extension. Section 4 describes the data. Section 5 presents the closed-economy results, the results under heterogeneous earnings elasticities, and the open-economy results. Section 6 discusses limitations and ideas for further research, and Section 7 concludes.

2. Related Literature

A central contribution is Auclert (2019), who argues that redistribution is a first-order channel of monetary policy transmission. In this framework, interest rate changes affect aggregate consumption through five channels, three of which are redistributive: heterogeneous labor-income responses (earnings heterogeneity channel), redistribution between nominal creditors

and debtors (Fisher channel), and differences in unhedged interest rate exposure (URE). The aggregate-income and intertemporal-substitution channels complete the decomposition. For each redistributive channel, the aggregate effect depends on the covariance between household MPCs and exposure, not on average exposure.

Slacalek et al. (2020) develop a related estimate for the euro area and find that the indirect labor-income channel and the effect of housing wealth, rather than the direct balance-sheet channels, drive both the size of the aggregate consumption response and its dispersion across countries. Tzamourani (2021) measures unhedged interest rate exposure in the HFCS for every euro area country and traces the cross-country pattern largely to the prevalence of variable rate mortgages. Patterson (2023) demonstrates that labor-market heterogeneity amplifies business-cycle fluctuations because high-MPC workers are disproportionately employed in jobs whose earnings are more cyclical. In US administrative data, this matching multiplier raises the aggregate MPC by about 20 percent relative to a benchmark of equal exposure, and the covariance between MPCs and earnings elasticities that generates it is closely related to the earnings-heterogeneity channel we estimate for Austria. Pekanov (2024b) shows that earnings elasticities in the euro area are highest for the bottom income groups and decline along the income distribution; the groups with the highest elasticities have higher MPCs.

Boehnert et al. (2025) highlight expenditure composition as an additional channel, which our balance-sheet decomposition does not capture. Across the member states of the euro area, countries with higher inequality have larger service expenditure shares and a weaker output response to common monetary policy. With a service expenditure share of 38 percent, Austria is below most euro area countries in their data, which in their framework places it on the side of comparatively strong transmission.

Household heterogeneity is carried into an open-economy setting by de Ferra et al. (2020), who build a heterogeneous-agent New Keynesian small open model economy (HANKSOME) that experiences a sudden stop in capital inflows. When high-MPC households hold foreign-currency liabilities, exchange rate depreciations generate large negative wealth effects that make depreciation welfare-reducing. This mechanism provides an explanation for "fear of floating" and shows that a depreciation can have adverse welfare effects in economies with exposed household balance sheets. Beer et al. (2010) documents a high share of household debt denominated in foreign currency in Austria in the 2000s, which is relevant to the foreign exposures we measure below.

Bilbiie (2025) shows that the quantitative importance of heterogeneity hinges on how the income of high-MPC (hand-to-mouth) households moves with aggregate income: amplification obtains when their income is more cyclical than average, and it can turn into dampening otherwise. Because taxes and transfers are countercyclical, inequality in disposable income, which Bilbiie (2025) regards as the empirical counterpart of the model's key object, is less countercyclical than inequality in labor earnings and may even be procyclical. Using Norwegian administrative data on income, wealth and consumption, Bilbiie et al. (2025) show that the aggregate MPC is very close to the average MPC and that heterogeneity does not amplify demand shocks when income is measured after taxes and transfers.

Crawley and Kuchler (2023) estimate Auclert's sufficient statistics on Danish administrative

data and find the redistribution channels to be large: a one-percentage-point increase in the real interest rate lowers aggregate consumption growth by 29 basis points through interest rate exposure alone. They point to the lower prevalence of variable rate mortgages in the United States as a factor behind its small interest rate exposure channel, and to lower household debt as a factor behind its smaller Fisher channel.

Our open-economy extension connects the literature on heterogeneous-agent monetary transmission with the literature on external balance sheets. While the closed-economy benchmark of Auclert (2019) represents the redistribution channels through covariances between MPCs and household exposures, the literature on net foreign assets examines how a country's external balance sheet shapes the response of the aggregate economy to shocks without allowing for heterogeneity in MPCs (Ghironi, 2008). The HANKSOME framework of de Ferra et al. (2020) bridges these strands for the special case of foreign-currency debt concentrated among constrained households. Auclert et al. (2021) quantify the real-income channel of exchange rate movements in an open-economy HANK model, a channel that operates through the effect of import prices on real incomes and is therefore distinct from the balance-sheet revaluation we isolate. Guo et al. (2023), in turn, show that heterogeneity in households' exposure to international markets drives unequal consumption responses to external shocks more than heterogeneity in income or wealth does, and that monetary policy in open economies faces a tradeoff between stabilization and inequality.

3. Theoretical Approach

3.1. The closed-economy decomposition

We closely follow the approach developed by Auclert (2019). Three redistribution channels operate when households have different MPCs and different portfolios: an unhedged interest rate exposure (URE) channel, an earnings heterogeneity channel and a net nominal position (NNP) channel. To quantify these channels, we need to specify the monetary policy shock and its effects on aggregate income, the price level, and the real interest rate. These assumptions serve as exogenous inputs to the decomposition of the consumption response and define the comparative statics exercise.

Following Pekanov (2024a), we assume that an interest rate cut of $dR/R = -1\%$ raises GDP by $dY/Y = +0.4\%$ and the aggregate price level by $dP/P = +0.2\%$. The gross real interest rate R is close to one, so that a cut of one percentage point corresponds approximately to $dR/R = -1\%$. We treat the one-percentage-point cut in the ECB policy rate as an equal decrease in the relevant real rate of return. The assumed output response is in line with the output response to a one-percentage-point policy rate change in structural models of the euro area (cf. Coenen et al., 2012, Section III).

Households are differently exposed to these aggregate changes (dP, dY, dR), and we can quantify these exposures given suitable household-level data. First, the net nominal asset position (NNP) describes the nominal asset exposures of households. Additional inflation due to the monetary policy change creates implicit redistribution from holders of nominal assets to holders of nominal liabilities. The net nominal position (NNP) channel describes this redistribution and its effect on consumption. Second, the total income of households is

also influenced by the monetary policy change due to the aggregate output growth. In the simplest benchmark, each household is affected uniformly by the aggregate output change. Our baseline instead follows Auclert (2019) in letting relative incomes respond to aggregate income. Individual earnings elasticities are a central input to our analysis. We later allow these elasticities to vary across the income distribution. This relaxation permits households to respond differently to aggregate GDP fluctuations depending on their income position. Similar to Guvenen et al. (2017), we define individual earnings elasticities with respect to aggregate output as shown in Equation (1), where γ_h is the earnings elasticity of an individual or household in a specific income bin. E_h denotes the individual's or household's earnings and Y is the aggregate GDP of an economy. In US administrative data, Guvenen et al. (2017) find that the exposure of individual earnings to GDP is U-shaped in the level of earnings, with the highest exposure at both tails and the increase at the top concentrated in the 99th and 99.9th percentiles. The Austrian profile estimated in Section 5.1.1 declines from the 10th to the 90th percentile.

$$\gamma_h = \frac{dE_h}{dY}\frac{Y}{E_h}. \tag{1}$$

Finally, the rate cut also affects households differently: households with unhedged interest payments pay less after the central bank's rate cut, while households that receive interest income receive less. This implicit redistribution through households' unhedged positions is the unhedged interest rate exposure (URE) channel.

Auclert (2019) shows that the consumption response to an interest rate change can be expressed analytically and decomposed in a reduced form with only a small number of channels, estimable from microdata. The decomposition in Equation (2) shows that the aggregate consumption response to an interest rate change can be described by products of the three macroeconomic changes described above (dP, dY, dR) and five objects describing the households' exposures: M and S for aggregate income and intertemporal substitution respectively, and three elasticities E_P, E_Y and E_R. This simplified decomposition rests on two assumptions: that the elasticity of intertemporal substitution is the same across individuals ($\sigma_i = \sigma$) and that the elasticity of relative income to aggregate income is the same across households ($\eta_i = \eta$). The consumption change from a standard consumption choice problem following an interest rate change can be expressed using the following elasticities:

$$\frac{dC}{C} = (M + \eta E_Y)\frac{dY}{Y} - E_P\frac{dP}{P} + (E_R - \sigma S)\frac{dR}{R}. \tag{2}$$

We write η for Auclert's relative-income parameter and reserve γ_i for household earnings incidence. Two remarks on the parameter η in Equation (2) are important for what follows. First, η here is Auclert's elasticity of *relative* income to aggregate income, not the Guvenen-type earnings elasticity γ_h of Equation (1): proportional incidence ($\gamma_h = 1$ for all h) corresponds to $\eta = 0$, in which case the earnings-heterogeneity channel is exactly zero by construction. The decomposition implements η through the incidence rule $dY_i = [Y_i + \eta(Y_i - \mathbb{E}_I[Y_i])]\, dY/Y$, which reproduces the earnings term $\eta E_Y\, dY/Y$ of Equation (2) and adds up to the aggregate income change for any η. Proportional incidence means that every household gains

the same percentage of its income. With $\eta = -1$, every household gains the same euro amount instead, so that low-income households gain more in percent of their income. Second, our baseline decomposition sets $\eta = -1$, consistent with the evidence cited by Auclert (2019) that income risk is countercyclical and that monetary accommodation reduces income inequality (Coibion et al., 2017), so that the baseline earnings-heterogeneity channel contributes $-E_Y\, dY/Y$. Pekanov (2024a) assumes proportional incidence ($\eta = 0$); we reproduce his reported total response of 0.86 percent and amplification of 15 percent with $\eta = -1$.

Table 1 defines the five sufficient statistics used in Equation (2). The three redistribution elasticities are covariances between MPCs and the unhedged interest rate exposure, the net nominal position and income.

Table 1: Channels of monetary policy transmission

Moment	**Definition**	**Name**	**Channel**
E_R	$\mathrm{cov}_I\left(MPC_i,\ \dfrac{URE_i}{\mathbb{E}_I[c_i]}\right)$	Redistribution elasticity for R	Interest rate exposure
S	$\mathbb{E}_I\left[(1-MPC_i)\,\dfrac{c_i}{\mathbb{E}_I[c_i]}\right]$	Hicksian scaling factor	Substitution
E_P	$\mathrm{cov}_I\left(MPC_i,\ \dfrac{NNP_i}{\mathbb{E}_I[c_i]}\right)$	Redistribution elasticity for P	Fisher
E_Y	$\mathrm{cov}_I\left(MPC_i,\ \dfrac{Y_i}{\mathbb{E}_I[c_i]}\right)$	Redistribution elasticity for Y	Earnings heterogeneity
M	$\mathbb{E}_I\left[MPC_i\,\dfrac{Y_i}{\mathbb{E}_I[c_i]}\right]$	Income-weighted MPC	Aggregate income

$\mathbb{E}_I$ and cov_I denote the survey-weighted cross-sectional mean and covariance over households. All exposures are normalized by mean household consumption $\mathbb{E}_I[c_i]$, so that each moment reads as an aggregate consumption elasticity. E_P, E_R and E_Y are the three redistribution elasticities. The moments M and S are present even without heterogeneity. Source: adapted from Table 1 of Auclert (2019).

