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Asymmetric Taxation of Liquid and Illiquid Assets: A Ramsey-Based Partial-Equilibrium Approach

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Abstract

This thesis studies the portfolio, liquidity, and welfare effects of asymmetric capital income taxation in a two-asset incomplete-markets model calibrated to Austrian household balance-sheet data. Motivated by Austria's relatively high wealth inequality, stagnating real median incomes, and the predominance of illiquid wealth on household balance-sheets, the analysis builds on a key feature of such models: illiquid assets serve not only as a vehicle for long-run wealth accumulation but also as a self-insurance buffer against persistent income risk, while liquid assets provide short-run consumption smoothing. These two roles define the illiquid accumulation channel and the liquid self-insurance channel that are central to the analysis. The analysis asks how differential taxation of these two asset classes affects welfare, portfolio composition, and the prevalence of liquidity-constrained households along a Ramsey-constrained tax schedule.

Applying Ramsey's inverse-elasticity rule in a partial equilibrium model based on Kaplan and Violante (2014), I show that aggregate illiquid holdings are roughly twice as elastic as liquid holdings with respect to the corresponding after-tax return, driven not by adjustment frequency but by the large size of positions households move to conditional on adjusting. The Ramsey rule therefore calls for a lower capital income tax on illiquid than on liquid assets. The welfare gains from this asymmetry are substantial at low policy intensity but non-monotone: beyond a critical liquidity threshold, both the illiquid accumulation and liquid self-insurance channels deteriorate simultaneously, triggering a discrete jump in hand-to-mouth prevalence and a sharp welfare collapse. Low illiquid taxation compresses the hand-to-mouth share far below what any liquid tax adjustment can achieve alone, by raising the payoff to maintaining illiquid self-insurance buffers. Austria's tax code moves in the right direction but achieves this through categorical exemptions concentrated on owner-occupied housing, disproportionately benefiting wealthy homeowners.

Kurzfassung

Diese Arbeit untersucht die Portfolio-, Liquiditäts- und Wohlfahrtseffekte asymmetrischer Kapitaleinkommensbesteuerung in einem Zwei-Asset-Modell unvollständiger Märkte, kalibriert auf österreichische Haushaltsdaten. Illiquide Vermögenswerte dienen nicht nur der langfristigen Akkumulation, sondern auch als Selbstversicherungspuffer gegen persistente Einkommensrisiken, während liquide Bestände der kurzfristigen Konsumglättung dienen—diese beiden Rollen definieren den illiquiden Akkumulationskanal und den liquiden Selbstversicherungskanal. Die Analyse fragt, wie eine differenzierte Besteuerung dieser Vermögensklassen Wohlfahrt, Portfoliozusammensetzung und den Anteil liquiditätsbeschränkter Haushalte entlang eines Ramsey-restringierten Steuerpfads beeinflusst.

Unter Anwendung der inversen Elastizitätsregel von Ramsey in einem partiellen Gleichgewichtsmodell auf Basis von Kaplan and Violante (2014) zeige ich, dass aggregierte illiquide Vermögensbestände bezüglich der Nachsteuerrendite etwa doppelt so elastisch sind wie liquide Bestände, getrieben durch die Anpassungsgröße, nicht die Anpassungshäufigkeit. Die Ramsey-Regel spricht daher für einen niedrigeren Kapitaleinkommensteuersatz auf illiquide als auf liquide Vermögenswerte. Die Wohlfahrtsgewinne sind erheblich, jedoch nicht monoton: Jenseits eines kritischen Schwellenwerts verschlechtern sich beide Kanäle gleichzeitig, was einen diskreten Anstieg liquiditätsbeschränkter Haushalte und einen starken Wohlfahrtseinbruch auslöst. Niedrige illiquide Besteuerung stärkt den Selbstversicherungskanal und senkt den Anteil liquiditätsbeschränkter Haushalte weit unter das durch Liquiditätsbesteuerung allein erreichbare Niveau. Österreichs Steuersystem bewegt sich in die richtige Richtung, erreicht die Asymmetrie jedoch durch kategorische Ausnahmen konzentriert auf selbstgenutztes Wohneigentum, die wohlhabende Eigentümer überproportional begünstigen.

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1. Motivation

There are three central observations relating to the Austrian economy that motivate this thesis. First, Austria exhibits a high degree of wealth inequality compared to countries within the euro area. According to the most recent wave of the Household Finance and Consumption Survey (HFCS), the top 10% of households owned 51.4% of total net wealth in 2023, whereas the bottom 50% held only 3.8% (see Table A.1). Austria's Gini coefficient of 0.70 in 2023 has been among the highest in the euro area throughout the last decade (see Figure A.1), and Fessler et al. (2025) document a rising mean–median ratio, indicating that absolute wealth gaps have widened.[1] Second, real median net income of Austrian employees has stagnated since 1998 while real GDP per capita has more than doubled, indicating a pronounced decoupling between aggregate performance and the purchasing power of the median worker (see Figure A.2). Third, household consumption fell by nearly 7% in the first year of the Covid-19 pandemic relative to 2019, with considerable macroeconomic consequences given that private consumption accounts for roughly half of Austrian GDP.[2]