3.2. General form of the closed-economy decomposition

Equation (2) is the special case, under $\sigma_i = \sigma$ and $\eta_i = \eta$, of the general first-order decomposition in Theorem 3 of Auclert (2019), which is the starting point of our open-economy extension. The first-order response of aggregate consumption in a closed economy to a shock to the vector (dY_i, dY, dP, dR) is given by

$$\begin{aligned} dC \;=\; & \underbrace{\mathbb{E}_I\left[\tfrac{Y_i}{Y}\widehat{MPC}_i\right] dY}_{\text{aggregate income}} + \underbrace{\mathrm{cov}_I\left(\widehat{MPC}_i,\ dY_i - Y_i\tfrac{dY}{Y}\right)}_{\text{earnings heterogeneity}} \\ & - \underbrace{\mathrm{cov}_I(\widehat{MPC}_i, NNP_i)\,\tfrac{dP}{P}}_{\text{Fisher}} + \underbrace{\mathrm{cov}_I(\widehat{MPC}_i, URE_i)\,\tfrac{dR}{R}}_{\text{interest rate exposure}} - \underbrace{\mathbb{E}_I[\sigma_i(1-\widehat{MPC}_i)c_i]\,\tfrac{dR}{R}}_{\text{substitution}}, \end{aligned} \tag{3}$$

where $\widehat{MPC}_i$ denotes household i's MPC out of a change in total income, NNP_i its net nominal position, URE_i its unhedged interest rate exposure, c_i consumption, and σ_i the elasticity of intertemporal substitution.

The hat on the MPC is Auclert's Corollary 1: because a household that receives a windfall income may choose to adjust its working hours, the change in its *total* income differs from the transfer, and the consumption response per unit of total income is $\widehat{MPC}_i = MPC_i/(MPC_i + MPS_i) = MPC_i/(1+w\,MPN_i)$, where MPS_i and $MPN_i \leq 0$ are the marginal propensities to save and to work. This adjustment vanishes when labor supply is inelastic: then $MPN_i = 0$ and $\widehat{MPC}_i = MPC_i$. Since the HFCS lottery question asks about spending out of a windfall without inviting any adjustment of hours, we set $\widehat{MPC}_i = MPC_i$ throughout.

A closed economy with consolidated firms entails the following two market-clearing identities:

$$\mathbb{E}_I[NNP_i] = -NNP_g, \qquad \mathbb{E}_I[URE_i] = -URE_g, \tag{4}$$

where g denotes the government. Combined with a lump-sum fiscal rule, the aggregate balance-sheet exposures of households are absorbed by the government and net to zero in the household decomposition. Only the cross-sectional *covariances* between MPCs and exposures remain. This is the central insight of Auclert (2019): average exposures are irrelevant, only their distribution across the MPC distribution matters.

3.3. Open-economy setting

We extend the sufficient-statistics decomposition of Auclert (2019) to a small open economy in which households hold heterogeneous foreign positions. The treatment is more general than the Austrian implementation in Section 5.2. We derive the decomposition for arbitrary domestic and foreign positions and only adapt it to a member of the euro area in the final step (Section 3.8). In an open-economy setting, the closed-economy market-clearing restrictions that underlie Auclert's covariance representation do not hold. The aggregate consumption response gains new channels, each of which depends on the *level* of the household sector's aggregate foreign exposure in addition to its cross-sectional distribution (see the discussion in Auclert, 2019, Section II.D).

Households and the foreign asset menu

Consider a small open economy populated by heterogeneous households as in Auclert (2019), but augment the asset menu with claims on the rest of the world. Each household i holds a portfolio that splits into a domestic-currency part and a foreign part:

- **Domestic nominal positions** NNP_i^d (domestic-currency deposits, mortgages, government and corporate bonds).
- **Domestic real positions** (equity in domestic firms, inflation-indexed bonds). Equity is a real position because it is a claim on dividends whose nominal value moves with the price level, so a one-time jump in P leaves its real value unchanged. Only claims fixed in units of currency belong in NNP_i. Treating equity as a purely real position is a simplification consistent with Auclert (2019).

- **Foreign nominal positions** NNP_i^f, denominated in a basket of foreign currencies. We keep a single index f for notational simplicity. The extension to a multi-currency setting is mechanical and is precisely the disaggregation called for in Section 6.
- **Foreign real positions**, principally foreign equity θ_i^f, with foreign-currency dividend stream d_t^f and price S_t^f.
- **Foreign-currency liabilities**, which enter NNP_i^f with a negative sign (mostly CHF-denominated mortgages, historically important in Austria).

Let $\mathcal{E}_t$ denote the nominal exchange rate expressed as units of domestic currency per unit of foreign currency, so an increase in $\mathcal{E}_t$ is a domestic-currency depreciation. Let P_t^* be the foreign price level, R_t^* the foreign real interest rate, and Q_t^* the foreign nominal discount factor, with a foreign Fisher relation holding analogously to the domestic side.

Open-economy budget and balance-sheet exposures
Adapting Auclert (2019)'s flow budget constraint, the household's initial ($t = 0$) resource flow in domestic currency now includes converted foreign flows:

$$\begin{aligned} P_0 c_{i0} \;=\; & P_0 y_{i0} + W_0 n_{i0} - T_{i0} \\ & + \Big[({}_{-1}B^d_{i0}) + \sum_{s\geq 1} Q_s \, ({}_{-1}B^d_{is} - {}_{0}B^d_{is}) \Big] \\ & + P_0 \Big[({}_{-1}b^d_{i0}) + \sum_{s\geq 1} q_s \, ({}_{-1}b^d_{is} - {}_{0}b^d_{is}) \Big] \\ & + (d_0 + S_0)\, \theta^d_{i,-1} - S_0\, \theta^d_{i0} \\ & + \mathcal{E}_0 \Big[({}_{-1}B^f_{i0}) + \sum_{s\geq 1} Q^*_s \, ({}_{-1}B^f_{is} - {}_{0}B^f_{is}) \Big] \\ & + \mathcal{E}_0 P^*_0 \Big[({}_{-1}b^f_{i0}) + \sum_{s\geq 1} q^*_s \, ({}_{-1}b^f_{is} - {}_{0}b^f_{is}) \Big] \\ & + \mathcal{E}_0 \Big[(d^f_0 + S^f_0)\, \theta^f_{i,-1} - S^f_0\, \theta^f_{i0} \Big]. \end{aligned} \tag{5}$$

Here ${}_tB_{is}$ and ${}_tb_{is}$ are the nominal and inflation-indexed amounts maturing at date s from the bond positions that household i holds at the end of period t, and Q_s and q_s are the corresponding nominal and real discount factors.[1] Equity holdings are θ_i, with dividend d and ex-dividend price S, y_{i0} is non-financial unearned income, $W_0 n_{i0}$ labor income and T_{i0} net taxes. Foreign-currency counterparts carry the superscript f, foreign prices and discount factors carry a star, and the last three lines convert the foreign block into domestic currency at the spot rate $\mathcal{E}_0$. Every deposit, bond or mortgage is treated as a set of payments maturing

[1]The first four lines combine the domestic budget constraints of Auclert (2019), with nominal and real bonds as in his problem (1) and equity as in his budget constraint (9). The pre-shock present-value normalizations $q_0 = Q_0 = q_0^* = Q_0^* = 1$ are imposed. The interest rate changes last one period, while the changes in the price levels and in the real exchange rate are permanent. The expected future path of the exchange rate shifts only by this permanent change and does not otherwise respond to the foreign interest rate. Maturing foreign-currency positions are rolled over in foreign currency.

at future dates, so that ${}_{-1}B_{is}$ is the amount due at date s from positions chosen before the shock. Only the amounts due today ($s = 0$) must be reinvested at the new rate, which is why they make up the unhedged interest rate exposure. Define open-economy analogues of Auclert's exposure measures. We express all exposures in units of domestic consumption. Foreign positions are first valued in units of foreign consumption and then converted at the real exchange rate $e_0 \equiv \mathcal{E}_0 P_0^*/P_0$. The *foreign net nominal position* is

$$NNP_i^f \equiv e_0 \sum_{s\geq 0} Q_s^* \frac{{}_{-1}B_{is}^f}{P_0^*}, \tag{6}$$

and the *foreign unhedged interest rate exposure* is the value, in units of domestic consumption, of maturing foreign-currency claims net of foreign-currency liabilities at $t = 0$, excluding consumption (since the household consumes the domestic good):

$$URE_i^f \equiv e_0 \left[\frac{d_0^f \theta_{i,0}^f}{P_0^*} + ({}_{-1}b_{i0}^f) + \frac{{}_{-1}B_{i0}^f}{P_0^*} \right]. \tag{7}$$

The household's net foreign asset position is $NFA_i \equiv NNP_i^f + e_0 S_0^f \theta_i^f / P_0^*$ plus any other foreign real claims. It is the total value of foreign holdings exposed to the exchange rate, in units of domestic consumption.

The shock vector and asset-price responses

The closed-economy experiment now generalizes to a vector

$$\left(dY_i,\ dY,\ \tfrac{dP}{P},\ \tfrac{dR}{R},\ \tfrac{dP^*}{P^*},\ \tfrac{dR^*}{R^*},\ \tfrac{d\mathcal{E}}{\mathcal{E}} \right). \tag{8}$$

Two cases should be distinguished. After a monetary shock in a small open economy with its own monetary authority, the domestic block and the exchange rate move, while world prices and world interest rates remain fixed. After an ECB shock, Austria is small but the currency area is not, so that foreign prices and interest rates may respond as well. The assumption of a small economy plays a role in only one place. The foreign block $(dP^*/P^*, dR^*/R^*, d\mathcal{E}/\mathcal{E})$ is taken as exogenous rather than determined jointly with the domestic block, because domestic households are too small to move world prices, world interest rates or, in our application, the euro exchange rate. Proposition 1 itself is a comparative statics result that holds for any shock vector and for any open economy whose domestic block satisfies the closure conditions. The calibration of the foreign block would change for a large economy. For a euro area member, the policy rate is set by the ECB for the currency area as a whole. Our calibration therefore applies euro area responses of the interest rate, the price level and income $(dR/R, dP/P, dY/Y)$ to Austria. This is an approximation, because national prices and output can respond differently from the euro area averages. What the decomposition allows to differ across member states is the *incidence* (heterogeneous dY_i and heterogeneous foreign exposures). The foreign block $(dP^*/P^*, dR^*/R^*)$ moves only to the extent that ECB shocks spill over abroad, and the exchange rate $d\mathcal{E}/\mathcal{E}$ is typically the most responsive. Asset prices adjust to reflect discounting alone, mirroring Auclert (2019)'s assumption. Foreign equity is a claim on foreign real dividends, so that, for a one-period change in the foreign real rate, its real price $s^f \equiv S^f/P^*$ moves by $ds^f/s^f = -dR^*/R^*$, and its nominal price by

$dS^f/S^f = dP^*/P^* - dR^*/R^*$. In units of domestic consumption, the value of foreign equity therefore changes by

$$\frac{d(e\,s^f)}{e\,s^f} \;=\; \frac{de}{e} - \frac{dR^*}{R^*}, \tag{9}$$

which delivers a separate exchange rate revaluation that closed-economy households do not experience. Only the real depreciation de/e in (9) survives into the wealth change below. Under the timing assumptions of the budget constraint, the discount-rate part of the capital gain, $-dR^*/R^*$, does not change the payments that a household holding its foreign positions to maturity converts into domestic consumption, as in the closed economy. The only remaining foreign-rate exposure is therefore the unhedged one in URE_i^f, which arises because maturing foreign-currency claims and liabilities are rolled over at the new foreign rate.