Atkinson and Morelli (2011) provide a unifying framework for these observations. Economic downturns disproportionately affect households with the fewest financial resources, as they are least able to smooth consumption in the face of income or employment losses. Austria's wealth distribution indicates that a substantial share of households hold very little net wealth, especially in liquid form (i.e., readily accessible assets such as deposits

[1] The net wealth Gini coefficient based on the Distributional Wealth Accounts may differ from that based on the HFCS reported in Table A.1. The Distributional Wealth Accounts reconcile microdata from the HFCS with macroeconomic aggregates from the Quarterly Sector Accounts.

[2] See Statistik Austria (https://www.statistik.at/en/statistics/national-economy-and-public-finance/national-accounts/gross-domestic-product-and-main-aggregates).

and cash), and the stagnation of real median income suggests that typical households have not improved their capacity to accumulate precautionary savings despite substantial aggregate growth.

These structural features have direct implications for how households respond to income shocks. A household with little liquid wealth (deposits, stocks, and bonds) cannot smooth consumption when income falls, regardless of what it holds in illiquid form (real estate, retirement accounts, business equity)—a distinction following Kaplan et al. (2014). Recent literature formalizes this insight through heterogeneity in the marginal propensity to consume (MPC). Kaplan et al. (2014) identify three household types: poor hand-to-mouth (HtM) households with low or zero holdings of both liquid and illiquid assets; wealthy HtM households with substantial illiquid wealth but little liquid wealth; and non-HtM households holding significant amounts of both. HtM households exhibit substantially higher MPCs than non-HtM households, and Albacete et al. (2024) document elevated MPCs among liquidity-constrained households across Austria and the euro area. Jappelli and Pistaferri (2014) show that redistributive fiscal policy has larger aggregate consumption effects precisely because it reallocates resources toward high-MPC households. Crucially, a rising aggregate MPC is not necessarily a sign of improved redistribution effectiveness: as shown in chapter 4, when capital income taxes are set too high, illiquid buffers erode and more households become liquidity constrained, so a higher aggregate MPC measures insurance loss rather than redistribution potential.

This thesis studies how the structure of capital income taxation, specifically, the differential taxation of liquid and illiquid assets, affects household welfare, portfolio composition, and the prevalence of liquidity-constrained households under incomplete markets. This question is particularly relevant in the context of Austria. Illiquid assets account for the bulk of household wealth—the median household's net illiquid assets exceed net liquid assets by roughly a factor of four (see Table A.2)—and Austria's tax code, while nominally applying higher rates to illiquid asset income, in practice favors it through exemptions, outdated valuations, and generous deductions, while liquid asset income faces a flat tax with no such relief.

The thesis asks whether differential capital income taxation of liquid and illiquid assets improves welfare relative to a symmetric baseline, how welfare evolves along a Ramsey-constrained schedule, and how the share and consumption behavior of liquidity-constrained households respond to asymmetric capital income taxation. The central finding is that aggregate illiquid asset holdings respond more strongly to changes in their effective after-tax return than liquid holdings do, driven not by adjustment frequency but by the size of illiquid positions households move to conditional on adjusting. Following Ramsey (1927), the optimal capital income tax on illiquid assets should therefore be lower than on liquid assets. The Ramsey asymmetry substantially dominates symmetric taxation at low tax rates, but welfare is non-monotone and collapses beyond a critical liquidity threshold at which both channels deteriorate simultaneously: the illiquid accumulation channel, through which households build long-run wealth and maintain a medium-run buffer against persistent income losses, and the liquid self-insurance channel, through which households smooth consumption against short-run shocks. The Ramsey-implied tax code does not align with recent assessments of the Austrian tax system: existing evidence suggests that Austria's code effectively favors homeownership over renting (Fessler et al., 2023; Causa et al., 2019), and IMF (2025) recommends shifting the fiscal burden away from labor and toward property and inheritances.

The thesis is structured as follows. Chapter two reviews the literature on capital income taxation, MPC heterogeneity, and hand-to-mouth households. Chapter three describes the model, its parametrization, and the benchmark economy. Chapter four presents the capital income tax experiments and the Ramsey-type policy analysis, and evaluates the Austrian tax code in light of these findings. Concluding remarks follow.

2. Literature Review

This thesis contributes to the following two strands of literature: on capital (income) taxation under complete and incomplete markets, where the classical result of zero optimal capital taxation emerges under complete markets, while relaxing these assumptions—by introducing uninsurable idiosyncratic risk and borrowing constraints—typically leads to positive optimal capital taxes; and on heterogeneity in marginal propensities to consume (MPCs) and the prevalence of three different types of Hand-to-Mouth (HtM) consumers and their relevance for fiscal policy design.

2.1. Capital Income Taxation

Two foundational paradigms in optimal taxation frame the analysis. In the Ramsey framework (Ramsey, 1927) the government observes all relevant variables and chooses distortionary taxes to raise a given amount of revenue while minimizing welfare losses, with the central insight that more inelastic bases should bear heavier taxation.[1] In contrast, the Mirrlees framework (Mirrlees, 1971) assumes that individual labor productivity is privately observed and cannot be taxed directly, requiring the government to design a nonlinear income tax that induces self-selection through households' consumption–leisure choices.

The well-known Chamley–Judd result, developed in Chamley (1986) and Judd (1985), establishes that long-run capital demand is perfectly elastic, so a second-best government should tax labor income rather than capital income in the long run, while a positive

[1] Subsequently, the thesis employs Ramsey's logic in determining tax rates on capital income from both liquid and illiquid assets.

capital income tax is temporarily efficient in the short run. This zero-capital-income-tax result proves robust across a variety of extensions, including stochastic business cycle environments (Chari et al., 1994), heterogeneous agents and endogenous growth (Atkeson et al., 1999), calibrated welfare costs of capital income taxation (Lucas Jr, 1990), and dynamic Mirrleesian settings where history-dependent labor taxes render capital income taxation redundant (Werning, 2007).[2]

Several counterexamples nonetheless challenge this result. An untaxable production factor can make a non-zero capital income tax desirable (Correia, 1996). When the intertemporal elasticity of substitution falls below one, the optimal long-run capital income tax is strictly positive (Straub and Werning, 2020). With idiosyncratic income shocks and private information, the constrained-efficient allocation satisfies an inverse Euler equation requiring a positive capital income tax (Farhi and Werning, 2012). And in life-cycle economies, a positive capital income tax imperfectly replicates age-dependent tax wedges (Erosa and Gervais, 2002).

With the development of macroeconomic models incorporating uninsurable idiosyncratic labor income risk (e.g., Aiyagari, 1994), the case for zero capital income taxation weakens considerably. In a seminal contribution, Aiyagari (1995) shows that precautionary saving leads to over-accumulation of capital above the golden-rule level, making a positive capital income tax optimal as a corrective wedge. Conesa et al. (2009) reinforce this finding, showing that a capital income tax of around 36%—alongside progressive labor taxation—is optimal in a calibrated overlapping-generations model with uninsurable heterogeneity. Nakajima (2020) demonstrates the sensitivity of this result to capital stock composition: introducing housing into an otherwise similar framework, the optimal capital income tax falls from 31% to just 1% given U.S. preferential treatment of owner-occupied housing, and rises back to 24% once that preference is removed—confirming that capital income taxation must be evaluated jointly with the broader tax treatment of capital assets.

Debates persist about the form of optimal capital taxation. Guvenen et al. (2023)

[2] Chari et al. (1994) emphasize that capital income should be taxed in the initial period(s) to capture welfare gains from taxing pre-existing capital; only subsequently should the capital income tax rate converge to zero.

argue that taxing wealth rather than capital income maximizes welfare with financially constrained entrepreneurs. In contrast, Boar and Midrigan (2023) show that redistributive benefits of capital income taxation outweigh efficiency gains from taxing wealth, with Boar and Midrigan (2022) finding that flat uniform taxes on labor and capital income are approximately optimal under plausible redistribution preferences (consistent with Conesa et al., 2009).

2.2. MPC Heterogeneity and Hand-to-Mouth Households

Private consumption is the largest component of aggregate demand, and a central empirical insight of the recent literature is that households differ substantially in their MPC, closely tied to their liquidity and balance-sheet positions. These findings stand in tension with the sharpest prediction of the Permanent Income Hypothesis (PIH). Surveying both theory and evidence, Jappelli and Pistaferri (2010) document that consumption responds to anticipated and transitory income movements more than the frictionless PIH implies, attributing departures to borrowing constraints, limited insurance, adjustment frictions, and information imperfections.

Quasi-experimental evidence confirms this picture. Parker et al. (2013) exploit variation in the timing of the 2008 Economic Stimulus Payments and find that households spend 12–30% on nondurables in the quarter of receipt, rising to 50–90% including durables.[3] Fisher et al. (2020) show markedly higher MPCs for low-wealth households, and Carroll et al. (2014) document that more unequal wealth distributions are associated with higher aggregate MPCs across European countries.

Jappelli and Pistaferri (2014) use household-level reported MPCs from the 2010 Italian Survey of Household Income and Wealth (SHIW) to study how MPC heterogeneity shapes the aggregate consumption impact of redistributive fiscal policy. In a balanced-budget experiment that taxes the top income decile and redistributes to the bottom decile, aggregate consumption rises by about 0.33%, with the bulk of the response attributable

[3] Earlier evidence from the 2001 tax rebates is provided by Johnson et al. (2006), who estimate that households spent roughly 20–40% of the rebate on nondurable goods.

to MPC heterogeneity across the cash-on-hand distribution rather than to demographic correlates.