3.4. The open-economy net-wealth revaluation

Repeating the proof of Theorem 1 in Auclert (2019) on the augmented budget constraint (5), the household's net-of-consumption wealth change becomes

$$\begin{aligned} d\Omega_i \;=\; & \underbrace{dY_i}_{\text{income}} - \underbrace{NNP_i^d \tfrac{dP}{P}}_{\text{domestic Fisher}} + \underbrace{URE_i^d \tfrac{dR}{R}}_{\text{domestic URE}} \\ & - \underbrace{NNP_i^f \tfrac{dP^*}{P^*}}_{\text{foreign Fisher}} + \underbrace{URE_i^f \tfrac{dR^*}{R^*}}_{\text{foreign URE}} + \underbrace{NFA_i \tfrac{de}{e}}_{\text{exchange rate revaluation}}, \end{aligned} \tag{10}$$

where URE_i^d is Auclert's original URE measure restricted to domestic-currency flows. The foreign-Fisher and foreign-URE terms have the same structure as their domestic counterparts. Foreign inflation erodes the real value of foreign-currency nominal claims, and a decrease in the foreign real rate redistributes from foreign net savers (positive URE^f) to foreign net borrowers. The exchange rate term is qualitatively distinct. All exposures are measured in units of domestic consumption, so every foreign position revalues with the real exchange rate $e = \mathcal{E}P^*/P$, whose change is $de/e = d\mathcal{E}/\mathcal{E} + dP^*/P^* - dP/P$. A real depreciation of 1 percent raises the value of any foreign position, nominal or real, by 1 percent, scaled by NFA_i. The three foreign exposures are overlapping slices of one and the same portfolio: NNP_i^f is its nominal part, URE_i^f its fast-repricing part, and NFA_i the whole stock exposed to the exchange rate. They nevertheless do not double-count, because each multiplies a different shock: NNP_i^f is the exposure to foreign inflation, URE_i^f the exposure to the foreign real rate, and NFA_i the exposure to the real exchange rate. The same overlap is already present on the domestic side between NNP_i^d and URE_i^d.

Remark (valuation of foreign positions). All terms in (10) are changes in units of domestic consumption, and the foreign terms can be checked on four simple positions, each maturing or revalued at $t = 0$ with no interest rate or income shock. A foreign nominal claim B^f is worth $\mathcal{E}B^f/P$, so that its value changes by $d\mathcal{E}/\mathcal{E} - dP/P = de/e - dP^*/P^*$. This is the exchange rate revaluation term plus the foreign Fisher term, since the claim enters both NFA_i and NNP_i^f. A foreign price-indexed claim b^f is worth $\mathcal{E}P^*b^f/P = e\,b^f$ and changes by de/e, which is the revaluation term alone. A foreign-currency liability enters as a negative nominal position, so that the same valuation factor, $de/e - dP^*/P^*$, produces an oppositely signed wealth change. Foreign equity is a claim on foreign real dividends, so that its value

changes by de/e, as in Equation (9) without a change in the foreign rate. Applying the nominal rate $d\mathcal{E}/\mathcal{E}$ instead of the real rate de/e would omit the term $dP^*/P^* - dP/P$. In our calibration this term equals -0.3 percentage points, so that the nominal depreciation of 0.5 percent corresponds to a real depreciation of only 0.2 percent.

3.5. Open-economy aggregation

The key difference from the closed economy is that the cross-sectional means of foreign exposures do *not* net out against a government counterparty:

$$\mathbb{E}_I[NNP_i^f] = NNP_{\mathrm{c}}^f, \quad \mathbb{E}_I[URE_i^f] = URE_{\mathrm{c}}^f, \quad \mathbb{E}_I[NFA_i] = NFA_{\mathrm{c}}, \tag{11}$$

where the subscript 'c' denotes the aggregate exposure of the household sector, expressed per household so that it is consistent with the cross-sectional means on the left-hand side. This exposure need not equal the residency-based NIIP, because currency denomination and counterparty residency define different sets of positions. For a net creditor NFA_{c} is positive by definition, whereas NNP_{c}^f and URE_{c}^f can take either sign. In Austria, NNP_{c}^f is small relative to NFA_{c}, and URE_{c}^f is negative because fast-repricing foreign-currency liabilities (the legacy CHF variable rate mortgages) exceed maturing foreign-currency claims.

The identities (4) continue to hold for the domestic block if domestic-currency positions are held by domestic households and net out against the domestic government and (consolidated) domestic firms, and if government gains and losses are rebated equally per household. Domestic positions held by non-residents would add domestic level or fiscal-incidence terms that the decomposition omits. Summing the consumption responses of the individual households, given by Theorem 2 of Auclert (2019), across households yields the following extension of his Theorem 3, in which the mean foreign exposures remain as level terms.

Proposition 1 (Open-economy redistribution channel)**.** *To first order, in response to the shock vector* $(dY_i, dY, dP, dR, dP^*, dR^*, d\mathcal{E})$ *under lump-sum rebates of domestic government surpluses that are equal across households, aggregate consumption changes by*

$$\begin{aligned}
dC \;=\; & \underbrace{\mathbb{E}_I\Big[\tfrac{Y_i}{Y}\widehat{MPC}_i\Big]\, dY + \mathrm{cov}_I\Big(\widehat{MPC}_i,\, dY_i - Y_i\tfrac{dY}{Y}\Big)}_{\textit{closed-economy core}} \\
& - \mathrm{cov}_I(\widehat{MPC}_i, NNP_i^d)\,\tfrac{dP}{P} + \Big[\mathrm{cov}_I(\widehat{MPC}_i, URE_i^d) - \mathbb{E}_I[\sigma_i(1-\widehat{MPC}_i)c_i]\Big]\tfrac{dR}{R} \\
& \underbrace{- \mathbb{E}_I[\widehat{MPC}_i]\, NNP_c^f \tfrac{dP^*}{P^*} - \mathrm{cov}_I(\widehat{MPC}_i, NNP_i^f)\,\tfrac{dP^*}{P^*}}_{\textit{foreign Fisher channel}} \\
& \underbrace{+ \mathbb{E}_I[\widehat{MPC}_i]\, URE_c^f \tfrac{dR^*}{R^*} + \mathrm{cov}_I(\widehat{MPC}_i, URE_i^f)\,\tfrac{dR^*}{R^*}}_{\textit{foreign URE channel}} \\
& \underbrace{+ \mathbb{E}_I[\widehat{MPC}_i]\, NFA_c \tfrac{de}{e} + \mathrm{cov}_I(\widehat{MPC}_i, NFA_i)\,\tfrac{de}{e}}_{\textit{exchange rate revaluation channel}} \\
& \underbrace{+ \mathbb{E}_I[\widehat{MPC}_i]\, \mathbb{E}_I[\pi_i^{f,X} Y_i]\,\tfrac{de}{e} + \mathrm{cov}_I\Big(\widehat{MPC}_i,\, \pi_i^{f,X} Y_i\Big)\,\tfrac{de}{e}}_{\textit{foreign earnings channel}},
\end{aligned} \tag{12}$$

where $\pi_i^{f,X}$ denotes the share of traded-sector *labor and profit income in household i's income Y_i, so that $\pi_i^{f,X} Y_i$ is its traded-sector income, which is assumed to increase one-for-one with a real depreciation, and $\mathbb{E}_I[\pi_i^{f,X} Y_i]/\mathbb{E}_I[Y_i]$ is the aggregate tradables income share. In Equation* (12)*, dY_i and $dY = \mathbb{E}_I[dY_i]$ denote income changes* excluding *the response of traded-sector earnings to the real exchange rate, which the last line adds explicitly. The total income change of household i is therefore $dY_i^{tot} = dY_i + \pi_i^{f,X} Y_i \, de/e$, and the foreign earnings channel decomposes it rather than adding a further source of income. Note that Equation* (12) *is a comparative static with respect to an arbitrary shock vector: it does not require the elements of that vector to be mutually orthogonal. Our empirical implementation uses the total-income formulation instead. The calibrated dY is a total equilibrium income response of the euro area from Pekanov (2024a), in which the accompanying depreciation already contributes, so that the level term of the foreign earnings channel is set to zero. The covariance term measures how much of the earnings-heterogeneity channel is due to traded-sector exposure.*

Sketch. The proof follows the steps of Theorem 3 in Auclert (2019). The only modification is that the foreign block of exposures does not net out by an analogue of (4). For any foreign exposure X_i^f, the aggregate of the MPC-weighted revaluation satisfies

$$\mathbb{E}_I[\widehat{MPC}_i \, X_i^f] \;=\; \mathbb{E}_I[\widehat{MPC}_i] \, X_{\mathrm{c}}^f + \mathrm{cov}_I(\widehat{MPC}_i, X_i^f), \tag{13}$$

using $\mathbb{E}_I[X_i^f] = X_{\mathrm{c}}^f$ from (11). This delivers a level term (the household sector's aggregate exposure times the average MPC) *plus* a covariance term for each foreign exposure. For the earnings channel, write the total income change of household i as $dY_i^{\mathrm{tot}} = dY_i + \pi_i^{f,X} Y_i \, de/e$, where dY_i excludes the traded-sector component induced by the exchange rate. Applying the mean–covariance identity to the traded-sector component gives the last line of (12). □

3.6. No foreign substitution channel

Households consume the domestic basket and discount at the domestic real rate, so intertemporal substitution responds to dR alone and the Hicksian scaling factor S is unchanged by opening the economy. Foreign financial exposures enter through balance-sheet effects rather than through a separate substitution channel. A foreign substitution term would arise if households could shift consumption across currencies, or if the relevant discount rate were a portfolio-weighted average of domestic and foreign rates, and neither is implied by the environment above. This is why the open economy adds four channels rather than five.