Kaplan et al. (2014) argue that classifying HtM households by net worth is incomplete, as it overlooks a large group with substantial illiquid assets but very little liquid wealth. These wealthy HtM households still behave like liquidity-constrained consumers because illiquid wealth cannot readily smooth short-run income fluctuations. The authors therefore distinguish between poor HtM households (low net worth and low liquid wealth) and wealthy HtM households (high net worth but low liquid wealth). Using balance-sheet data, they document that roughly 30% of U.S. households are HtM, with about two-thirds wealthy HtM in 2010—a composition that appears across other advanced economies. Crucially, wealthy HtM households display significantly higher MPCs than non-HtM households when HtM status is defined using liquid rather than net wealth; defining HtM status by net worth instead causes this gap to disappear entirely.

These contributions motivate structural frameworks that endogenize liquid and illiquid portfolio choices. The two-asset environment is implemented in the seminal work of Kaplan and Violante (2014), which serves as the template for the model used in this thesis. Allowing households to allocate savings between a freely adjustable liquid asset and an illiquid asset subject to transaction costs, they study the consumption response to the 2001 U.S. tax rebate and find that roughly 30% is spent on nondurables within the year of receipt, driven primarily by (wealthy) HtM households. They further emphasize that larger rebates are more likely to induce illiquid portfolio adjustments, which dampens short-run consumption responses.

Yet the literature on capital taxation under incomplete markets, while providing strong arguments for positive capital taxation, typically treats capital as a homogeneous object, abstracting from the distinction between liquid and illiquid wealth and from the different types of HtM households. As Kaplan et al. (2014, p. 48) put it, "Macroeconomists need to move beyond one-asset models" when analyzing fiscal policy—a call this thesis answers by distinguishing between liquid and illiquid assets when evaluating capital income taxation.

3. Model

To study the asymmetric income taxation of liquid and illiquid assets under incomplete markets, this thesis builds on the framework developed by Kaplan and Violante (2014), who analyze the consumption response to fiscal stimulus payments. A central feature of their model is the distinction between wealthy hand-to-mouth households, poor hand-to-mouth households, and non-hand-to-mouth households. This distinction is made possible by introducing liquid and illiquid assets, rendering their framework particularly well-suited for the purposes of this study.

In the partial-equilibrium model, households can save in two distinct asset classes: liquid and illiquid assets. Liquid assets provide a lower rate of return but are freely accessible, while illiquid assets yield higher returns but are subject to transaction costs. Households are infinitely lived[1] and further exposed to uninsurable idiosyncratic labor income shocks.

3.1. Model Framework

Preferences. The stationary economy is populated by a continuum of infinitely lived households, indexed by $i \in [0, 1]$. Households have a CRRA objective function defined recursively as

$$V_{it} = \frac{c_{it}^{1-\theta}}{1-\theta} + \beta\, \mathbb{E}_t[V_{it+1}], \tag{3.1}$$

[1] Life-cycle structure is typically motivated by the need to model end-of-life wealth transfers and their tax treatment. Austria levies no inheritance, removing the primary institutional motivation for imposing a finite horizon in the present context. The infinite-horizon formulation is therefore the simpler and equally appropriate choice for studying the capital income tax questions examined here.

where $c_{i,t}$ is consumption of non-durables of household i at time t. The parameter β is the discount factor and θ relative risk-aversion parameter.

Labor income. Log labor productivity follows

$$\log y_{it} = \nu_i + z_{it}, \tag{3.2}$$

where ν_i is a household-specific fixed effect[2] and z_{it} is a stochastic idiosyncratic component, that follows an AR(1) process. That is,

$$z_{it} = \rho z_{it-1} + \varepsilon_{it}, \tag{3.3}$$

with i.i.d. productivity shock, $\varepsilon_i \sim \mathcal{N}(0, \sigma_\varepsilon^2)$, and $|\rho| < 1$.

Assets. Households can hold liquid asset m and illiquid asset a. The illiquid assets pays a gross financial return $R^a = 1 + r^a$, whereas the liquid assets pay $R^m = 1 + r^m$. In general, $R^a > R^m$, but deposits into, or withdrawals from, the illiquid account is only possible with proportional transactions costs $\kappa(a) = \kappa_0 + \bar{\kappa}\, a$.

Government. The government collects capital-income taxes on both assets, τ^a and τ^m, a flat labor-income tax rate τ^y and a consumption tax τ^c, and rebates a lump-sum transfers T_t. Furthermore, the government issues debt B^g and has consumption expenditure G. Both are given exogeneous.

Household Problem. Let the individual state vector be $\mathbf{s}_{it} = (m_{it}, a_{it}, z_{it})$. At the beginning of period t, after observing y_{it}, i.e. the current productivity shock, the household decides whether to adjust illiquid asset holdings and pay the transaction cost or merely adjust liquid asset holdings. The value function of this household is given by

$$V_{it}(\mathbf{s}_{it}) = \max\{V_{it}^0(\mathbf{s}_{it}), V_{it}^1(\mathbf{s}_{it})\},$$

[2] This paper assumes ν to be deterministic and zero for all households.

where $V_{it}^0(\mathbf{s}_{it})$ and $V_{it}^1(\mathbf{s}_{it})$ are the value function conditional on not adjusting (0) or adjusting (1) from the illiquid account, respectively. The two cases are:

1. $V^0 \geq V^1$: the household undertakes no adjustment on illiquid asset holdings and solves

$$V_{it}^0(\mathbf{s}_{it}) = \max_{c_{it}, m_{it+1}} \frac{c_{it}^{1-\theta}}{1-\theta} + \beta\, \mathbb{E}_t[V_{it+1}] \tag{3.4}$$

subject to

$$\begin{aligned}
&(1+\tau^c)c_{it} + m_{it+1} = (1-\tau^y)\, w_t\, y_{it} + \big(1 + \tilde{r}^m(m_{it})\big)\, m_{it} + T_t,\\
&a_{it+1} = a_{it} + (1-\tau^a)\, r_t^a\, a_{it},\\
&c_{it} \geq 0,\ m_{it+1} \geq -\underline{m}_{t+1}(y_t),\\
&y_{it} = \exp(z_{it}).
\end{aligned}$$

2. $V^0 < V^1$: the household adjusts its illiquid asset holdings and solves

$$V_{it}^1(\mathbf{s}_{it}) = \max_{c_{it}, m_{it+1}, a_{it+1}} \frac{c_{it}^{1-\theta}}{1-\theta} + \beta\, \mathbb{E}_t[V_{it+1}] \tag{3.5}$$

subject to

$$\begin{aligned}
&(1+\tau^c)c_{it} + m_{it+1} + a_{it+1} + \kappa(a_{it+1}) = (1-\tau^y)\, w_t\, y_{it} + \big(1 + \tilde{r}^m(m_{it})\big)\, m_{it}\\
&\qquad\qquad\qquad + \big(1 + (1-\tau^a)\, r_t^a\big)\, a_{it} + T_t,\\
&c_{it},\ a_{it+1} \geq 0,\ m_{it+1} \geq -\underline{m}_{t+1}(y_t),\\
&y_{it} = \exp(z_{it}).
\end{aligned}$$

The after-tax liquid return $\tilde{r}^m(m)$ depends on the liquid asset position, reflecting both the borrowing–saving wedge and the asymmetric tax treatment: capital income tax τ^m

applies only to liquid savings, not to borrowing costs. Hence,

$$\tilde{r}^m(m) = \begin{cases} (1-\tau^m)r^m & m \geq 0 \\ r^{\text{borr}} & m < 0 \end{cases}$$

with $r^{\text{borr}} > r^m$. Whenever r^m is written without explicit dependence on m, it refers to the pre-tax interest rate on liquid savings (i.e., for $m \geq 0$).

The analytical solution to the households' optimization problem and brief interpretations can be found in section A.1. In particular, the adjustment case yields a portfolio indifference condition (A.9) that equates the marginal value of liquid and illiquid assets, where the marginal value of illiquid holdings depends on whether the household adjusts in the subsequent period. This is a feature that distinguishes this two-asset environment from standard single-asset incomplete-markets models. The no-adjustment case, by contrast, is identical to a standard consumption–saving model, with the Euler equation in the liquid asset being the sole optimality condition.

Balanced Budget. The government satisfies its per-period budget constraint,

$$G + T_t = \tau^y L + \tau^m r^m M_t^{pos} + \tau^a r^a A_t + \tau^c C_t - r^m B^g, \tag{3.6}$$

where $A_t = \int_i a_t(i)\,\mathrm{d}i$ is aggregate illiquid asset holdings, $C_t = \int_i c_t(i)\,\mathrm{d}i$ is aggregate consumption, $M_t = \int_i m_t(i)\,\mathrm{d}i$ is aggregate liquid asset holdings, and $M_t^{pos} = \int_i m_t(i)\,\mathbb{1}_{\{m_t(i)>0\}}\,\mathrm{d}i$ is aggregate positive liquid asset holdings, reflecting that capital income tax τ^m applies only to liquid savings. Labor is supplied inelastically and $L = 1$.

Stationary Equilibrium. A stationary equilibrium is defined by a solution to the households' problem, a stationary distribution of the households, government fiscal policy and aggregate quantities, such that

1. Given prices $\{\tilde{r}^m(m), r^a\}$ and government fiscal policy $\{\tau^m, \tau^a, \tau^y, \tau^c, T\}$, $\{a, m, c, V\}$ solves the household's problem characterized in A.1;

2. A stationary distribution μ^* given the household's optimal solution;

3. The government satisfies the budget constraint (3.6).

3.2. Parametrization

The stationary equilibrium of the model is calibrated to Austrian household balance-sheet and wealth distribution moments from the third wave of the HFCS (2017). The HFCS wave of 2021 is not used for calibration because household balance sheets were likely affected by the COVID-19 pandemic and may therefore not reflect a stationary distribution. The calibration targets are (i) unconditional median illiquid wealth to unconditional median net wages or replacement income, (ii) unconditional median liquid wealth to unconditional median net wages or replacement income, and (iii) the net wealth Gini coefficient. Further, in the benchmark model the tax rates on capital income of liquid and illiquid assets are assumed to be symmetric and equal to capital income tax rate in Austria (KESt), i.e. to 27.5%.