3.7. Estimable moments and the open-economy elasticity

Under the same assumptions as Auclert's Corollary 2 ($\sigma_i = \sigma$ and constant relative-income elasticity η), the open-economy aggregate consumption elasticity becomes

$$\begin{aligned} \frac{dC}{C} \;&= (M + \eta \, E_Y) \, \tfrac{dY}{Y} - E_P \, \tfrac{dP}{P} + (E_R - \sigma S) \, \tfrac{dR}{R} \\ &\quad - (F^{f,NNP} + E^{f,NNP}) \, \tfrac{dP^*}{P^*} + (F^{f,URE} + E^{f,URE}) \, \tfrac{dR^*}{R^*} + (F^{f,NFA} + E^{f,NFA}) \, \tfrac{de}{e} \\ &\quad + (F^{f,X} + E^{f,X}) \, \tfrac{de}{e}, \end{aligned} \tag{14}$$

where M, E_Y, E_P, E_R and S are the closed-economy moments of Table 1, while $\mathcal{E}$ denotes the exchange rate. Suppressing the $1/\mathbb{E}_I[c_i]$ normalization, each new pair consists of a level moment $F^{f,\cdot} \equiv \mathbb{E}_I[\widehat{MPC}_i]\, X_c^f$ and a redistribution-elasticity moment $E^{f,\cdot} \equiv \mathrm{cov}_I(\widehat{MPC}_i, X_i^f)$. Table 9 in Section 5.2 reports these contributions for Austria, i.e. the moments $F^{f,\cdot}$ and $E^{f,\cdot}$ for NFA, URE^f and NNP^f multiplied by the corresponding shocks. For the foreign earnings channel, the level term $F^{f,X}$ is excluded to avoid double counting.

3.8. Adaptation to Austria and testable priors

Adapting the decomposition to Austria as a euro area member, the relevant exchange rate is the euro's external value. Three priors follow from the decomposition together with what is known about Austrian balance sheets.

1. **Aggregate NFA is positive.** The level component $F^{f,NFA}$ is therefore positive, contributing an expansionary effect of ECB easing through a real depreciation of the euro that is absent in the closed-economy decomposition.

2. **Foreign equity is concentrated at the top of the wealth distribution.** If MPCs decline with wealth, as they do with cash-on-hand in the euro area (Albacete et al., 2025), the covariance component $E^{f,NFA}$ is negative and partially offsets the positive level effect $F^{f,NFA}$. Whether this holds is an empirical question for each country. The same reasoning does not determine the role of $E^{f,URE}$ and $E^{f,NNP}$, because the foreign nominal and fast-repricing positions are dominated by foreign-currency mortgages held by working-age borrowers. Their signs depend on whether these borrowers have higher or lower MPCs than the holders of foreign deposits and bonds.

3. **Net effect.** Whether the exchange rate revaluation channel amplifies ECB transmission in Austria, relative to the closed-economy benchmark, hinges on the relative magnitudes of its level component and its redistribution component. For typical orders of magnitude ($\mathbb{E}[\widehat{MPC}] \approx 0.46$, $NFA/C > 0$, and a moderately negative MPC–NFA covariance), the level effect dominates, yielding net amplification through the exchange rate revaluation channel even after redistribution is accounted for.

A symmetric statement applies to the foreign earnings channel, whose level component is positive because a depreciation raises traded-sector earnings. If high-MPC households are concentrated in non-tradables employment, $\mathrm{cov}_I(\widehat{MPC}_i, \pi_i^{f,X} Y_i) < 0$, and the redistribution component attenuates the level component.

4. Data and Empirical Approach

We build on the survey-based approach using the HFCS question that elicits the marginal propensity to consume of households in euro area countries. The question has been part of the survey since the third wave. In Austria it was also asked in the fifth wave of 2023 (Albacete and Lindner, 2025), whereas the present analysis uses the fourth wave.

The HFCS is a detailed microdata survey, intended to be conducted every three years, in which households in the euro area countries and in some other EU countries respond to an extensive questionnaire regarding their household characteristics, income, consumption,

assets and liabilities. The recent waves of the HFCS also include a direct question on consumption behavior after an unexpected, transitory income shock:

> "Imagine you unexpectedly receive money from a lottery, equal to the amount of income your household receives in a month. What percent would you spend over the next 12 months on goods and services, as opposed to any amount you would save for later or use to repay loans?"

The question elicits a household-specific reported spending response to a hypothetical windfall equal to one month's income, which allows MPCs to be linked directly to balance-sheet characteristics. Since the question asks about spending rather than consumption, respondents are likely to include durable as well as non-durable goods.

Figure 1 shows the resulting distribution of MPCs for Austria. While the sample mean MPC for the euro area is 42 percent in the fourth wave and the sample of household heads aged 25–64 used by Pekanov (2024a), the corresponding value for Austria is slightly higher at 46 percent, indicating that Austrian households spend, on average, just under half of an additional euro of income. The euro area mean of 46 percent reported by Albacete et al. (2025) refers to the third wave and to households of all ages, and is therefore not directly comparable. There is noticeable heaping around round numbers, as well as bunching around the points 0, 50 and 100 percent. A pitfall of this estimation method is the fact that it only allows us to note households' intentions instead of their actions. However, the results from the HFCS allow us to conduct comparisons across the entire euro area. In addition, Colarieti et al. (2024) show for a large survey of US households that answers to hypothetical income-shock scenarios closely match the responses estimated in earlier studies from observational and quasi-experimental data. They conclude that surveys are useful for anticipating household responses in macroeconomic and policy settings. They attribute this accuracy to scenarios that resemble everyday financial decisions rather than rare events such as a lottery jackpot. The windfall, although framed as a lottery win, equals one month of household income and is therefore modest.

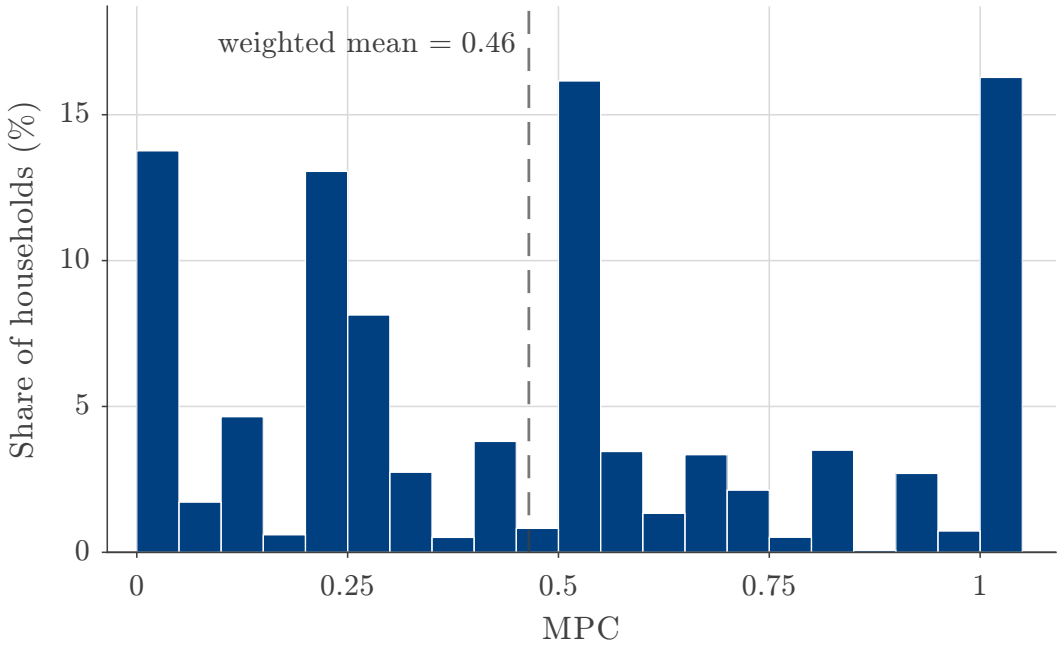
Using this data, we characterize the sign and magnitude of the redistribution channels in Austria and the euro area. Because the HFCS records only part of household consumption, we impute total consumption by scaling the HFCS expenditure items with the consumption shares of the Eurostat Household Budget Survey, matched by percentile of household income. To obtain the necessary covariance measures we need data on the MPC of households, together with their consumption, income, assets and liabilities. The sample comprises households whose heads are aged 25–64 from the fourth wave of the HFCS. All measurements are calculated using survey weights.

4.1. Data for the open-economy extension

We assemble the data for the open-economy extension from several sources.

Household-level foreign exposures. The household-level foreign exposures NNP_i^f, URE_i^f and NFA_i that enter the covariance components are more difficult to construct. The Austrian HFCS records direct holdings of deposits, bonds, mutual funds, listed shares, voluntary pension plans and business wealth, as well as foreign-currency loans. However, it does not record

Figure 1: Distribution of the marginal propensity to consume, Austria



The figure shows the survey-weighted shares of households by the MPC reported in the HFCS lottery question, in bins of five percentage points. The dashed line marks the weighted mean of 0.46. Source: HFCS Wave 4, own calculations.

the currency or issuer-residency composition of these holdings. Moreover, a large share of household foreign-equity exposure is held *indirectly* through Austrian-domiciled funds. In the absence of a security-level portfolio decomposition, we impute foreign household exposures by allocating aggregate foreign household positions from OeNB financial accounts and bank statistics to households that report holding the corresponding instrument in the HFCS. Foreign listed shares are allocated to the households that report holding shares issued by foreign companies and foreign credit liabilities to all indebted households in proportion to their total debt. The asset allocation proceeds in two steps: across income quintiles in proportion to the income shares of the eligible households, and within quintiles in proportion to the corresponding domestic balance-sheet item. We use disposable household income as a basis for the allocation. Since the harmonized dataset does not record the currency of individual loans, we assume that foreign-currency loans were issued at variable rates and allocate them to households with variable rate mortgages in proportion to their total outstanding household debt. The Austrian questionnaire collects information on foreign-currency loans as a country-specific addition that is not part of the harmonized euro area dataset (Albacete and Lindner, 2025). By construction this calibrated imputation preserves the aggregate level of foreign exposure, which is what the level components of the new channels require, but the distribution of foreign holdings across households is only approximated, a limitation we return to in Section 6. The foreign assets and foreign credit liabilities are residency-based

positions. We treat them as exposed to the euro's external value, which assumes that foreign holdings revalue one-for-one with the real exchange rate of the euro, irrespective of their currency of denomination. The allocation is carried out over the full Wave 4 household population, so that the estimation sample (household heads aged 25–64 with a valid MPC response) holds its population-consistent share of the sector aggregates (about 55 percent of the constructed household-sector foreign-exposure aggregate) rather than absorbing the entire aggregates. Figure 2 shows the eight OeNB aggregates that serve as calibration targets: foreign investment-fund and listed-equity holdings dominate the asset side. The liability side consists of the legacy CHF mortgage stock and foreign credit liabilities.

Reconciliation of domestic and foreign exposures. Part of the imputed foreign holdings is already contained in the survey. To avoid double counting, we subtract the imputed foreign part from the reported item and treat the remainder as domestic (Table 2). Of the imputed foreign assets of EUR 46.9 bn, EUR 30.3 bn is covered by reported holdings, so that the foreign block adds EUR 16.6 bn to the survey balance sheets, mostly in listed shares. This is consistent with survey under-coverage of financial assets, but it also reflects that the foreign listed shares are assigned only to the households that report foreign shares, and how survey and financial-accounts categories are matched.