Table 3.1 reports internally calibrated and externally set parameters.

Assigned Parameters. The consumption tax τ^c is set to 20%, corresponding to the standard VAT rate in Austria in 2017 (OECD, 2024). The labor income tax rate τ^y is set to 47.4%, equal to the average labor tax wedge for a single person in Austria in 2017 (OECD, 2025).

The borrowing spread is imposed exogenously as the difference between a proxy for the borrowing rate and a proxy for the liquid saving return, $r^{\text{borr}} - r^m$. The borrowing rate r^{borr} is approximated by the geometric mean of the annual lending rate on consumption loans to households over 2011–2020, as published by the Austrian National Bank.[3] The liquid saving return r^m is approximated by the geometric-mean performance of a representative liquid financial portfolio of Austrian households over 2011–2020, based on Aruqaj and Zhan (2021).[4] They report a representative household financial portfolio covering deposits

[3]For reference, see https://www.oenb.at/isawebstat/createChart?lang=EN&chart=2.10.1.
[4]I thank Jun Chao Zhan for providing me the data underlying Figure 2 in Aruqaj and Zhan (2021).

Table 3.1.: Model Parameters

Panel A. Internally calibrated parameters		
Parameter	Description	Value
β	Discount factor	0.9785
$\bar{\kappa}$	Proportional adjustment cost	0.0325
$r^a - r^m$	Asset return spread	0.01495

Panel B. Externally set parameters			
Parameter	Description	Value	Source
θ	Risk aversion	2.0	—
ϕ	Borrowing limit	0.185	See text
κ_0	Fixed adjustment cost	0.002	See text
N_z	Number of income states	9	—
ρ_z	Income persistence	0.9245	Bayer and Juessen (2012)
σ_z^2	Income risk	0.1778	Bayer and Juessen (2012)
τ^c	Consumption tax	0.20	OECD (2024)
τ^y	Average income tax	0.474	OECD (2025)
$r^{\text{borr}} - r^m$	Borrowing spread	0.0391	See text
G/Y	Government spending share	0.21	See text
B^g/Y	Public debt ratio	0.79	See text

Notes: Panel A lists internally calibrated parameters; Panel B lists externally set parameters.

and cash, interest-bearing securities, listed shares, investment certificates, life-insurance claims, funded pensions, other equity interests, and other financial assets. I construct a proxy for the return on liquid assets by restricting this decomposition to the components classified as liquid in the model and computing the corresponding geometric-mean return.

Kaplan and Violante (2014) set the unsecured credit limit to 0.74 times quarterly labor income, based on households' self-reported total credit limit in the Survey of Consumer Finances (SCF). When expressed relative to annual income, this corresponds to a borrowing limit of $0.74/4 \approx 0.185$, i.e. 18.5% of annual income. To my knowledge, an directly comparable SCF-style measure of total unsecured credit limits is not available for Austria. Kaplan et al. (2014) document that euro-area households have substantially less negative liquid wealth than U.S. households and argue that tighter access to unsecured credit in Europe is a likely explanation.[5] However, to keep the model parameters

[5]By Table A.2, only 12.2% of Austrian households report a credit overdraft or credit card debt.

empirically based I stick to borrowing constraint imposed by Kaplan and Violante (2014) and set $\phi = 0.185$, since quarterly income equals one fourth of annual income, $0.74\, y_q = 0.74\,(y/4) = 0.185\, y$, with y_q denoting quarterly income and y annual income.

The fixed adjustment cost is set to $\kappa_0 = 0.002$, which corresponds to approximately €135.[6] The fixed adjustment cost serves a purely technical role: it rules out costless portfolio adjustments, in particular corner solutions in which households freely choose $a' = 0$. For robustness, different values of κ_0 are considered; unless stated otherwise, $\kappa_0 = 0.002$ constitutes the benchmark specification.[7]

Finally, the government spending share G/Y is set to the average ratio of government consumption to GDP over 2011–2020, based on Statistik Austria's national accounts ("gross domestic product and main aggregates"). The public debt ratio B^g/Y is computed likewise.[8]

Calibrated Parameters. To match the empirical moments described above, the model disciplines three parameters internally: the discount factor β, the proportional adjustment cost on illiquid assets $\bar{\kappa}$, and the return spread $r^a - r^m$ between illiquid and liquid assets.