The constructed foreign positions combine two classifications. Foreign assets and foreign credit liabilities are positions against non-residents in the residency-based financial accounts, whereas the CHF mortgages are foreign-currency loans from Austrian banks. The aggregate of about EUR 62 bn is therefore not the household sector's residency-based net foreign asset position. Treating the CHF mortgages as foreign positions assumes that the lending banks have passed the currency risk abroad through foreign funding or hedging, so that no offsetting valuation effects arise for resident counterparties.

Shock calibration. The closed-economy block retains the calibration of Pekanov (2024a), which is motivated by Coenen et al. (2012). The open-economy block adds our own calibration of the response of the euro's external value and of foreign rates to ECB easing. Identified responses, for instance from the high-frequency identification of Jarociński and Karadi (2020), would be needed to replace it (Section 6). The direction of the exchange rate response is well established. Contractionary ECB policy shocks lead to a sizable appreciation of the euro against both its nominal effective and its bilateral exchange rates, with the peak on impact (Franz, 2020). For the size of the response we choose a deliberately small nominal depreciation of 0.5 percent, so that a larger exchange rate response would strengthen rather than weaken the open-economy effects. Since the exchange rate revaluation channel is linear in the real depreciation, the results can be rescaled: each percentage point of real depreciation adds about 0.32 pp to the consumption response, the MPC-weighted net foreign assets of the estimation sample relative to mean consumption. The foreign block also depends on the assumed decreases in the foreign real rate and in foreign prices, so the foreign calibration as a whole is not necessarily conservative. For a 100 basis-point ECB rate cut we assume:

Domestic:	$dR/R = -1.0\%$,	$dY/Y = +0.4\%$,	$dP/P = +0.2\%$
Foreign:	$d\mathcal{E}/\mathcal{E} = +0.5\%$ (euro depreciation),	$dR^*/R^* = -0.5\%$,	$dP^*/P^* = -0.1\%$

The elasticity of intertemporal substitution is fixed at $\sigma = 0.5$. Together with the domestic

Table 2: Reported and imputed foreign holdings of the estimation sample (EUR bn)

Item	**Reported (HFCS)**	**Imputed foreign**	**Covered by reported**	**Added beyond survey**
Deposits	80.8	5.1	5.1	0.0
Bonds	1.6	3.2	1.6	1.6
Mutual funds	18.8	20.7	18.2	2.4
Listed shares	5.1	13.8	2.2	11.7
Unlisted equity	1.8	2.4	1.6	0.8
Life insurance, pensions	9.9	1.6	1.6	0.0
Foreign assets	118.0	46.9	30.3	16.6
Foreign liabilities	61.9	12.6	12.6	0.0

For each item j, the domestic holding of household i is $A^d_{ij} = \max\{A^{\text{HFCS}}_{ij} - \widehat{A}^f_{ij}, 0\}$, and the full imputed foreign holding $\widehat{A}^f_{ij}$ enters the foreign exposures. The reported liability amount is total household debt. Foreign liabilities are the imputed CHF mortgages and foreign credit liabilities. The CHF mortgages are subtracted from the variable rate mortgage balances and from total liabilities, and the foreign credit liabilities from total liabilities. Source: HFCS Wave 4, OeNB, own calculations.

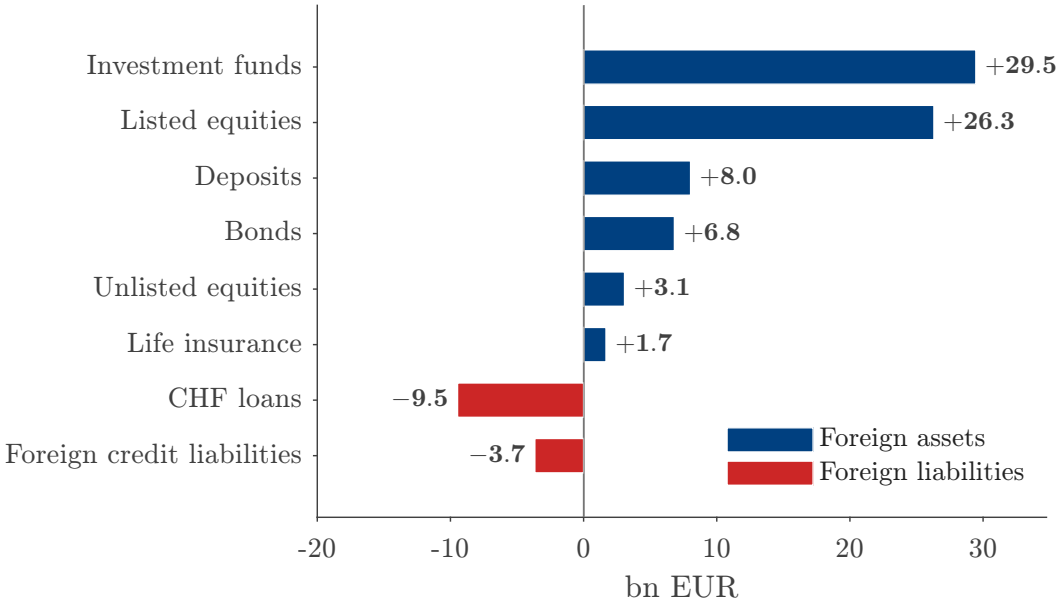
and foreign price changes, the nominal depreciation implies a real depreciation of $de/e = 0.5 - 0.1 - 0.2 = +0.2\%$, which drives the exchange rate revaluation channel. The foreign earnings channel is set to zero in the headline decomposition, because its level term is already embedded in the equilibrium dY. Table 3 collects every object that enters the decomposition.

Table 3: Decomposition inputs: construction and sources, Austria

Object	**Construction**	**Source**
Closed-economy block		
MPC_i	lottery answer /100, taken as measured	HFCS Wave 4 (2021)
c_i	HFCS expenditure items scaled to total consumption	HFCS + Eurostat HBS shares
Y_i	gross income, post-tax income in URE_i	HFCS, OECD tax rates as in Pekanov (2024a)
NNP_i	nominal claims (deposits, bonds, money owed to the household) − total liabilities, net of imputed foreign holdings	HFCS balance sheets
URE_i	$Y_i - c_i +$ maturing assets − repricing liabilities, with Y_i post-tax income (OECD tax rates), net of imputed foreign holdings	HFCS, duration-scaled
γ_i	quantile regressions of income on GDP, by decile	EU-SILC 2008–2024
σ	calibrated at 0.5	Pekanov (2024a)
Open-economy block		
$NNP_i^f,\ URE_i^f,\ NFA_i$	imputed: sector aggregates allocated to holders	OeNB, 2021 Q4
NFA_c	level-term anchor	OeNB
Shock vector		
$dR/R,\ dY/Y,\ dP/P$	−1%, +0.4%, +0.2%	Pekanov (2024a), motivated by Coenen et al. (2012)
$d\mathcal{E}/\mathcal{E},\ dR^*/R^*,\ dP^*/P^*$	+0.5%, −0.5%, −0.1%	own calibration

The estimation sample comprises 1,265 households whose heads are aged 25–64 and who gave a valid MPC response, representing 2.58 of 4.07 million Austrian households. All moments are survey-weighted. Exposures are normalized by mean annual consumption, so that each channel reads as an elasticity of consumption. The γ_i profile is rescaled to satisfy $\mathbb{E}_I[\gamma_i Y_i] = \mathbb{E}_I[Y_i]$, so that it distributes the aggregate income change without altering it. Source: own compilation.

Figure 2: Foreign exposures of Austrian households, 2021 Q4



The figure shows the OeNB aggregates of the household sector in bn EUR that serve as calibration targets of the household-level imputation. The foreign assets and the foreign credit liabilities are residency-based financial-accounts positions. The CHF loans are foreign-currency loans from Austrian banks. NNP^f comprises deposits and bonds net of liabilities, and *NFA* additionally includes equities, funds and life insurance. Source: OeNB, own calculations.

5. Results

5.1. Closed Economy

The Austrian exposures in this section exclude the imputed foreign holdings (Section 4.1), so that the closed-economy results describe the domestic block of the open-economy decomposition. Table 4 provides summary statistics for income, consumption and balance-sheet exposures in the sample.

Figure 3 displays the relationship between average MPCs and household exposures to URE, net nominal positions and gross income across percentile bins of each exposure in Austria. The linear fits slope downward in all three panels. From the bottom to the top of each distribution, the fitted MPC falls by 0.10 for URE, by 0.09 for gross income and by 0.05 for the net nominal position, or 21, 19 and 11 percent of the mean MPC of 0.46. The decline is statistically significant for URE and income, with 95 percent bootstrap confidence intervals of $[-0.18, -0.02]$ and $[-0.16, -0.01]$, but not for the net nominal position ($[-0.12, +0.03]$). The relationship is, moreover, not monotonic. By quintile of each exposure, the mean MPC is lowest in the fourth quintile (0.38 for URE, 0.40 for the net nominal position and 0.39 for income) and rises again in the top quintile (0.48, 0.48 and 0.44). Along the income distribution it is flat across the bottom three quintiles, at about 0.50. Households with the

Table 4: Summary statistics for Austria

Variable	Mean	SD	p5	p25	p50	p75	p95
Net income (OECD tax rates)	1.93	1.03	0.60	1.18	1.80	2.47	3.70
Gross income	2.62	1.68	0.61	1.39	2.32	3.51	5.68
Consumption c_i	1.00	0.52	0.40	0.65	0.90	1.22	1.95
Maturing assets	2.73	5.50	0.02	0.35	1.34	2.88	9.36
Repricing liabilities	0.55	2.17	0.00	0.00	0.00	0.18	2.57
Interest rate exposure URE_i	3.11	5.90	−0.38	0.69	1.98	3.96	10.72
Nominal assets	1.41	2.80	0.01	0.20	0.70	1.49	4.89
Nominal liabilities	0.89	2.85	0.00	0.00	0.00	0.26	5.38
Net nominal position NNP_i	0.52	3.79	−3.64	0.02	0.38	1.17	4.33
Marginal propensity to consume MPC_i	0.46	0.34	0.00	0.20	0.50	0.71	1.00

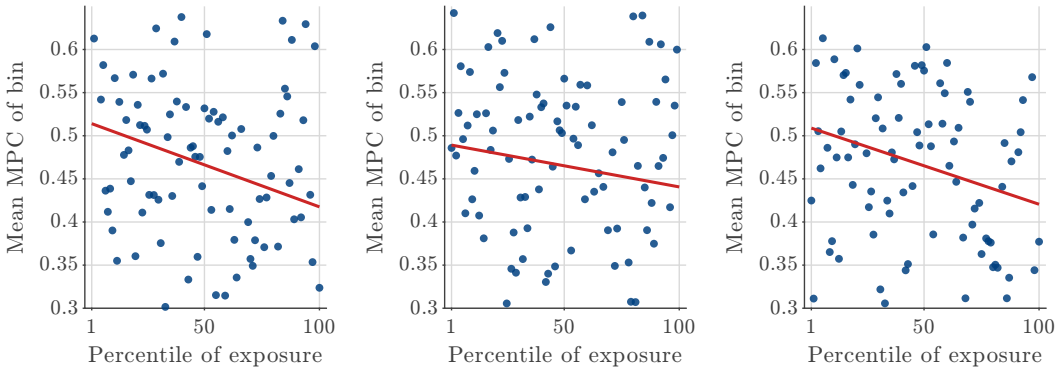
All statistics are computed using survey weights. Every variable except the MPC is normalized by mean annual household consumption. *Maturing assets* and *repricing liabilities* are the two stock components of the unhedged interest rate exposure, $URE_i = Y_i - c_i +$ maturing assets − repricing liabilities. Nominal assets are deposits, bonds and money owed to the household. Maturing assets, repricing liabilities, nominal assets and nominal liabilities exclude the imputed foreign holdings covered by the reported items (Section 4.1). In URE_i, Y_i is net income computed with OECD tax rates. Source: HFCS Wave 4, own calculations.

largest exposures therefore do not have systematically lower MPCs. By income decile, the MPC declines only mildly and non-monotonically, while the URE and income exposures increase and the net nominal position is highest in the seventh and the top decile.

Table 5 reports the elasticities that summarize how different channels contribute to the aggregate consumption response following an interest rate change of −1 percent. In the baseline, the aggregate-income and earnings-heterogeneity moments use total household gross income, while the unhedged interest rate exposure uses post-tax income computed with OECD tax rates. The baseline restricts nominal assets to deposits, bonds and money owed to the household, as in Section 3.3.

Figure 4 compares the relative contribution of each monetary policy transmission channel for Austria with the euro area, both based on the baseline income definitions. Variable rate housing loans are widespread among Austrian mortgage borrowers: in 2017, 63 percent of Austrian households with a mortgage had a variable rate. Since only about one in six Austrian households has a mortgage, the mean interest rate exposure is positive and large, driven by high deposit holdings (Tzamourani, 2021). This channel is strong because the exposure is distributed unevenly: the households with variable rate mortgages, whose debt service changes immediately with the policy rate, have higher MPCs than the deposit holders on the other side. In our sample the 9 percent of households with a variable rate mortgage

Figure 3: Marginal propensities to consume and exposures in Austria



(a) $URE_i/\mathbb{E}_I[c_i]$ (b) $NNP_i/\mathbb{E}_I[c_i]$ (c) $Y_i/\mathbb{E}_I[c_i]$

The three exposures – unhedged interest rate exposure (a), net nominal position (b) and gross income (c) – are normalized by mean consumption. The horizontal axes report the weighted percentile rank of each exposure measure (100 bins). The y axes report the mean MPC within each bin, and the lines are linear fits. Source: HFCS Wave 4, own calculations.

Table 5: Estimates of the elasticities of monetary policy channels

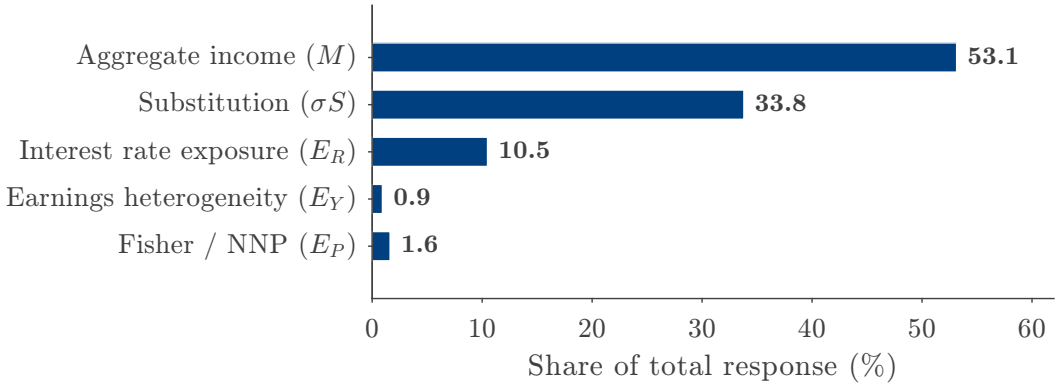
	Baseline
Interest rate exposure $\widehat{E_R}$	−0.11
Substitution channel $\widehat{S}$	0.54
Fisher channel $\widehat{E_P}$	−0.04
Earnings heterogeneity $\widehat{E_Y}$	−0.03
Aggregate income $\widehat{M}$	1.18

All statistics are computed using survey weights. Baseline: total household gross income for M and E_Y and post-tax income computed with OECD tax rates in the unhedged interest rate exposure. The Austrian exposures exclude the imputed foreign holdings covered by the reported items (Section 4.1). Source: HFCS Wave 4, ECB, Auclert (2019), own calculations.

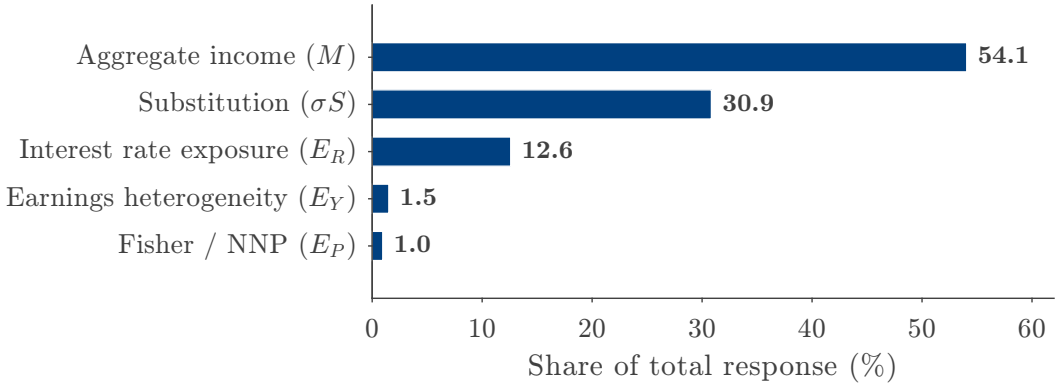
have a mean MPC of 0.56, whereas the MPC weighted by maturing assets is 0.44.

To quantify how much household heterogeneity matters in total, we compare the consumption response with a representative-agent (RANK) benchmark in which the three redistribution elasticities E_R, E_P and E_Y are set to zero. Only the aggregate-income channel $M\,dY/Y$ and the substitution channel $-\sigma S\,dR/R$ then remain. The benchmark retains the measured moments M and S, so that the difference between the heterogeneous-agent (HANK) response and the RANK response isolates the contribution of the redistribution channels. In Austria the RANK response is 0.744 pp. The redistribution channels add 0.132 pp, raising the response to 0.876 pp, an amplification of 17.8 percent. With the estimated earnings incidence

Figure 4: Contributions of monetary policy transmission channels



(a) Euro area



(b) Austria

The figure shows the contribution of each channel to the consumption response to a monetary policy change ($dR/R = -1\%$, $dP/P = +0.2\%$, $dY/Y = +0.4\%$), in percent of the total response, under the baseline incidence convention $\eta = -1$. The total response is 0.86 percent in the euro area and 0.88 pp in Austria. Both panels use the baseline income definitions of Table 5: gross income for the aggregate-income and earnings channels and post-tax income computed with OECD tax rates in the interest rate exposure. All contributions are expressed as increases in consumption after the rate cut. The euro area shares are computed from the elasticities of Pekanov (2024a), Table 8. Source: HFCS Wave 4, own calculations.

of Section 5.1.1, the amplification is 19.5 percent. In each case most of the effect is attributed to the interest rate exposure channel (0.110 pp).

5.1.1. Heterogeneous Earnings Elasticities

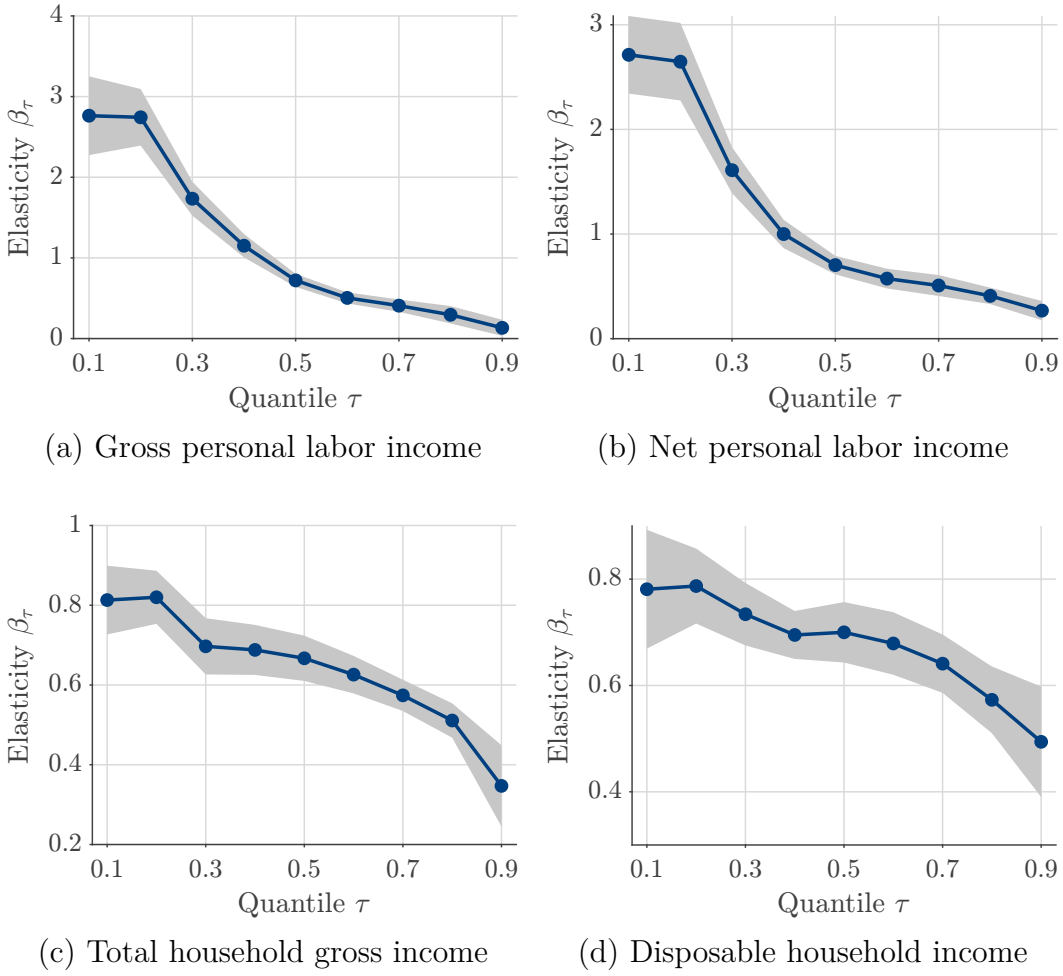
We next replace the baseline incidence convention with a profile calibrated from quantile regressions and compare both with proportional incidence. Figure 5 displays how individual and household incomes are associated with GDP across the income distribution. We estimate the elasticities using quantile regressions. While OLS delivers an average elasticity, quantile regression estimates conditional quantile functions and thereby traces how the elasticity varies from the bottom to the top of the income distribution. If elasticities decline in income, aggregate risk is disproportionately carried by low-income households. We regress log income on log real GDP in the pooled EU-SILC cross-sections for Austria over 2008–2024, controlling for household size in the household-level regressions (Koenker, 2005). We estimate the quantiles $\tau = 0.1, 0.2, \ldots, 0.9$. The coefficient for $\tau = 0.1$ measures how the 10th percentile of the conditional income distribution moves with GDP, not the income response of a fixed set of individuals. Mapping these quantile responses to the deciles of household income in the HFCS is an additional calibration assumption, and the household-income profiles are conceptually closer to the household exposure Y_i. The coefficients are descriptive associations between income and GDP over the sample period, which can also reflect common trends and changes in the composition of respondents. They are not estimated responses to changes in GDP induced by monetary policy.