The discount factor is primarily pinned down by the overall level of wealth accumulation and is set to $\beta = 0.9785$, which is in line with the quantitative two-asset literature. For comparison, Kaplan and Violante (2014) set $\beta = 0.981$ in a closely related framework. Importantly, β plays a double role in the calibration: first, it helps match the level of typical (median) asset holdings; second, by governing households' long-run saving incentives, it pins down the overall accumulation of wealth and therefore shapes the

[6] In the model, median income equals 0.4720. Using the empirical median annual wage (or replacement income) of 39,040€ reported by Albacete et al. (2024), one model unit corresponds to exchange = 39,040€/0.4720 ≈ 82,712€. Hence, in monetary units $\kappa_0 = \text{exchange} \cdot 0.002 \approx 165$€.

[7] At the same time, a small fixed component of transaction costs is plausible in practice, since many asset adjustments entail administrative and filing fees that are independent of transaction size. For example, in Austria the registration of an ownership change in the land register involves a flat fee (e.g. 81€) that must be paid irrespective of the value of the transaction (see, https://www.oesterreich.gv.at/en/themen/bauen_und_wohnen/wohnen/8/Seite.210150). This provides a simple benchmark indicating that fixed costs of the order of magnitude implied by κ_0 are empirically reasonable.

[8] For reference, see https://www.statistik.at/en/statistics/national-economy-and-public-finance/national-accounts/gross-domestic-product-and-main-aggregates.

cross-sectional wealth distribution.

The proportional adjustment cost is calibrated to $\bar{\kappa} = 3.25\%$. This parameter governs the degree of sluggish rebalancing between liquid and illiquid assets and therefore the extent of inertia in illiquid positions. Finally, the implied return spread is $r^a - r^m = 1.495\%$ (annualized), hence $r^a = 2.555\%$, which compensates households for bearing the liquidity friction associated with illiquid asset holdings. Taken together, $\bar{\kappa}$ and $r^a - r^m$ are key for matching households' portfolio decomposition, i.e. the split between liquid and illiquid wealth.

3.3. Performance of the Benchmark Model

This chapter evaluates how well the benchmark model replicates key features of the Austrian wealth distribution and household portfolio composition, before analyzing the model-implied distribution of liquid and illiquid asset holdings, hand-to-mouth shares, and the composition of wealthy- and poor-HtM households.

Table 3.2 reports the model moments both targeted calibration moments and additional, non-targeted moments alongside their empirical counterparts. The model overstates median liquid wealth and understates median illiquid wealth. The wealth distribution is replicated quite well when it comes to the net wealth Gini coefficient (0.73 in the data and 0.7234 in the model) and the 90/50 ratio (6.3 vs. 8.26), however is too compressed for the middle 50% of the distribution (21.6 vs. 12.17).

As mentioned, the model matches the net-wealth Gini reasonably well, but it does not reproduce the observed concentration of wealth across the top 10%, middle 40%, and bottom 50%. Relative to the Austrian data for 2017, the model generates a wealth distribution that is too even: the top 10% hold too small a share of total wealth, while the bottom 50% hold a share that is almost twice as large as in the data. This discrepancy is not surprising in a deliberately stylized framework. Replicating the extreme concentration at the top typically requires additional sources of heterogeneity, such as discount-factor heterogeneity (Hubmer et al., 2021), heterogeneous returns to wealth (Guvenen et al.,

Table 3.2.: Targeted and Non-targeted Moments: Model versus Data

Panel A. Targeted Moments	Data	Model
Gini coefficient (net wealth)	0.73	0.7234
Median ratios (unconditional)		
A / Wages or Replacement Income	1.2871	1.0593
M / Wages or Replacement Income	0.3314	0.4301

Panel B. Non-targeted Moments	Data	Model
Top 10% net-wealth share	0.560	0.491
Mid 40% net-wealth share	0.404	0.44
Bottom 50% net-wealth share	0.036	0.069
90/50 wealth ratio	6.3	8.26
75/25 wealth ratio	21.6	12.17
Participation rates		
Net wealth: $Pr(a > 0 \vee m \neq 0)$	0.991	0.998
Illiquid asset ownership: $Pr(a > 0)$	0.877	0.896
Debt participation: $Pr(m < 0)$	0.122	0.259
Non-positive net wealth: $Pr(a + m \leq 0)$	0.047	0.179

Notes: Empirical moments are taken from Fessler et al. (2019) for wealth distribution measures and from Albacete et al. (2024) for participation rates, and unconditional median ratios.

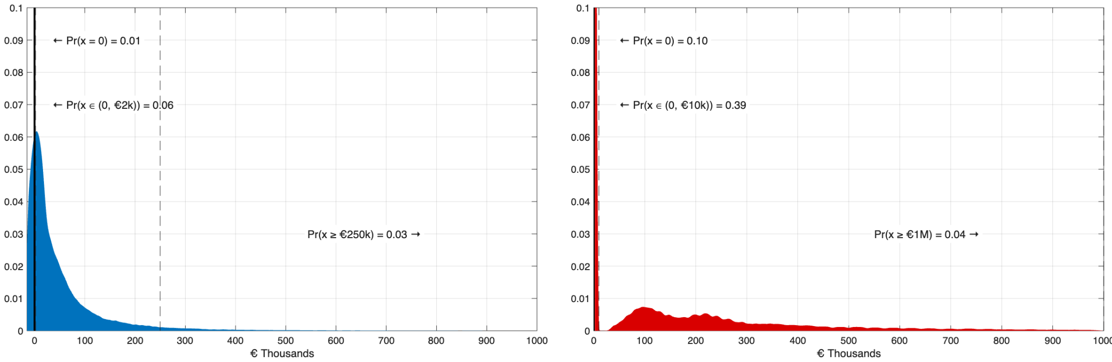
2023), or heterogeneity in entrepreneurial ability (Cagetti and De Nardi, 2006).