The top two panels of Figure 5 show the association of individual labor income with GDP. Earnings at the bottom of the distribution are most strongly associated with GDP, with elasticities of 2.76 (gross) and 2.71 (net) at the 10th percentile, declining sharply to 0.13 and 0.27 at the 90th percentile. A similar declining pattern emerges for household income, but the profile is substantially flatter. Household income elasticities decline from 0.81 (total) and 0.78 (disposable) at the 10th percentile to 0.35 and 0.49 at the 90th percentile. This is consistent with income smoothing mechanisms operating at the household level. Multiple earners within a household can offset individual earnings shocks; unemployment benefits and social transfers provide countercyclical support that stabilizes disposable income.

To feed these estimates into the decomposition we collapse them to a single earnings incidence parameter γ_i for each income decile, using the elasticity of *personal gross labor income* with respect to GDP. The decile d is represented by the quantile $(d-\frac{1}{2})/10$, with linear interpolation between adjacent estimated quantiles and flat extrapolation below the tenth percentile and above the ninetieth percentile. The resulting profile falls steeply along the income distribution. Under the incidence calibration based on these profiles, low-income households receive a disproportionate share of the aggregate income increment: when aggregate income rises after a rate cut, the income gains of the bottom deciles are amplified relative to the proportional benchmark, while those of the top deciles are damped. Whether this incidence matters for aggregate consumption depends on whether the low-income households that gain also have higher MPCs.

It is important to note that we cannot use the estimated raw profile in the decomposition. This is because in the setting of his Theorem 3, Auclert (2019) defines the aggregate income

Figure 5: Income elasticities from quantile regressions in Austria



(a) Gross personal labor income

(b) Net personal labor income

(c) Total household gross income

(d) Disposable household income

The figure shows the elasticities of income with respect to GDP, β_τ, by quantile τ of the income distribution. Panels (a) and (b): individual income. Panels (c) and (d): household income. Source: EU-SILC 2008–2024, own calculations.

change as $dY \equiv \mathbb{E}_I[dY_i]$, so that the incidence of an aggregate income change must add up, equivalently $\mathbb{E}_I[\gamma_i Y_i] = \mathbb{E}_I[Y_i]$. The raw quantile coefficients have an income-weighted mean of 0.69, implying that a 1 percent increase in GDP raises aggregate household income by only 0.69 percent. We rescale the profile by its income-weighted mean to ensure the consistency with the assumption that aggregate household income increases by $dY/Y = +0.4\%$.

Table 6 reports the profile in both forms together with the incidence shares it implies. The scale-free statement is in the last two columns: the bottom decile holds 2.4 percent of aggregate household income but receives 9.5 percent of the aggregate income increment, while the top decile holds 24.2 percent and receives 4.7 percent. The three lowest deciles together hold about 12 percent of household income but receive about 43 percent of the increment, whereas the three highest deciles hold about 53 percent and receive about 16 percent. This

shows that the calibrated incidence is strongly tilted toward low-income households. The rescaled γ_i should be read as these incidence weights rather than as literal decile elasticities. Their level is set by the adding-up constraint, and their shape by the quantile regressions.

Table 6: Earnings incidence by income decile in Austria

Income decile	γ_i **as estimated**	γ_i **rescaled (adding-up)**	**Share of income (%)**	**Share of increment (%)**
1 (lowest)	2.76	4.01	2.4	9.5
2	2.75	3.99	3.9	15.8
3	2.24	3.25	5.4	17.4
4	1.44	2.09	6.8	14.3
5	0.94	1.36	8.6	11.7
6	0.61	0.89	9.3	8.3
7	0.46	0.66	10.6	7.0
8	0.35	0.51	12.5	6.4
9	0.21	0.31	16.2	5.0
10 (highest)	0.13	0.19	24.2	4.7
Income-weighted mean	0.69	1.00	100.0	100.0

Column 3 rescales it so that $\mathbb{E}_I[\gamma_i Y_i] = \mathbb{E}_I[Y_i]$ (Theorem 3 of Auclert, 2019). This is the profile used in the decomposition. Column 4 is the decile's share of aggregate gross income in the HFCS estimation sample. Column 5 is its share of the aggregate income increment, $\gamma_d Y_d / \sum_k \gamma_k Y_k$, which is invariant to the rescaling. Income deciles are HFCS household gross-income deciles. Source: EU-SILC 2008–2024, HFCS Wave 4, own calculations.

Replacing proportional incidence with the estimated profile changes the decomposition only through the earnings-heterogeneity channel. Under *proportional incidence* ($\gamma_i \equiv 1$) every household's income moves with aggregate income, the entire income effect is carried by the aggregate-income channel, and the earnings-heterogeneity channel is zero by construction. The total response is 0.863 pp. Our *baseline* instead sets $\eta = -1$, so that every household gains the same euro amount rather than the same percentage of its income, in line with the evidence cited by Auclert (2019) that η is negative (see the remark after Equation (2)), which adds an earnings contribution of $-E_Y\, dY/Y = +0.013$ pp, or 1.5 percent of a total response of 0.876 pp. The difference from proportional incidence is small because MPCs covary only weakly with income (Table 5). Under the *estimated incidence* profile the earnings-heterogeneity channel is +0.026 pp, 3 percent of a total response of 0.889 pp.

The appropriate comparison is between the first and the third of these: relative to proportional incidence, letting the incidence of the income gain decline with income raises the aggregate consumption response by 0.026 pp, or 3.1 percent of the proportional-incidence response of 0.863 pp, and this amplification operates entirely through the earnings-heterogeneity channel. The comparison with the baseline (shares of 1.5 and 3 percent) measures the incremental effect of the estimated profile relative to an incidence assumption that is already redistributive, since the baseline convention $\eta = -1$ yields a non-zero earnings contribution.

Table 7: Closed-economy decomposition under three incidence assumptions for Austria

	Contribution to dC/C (pp)		
Channel	**Proportional** $\gamma_i \equiv 1$	**Baseline** $\eta = -1$	**Heterogeneous** γ_i estimated
Aggregate income (M)	+0.474	+0.474	+0.474
Substitution (σS)	+0.270	+0.270	+0.270
Interest rate exposure (E_R)	+0.110	+0.110	+0.110
Earnings heterogeneity (E_Y)	0.000	+0.013	+0.026
Fisher (E_P)	+0.008	+0.008	+0.008
Closed-economy response	**+0.863**	**+0.876**	**+0.889**
Earnings-heterogeneity share (%)	0.0	1.5	3.0

Contributions to the consumption response to a 1 pp interest rate cut, in percentage points. Calibration: $dR/R = -1\%$, $dY/Y = +0.4\%$, $dP/P = +0.2\%$, $\sigma = 0.5$. Proportional incidence sets $\gamma_i \equiv 1$, under which the earnings-heterogeneity channel is zero by construction. The baseline sets $\eta = -1$ and reproduces Table 5. Heterogeneous incidence uses the decile profile of Table 6 rescaled to satisfy adding-up. Only the earnings-heterogeneity channel differs across the three columns. Source: HFCS Wave 4, EU-SILC 2008–2024, own calculations.

How does the smallness of the heterogeneity channel reconcile with steep incidence? Relative to proportional incidence, the estimated profile shifts about 42 percent of the aggregate income increment from households in the upper half of the income distribution, whose γ_i is below one, to households in the lower half, whose γ_i is above one. Because the level term is zero, the channel equals this shifted amount multiplied by the difference between the average MPCs of the households that receive more and those that receive less of the income gain than under proportional incidence, each weighted by the income shifted. This MPC difference is only about 0.06 (0.50 against 0.44). The MPC is 0.49 in both the lowest and the highest income decile and peaks at 0.54 in the sixth decile, and its correlation with gross income in the estimation sample is only −0.06. The earnings-heterogeneity channel in Austria is limited by the weak relationship between MPCs and income. Its share in the total consumption response is much lower when we estimate incidence profiles using household gross or disposable income instead of personal gross earnings: 0.54 and 0.35 percent, respectively.

5.2. Open Economy

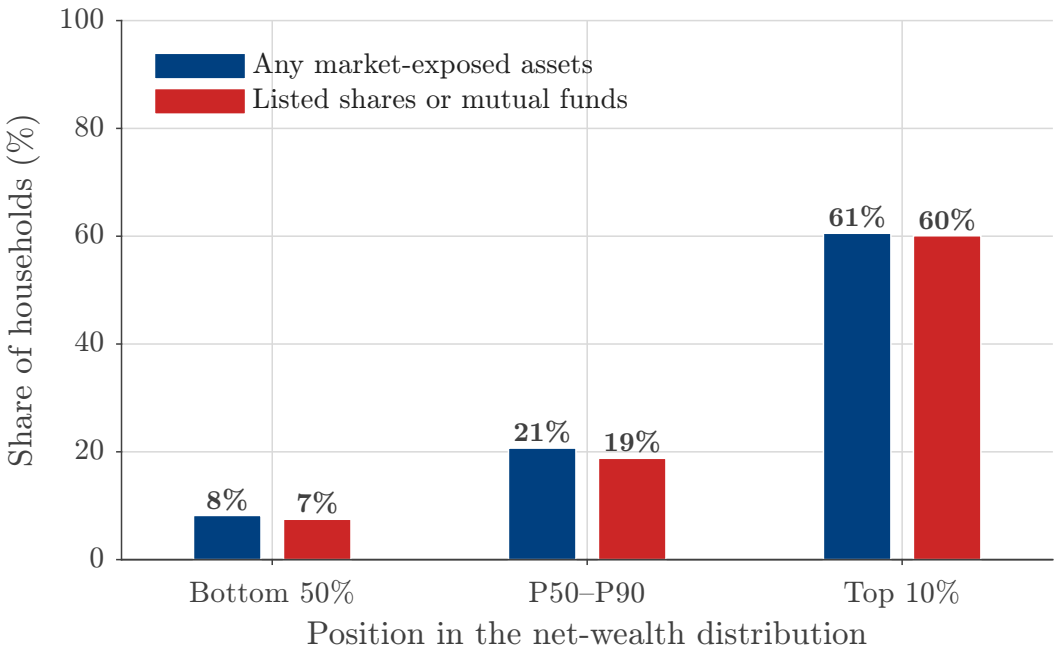
5.2.1. The open-economy decomposition for Austria

The exercise augments the closed-economy experiment with the foreign shock vector specified in Section 4.1. The headline decomposition reports three of the four foreign channels of Proposition 1. The level term of the foreign earnings channel is excluded because it is

already contained in the calibrated dY. All open-economy results treat the imputed foreign exposures, constructed from residency-based assets and foreign-currency liabilities, as exposed to the real exchange rate of the euro (Section 4.1).

Figure 6 shows that the share of households holding market-exposed assets increases with wealth. Direct holdings of market-exposed assets such as listed shares or mutual funds are concentrated at the top of the distribution.

Figure 6: Participation in market-exposed assets by net wealth, Austria



The figure shows the survey-weighted shares of households holding (i) any market-exposed assets (listed shares, mutual funds or bonds) and (ii) listed shares or mutual funds, by position in the net-wealth distribution. Source: HFCS Wave 4, own calculations.

In the baseline the foreign channels together add +0.112 pp to the closed-economy response of 0.876 pp, raising the total consumption response by 13 percent. The comparison adds the foreign block to the domestic block of the decomposition, together with the EUR 16.6 bn of assets that the imputation adds to the survey balance sheets (Table 2).

Which aggregate the level terms are anchored to. Since the level components of the foreign channels are proportional to aggregate exposures rather than to covariances, it matters which population they are measured over (Table 8). Austria's NIIP at the end of 2021 was EUR 58.4 bn, or 14.4 percent of GDP. The *household sector* held a net position in foreign-residency and foreign-currency claims of EUR 62.3 bn, constructed from the OeNB financial accounts and bank statistics. Because it includes CHF mortgages from resident banks (Section 4.1), this aggregate is not the household sector's residency-based net foreign asset position and is not directly comparable with the NIIP. It is the relevant anchor for a

household decomposition, and it is the aggregate our imputation in Section 4.1 is calibrated to. The *estimation sample* (household heads aged 25–64 with a valid MPC response, 2.58 of 4.07 million households) holds EUR 34.3 bn of that, or 55.2 percent. All cross-sectional moments reported in this section, including every level component, are computed over the estimation sample, so the reported dC is the consumption response of that sample and not of the household sector as a whole.

Table 8: Aggregation chain for the foreign level terms in Austria

	$\boldsymbol{NFA}$ **(EUR bn)**	$\boldsymbol{NNP^f}$ **(EUR bn)**	$\boldsymbol{URE^f}$ **(EUR bn)**
Austria, NIIP	58.4	–	–
Household sector, foreign positions (OeNB)	62.3	+1.7	–
HFCS estimation sample	34.3	−4.2	−10.2
Estimation sample, % of household sector	55.2	–	–

NIIP from the OeNB statistical database (OeNB, 2024), equal to 14.4 percent of GDP. The sample share of NNP^f is not reported because the sample and sector aggregates carry opposite signs. NNP^f and URE^f are not defined at the level of the national NIIP, which is a net-worth concept without a maturity or currency breakdown by household. Source: OeNB, HFCS Wave 4, own calculations.

Table 9 decomposes each channel into its level component (the aggregate foreign exposure of the estimation sample times the average MPC) and its redistribution component (the covariance between MPCs and household foreign exposure). Three results stand out.

First, the exchange rate revaluation channel is the largest (+0.057 pp level and +0.007 pp redistribution, together +0.065 pp) and is dominated by its *positive level* component. The households in the estimation sample hold positive net foreign assets, and because we treat these as exposed to the real exchange rate of the euro, a real depreciation delivers a first-order valuation gain on their foreign portfolio, which raises consumption in proportion to the average MPC. Second, the level component is reinforced by a small positive redistribution component (+0.007 pp). Because the imputation allocates foreign holdings by income and by domestic portfolio holdings, the sign of this component reflects how foreign assets are distributed in the imputation, not direct evidence on the MPCs of the actual holders of foreign assets. Third, the foreign URE channel is smaller but positive, because the aggregate foreign URE is negative (maturing foreign-currency liabilities, chiefly legacy CHF variable rate mortgages, exceed maturing foreign claims), so that a decrease in the foreign rate benefits the household sector. With the foreign earnings channel excluded, the foreign contribution we report rests entirely on balance-sheet channels: on stocks of foreign claims, which are not part of the income flow that dY measures, so that none of the three remaining channels is exposed to the double-counting problem.

The foreign Fisher channel is negligible (−0.006 pp), and both of its components are negative. The foreign net nominal position of the estimation sample is negative (EUR −4.2 bn,

Table 8), and the foreign-currency and foreign credit liabilities are held by households with higher MPCs than the foreign deposits and bonds (0.52 against 0.39), so that in the foreign Fisher component of the decomposition the decrease in foreign prices raises the real value of net foreign nominal liabilities. The channel is small because the calibrated decrease in foreign prices (-0.1 percent) is small and because its mean-exposure and its covariance components are small in the constructed data.

Table 9: The foreign block split into level and redistribution components in Austria

Channel	**Level**	**Redistribution**	**Total (pp)**
Closed-economy response			+0.876
Exchange rate revaluation (NFA)	+0.057	+0.007	+0.065
Foreign interest rate exposure (URE^f)	+0.043	+0.010	+0.053
Foreign Fisher (NNP^f)	−0.004	−0.002	−0.006
Foreign block	+0.097	+0.015	+0.112
Open-economy response			**+0.988**

Contributions in percentage points under the baseline incidence convention $\eta = -1$, with $d\mathcal{E}/\mathcal{E} = +0.5\%$, $dR^*/R^* = -0.5\%$ and $dP^*/P^* = -0.1\%$, and hence a real depreciation of $de/e = +0.2\%$. For each foreign exposure X^f the *level* component is $\mathbb{E}_I[MPC_i]\, X^f_{\mathrm{c}}$ and the *redistribution* component is $\mathrm{cov}_I(MPC_i, X^f_i)$, the two terms of the identity (13), each divided by mean consumption $\mathbb{E}_I[c_i]$ and multiplied by the corresponding shock. The foreign earnings channel is excluded, because its level term is already contained in the equilibrium dY. In the closed economy the level components vanish by (4), so the fact that they are present, and dominant, is what distinguishes the open economy. Source: HFCS Wave 4, OeNB, own calculations.

The level components also change the comparison with the redistribution-free benchmark. A representative household that holds the aggregate foreign position of the estimation sample experiences the level components but none of the redistribution components, because all covariances are zero in a representative-agent economy. The open-economy redistribution-free response is therefore the closed-economy RANK response of 0.744 pp plus the foreign level components of 0.097 pp, i.e., 0.841 pp. The level effect alone raises this benchmark by 13.0 percent. Relative to it, heterogeneity amplifies the response by 17.5 percent under the baseline convention (0.988 against 0.841 pp) and by 19.0 percent under the estimated earnings incidence (1.001 pp). This is less than the 17.8 and 19.5 percent of the closed economy, because the redistribution channels add only slightly more in the open economy (0.132 pp domestically and +0.015 pp abroad), while the benchmark they are compared with is larger. The redistribution-free benchmark captures much of the calibrated open-economy response because it retains the foreign level effects. What heterogeneity adds is the domestic redistribution, mainly through the interest rate exposure channel.

6. Discussion and Further Research

There are two limitations of the empirical analysis conducted in this paper. The first stems from the fact that we impute aggregate foreign positions to households based on simplifying assumptions, and the second from the fact that we use calibrated effects of a monetary shock to illustrate the relative importance of the terms in the sufficient-statistics decomposition.

Residency versus currency of denomination. For nominal contractual claims, currency denomination determines direct exchange rate exposure, so that euro-denominated deposits do not revalue when the euro depreciates. For funds, equity and other intermediated holdings, exposure depends on the underlying assets and on hedging arrangements, not on the currency in which the instrument is quoted. Fund shares domiciled in Luxembourg or Ireland, the largest single item, can therefore be exposed to the exchange rate although they are quoted in euro, and foreign-currency instruments can be hedged. Residency-based net foreign assets are therefore neither an upper nor a lower bound for the currency-exposed position that the theory calls for, and the headline open-economy results should be read as conditional on the assumption that the constructed foreign exposures are positions in the modeled foreign currency that revalue one-for-one with the real exchange rate of the euro.

The cross-sectional measurement of foreign exposure. The level components of the new channels are anchored to financial-accounts aggregates. This is adequate for the level terms, but the covariance terms depend on how well the allocation approximates the distribution of foreign holdings across households. The direction of any resulting bias in the MPC–foreign-exposure covariances is therefore not clear, and the redistribution component of the exchange rate revaluation channel in Table 9 should be interpreted with caution.

Top-tail under-coverage. The HFCS is likely to underrepresent the very top of the wealth distribution, where foreign equity exposure is concentrated. MPCs among these households are therefore measured with limited precision. Although our imputation preserves the OeNB household-sector aggregates, under-coverage can distort their allocation across households, the estimation sample's share of foreign holdings, and the covariance between MPCs and foreign exposure. Pareto-tail corrections could help assess the sensitivity of the redistribution components to this under-coverage.

Shock identification. The results of the open-economy decomposition depend substantially on the assumed shock vector. It could be replaced with impulse responses to an identified ECB monetary policy shock, but this would require a common identification scheme. The estimated joint impulse responses for Austria, Switzerland and the representative foreign aggregate would have to be aligned with the annual household exposures. While this is feasible in principle, it is beyond our current scope and is left for future research.

7. Conclusions

Building on the sufficient-statistics approach of Auclert (2019), this paper has quantified the redistribution channels of monetary policy in Austria as an open economy. Three findings stand out. First, in the closed economy, redistribution raises the consumption response to an ECB rate cut by 18 percent relative to a redistribution-free benchmark. About 84 percent

of this amplification comes from the unhedged interest rate exposure channel, which reflects the prevalence of variable rate housing loans in Austria. The Fisher contribution is small.

Second, the calibrated incidence of the income gain is steep but contributes little. The incidence profile based on personal gross earnings assigns to the three lowest income deciles about 43 percent of the income gain from a rate cut, although they hold about 12 percent of household income. Because MPCs are only weakly related to income, the earnings-heterogeneity channel nevertheless adds only about 3 percent to the consumption response with this profile.

Third, opening the economy changes the structure of the decomposition. The cross-sectional mean of foreign exposures no longer nets out but equals the household sector's aggregate foreign exposure, which enters the consumption response multiplied by the average MPC. In aggregate, the households in our sample hold positive net foreign assets, and in an illustrative calibration the foreign channels add about 13 percent to the response of the domestic block, mostly through the valuation gain on net foreign assets when the euro depreciates in real terms – a level effect rather than an amplification generated by household heterogeneity.

The foreign results are conditional on treating the constructed exposures as positions in the modeled foreign currency and on the foreign shock vector. The redistribution components of the foreign channels rest on imputed household-level foreign exposures. A more accurate measure would combine the HFCS with security-level portfolio data and with administrative data covering the top of the wealth distribution. The decomposition developed in this paper defines the moments that such an effort would need to estimate.

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