Wealth participation is high in both data and model (99.1% vs. 99.8%). However, the model substantially overpredicts indebtedness and low-wealth states. The fraction of households with negative liquid positions is more than twice as large as in the data, and the share with non-positive net wealth is almost four times as large.[9]

Liquid and illiquid asset holdings are positively but imperfectly correlated (0.6138), indicating that households with higher illiquid wealth tend to hold more liquid wealth on average, yet portfolio positions are far from moving one-for-one. In addition, illiquid wealth is much more dispersed: its standard deviation is 4.8, compared with 1.1 for

[9]The debt participation rate in Table 3.2 refers to households with credit overdrafts and credit card debt. It excludes mortgages and therefore corresponds most closely to negative liquid asset holdings in the model.

Figure 3.1.: Model-Implied Distributions of Net Wealth.



(a) Liquid Wealth Distribution (b) Illiquid Wealth Distribution

Notes: The curve shows smoothed histogram mass and conveys the shape of the stationary distribution. Annotated probabilities are computed from the unsmoothed distribution and are not comparable to the y-axis scale.

liquid wealth. Hence, cross-sectional heterogeneity in portfolios is driven primarily by variation in illiquid holdings—consistent with Figure 3.1, which reports the distribution of liquid and illiquid wealth. The imperfect co-movement between liquid and illiquid positions is also consistent with the presence of wealthy HtM households in the model: some households can hold substantial illiquid wealth while maintaining low or even zero liquid buffers.

HtM classification follows Kaplan et al. (2014) and Kaplan and Violante (2014), as described in section A.2. The model implies that 35.7% of households are hand-to-mouth (HtM), and that 83.3% of these HtM households are wealthy HtM. The aggregate HtM share is broadly consistent with the cross-country evidence: Kaplan et al. (2014) document shares of roughly one-third across advanced economies including Germany and the United Kingdom, which serves as the natural benchmark for Austria in the absence of a direct empirical estimate. The model substantially overpredicts debt participation, however: $\Pr(m < 0) = 0.259$ against 0.122 in the Austrian HFCS. As the policy analysis in chapter 4 shows, debt participation remains stable throughout the tax experiments, indicating that the excess borrowers are constrained for structural reasons independent of the tax system and do not drive the policy-induced variation in hand-to-mouth shares.

The model additionally overpredicts the fraction of wealthy HtM relative to the empirical shares reported in Kaplan et al. (2014). A likely explanation is visible in Figure 3.1: a large mass of households holds very small amounts of illiquid wealth. Under the HtM classification, these households are counted as wealthy as soon as illiquid holdings exceed zero, mechanically raising the share of wealthy HtM within total HtM.

The analysis is conducted in partial equilibrium, which has two related consequences for the interpretation of results. First, the tax experiments abstract from general-equilibrium feedback effects on asset prices and returns, wages, and the equilibrium supplies of liquid and illiquid assets. Higher demand for an asset would, in general equilibrium, bid up its price and lower its return, dampening further accumulation. Conversely, lower capital taxation raises the capital stock and wages, benefiting labor-income-dependent households. The welfare gains identified in section 4.2 should therefore be treated as reflecting household-side mechanisms rather than full general-equilibrium predictions, and are best interpreted as upper bounds on the true welfare effect. Partial-equilibrium analyses of this kind remain informative and widely used for isolating these mechanisms and maintaining discipline from micro evidence (Kaplan and Violante, 2014; Parker et al., 2013).

Second, and related, the partial-equilibrium setting prevents normalizing aggregate wealth holdings against macroeconomic aggregates such as GDP or national income, as a general equilibrium framework would permit. The calibration therefore relies on median-to-median ratios of asset holdings to wages or replacement income as portfolio targets. As the robustness analysis in Table A.3 shows, unconditional median ratios are sensitive to the fixed adjustment cost κ_0 in a way that means and participation rates are not—a consequence of the mass of households at or near zero liquid wealth rather than a structural weakness of the model. For the Austrian context, this is the best available empirical approach to replicating the household portfolio decomposition; Albacete et al. (2024) document the corresponding macroeconomic-aggregate normalization for euro area countries, which would be the natural calibration strategy in a general equilibrium model.

4. Tax Reform

In a seminal contribution, Ramsey (1927) shows that, to minimize the deadweight loss of taxation for a given revenue requirement, tax rates should be set inversely proportional to the compensated elasticities of each taxed base. While originally derived for commodity taxation, the rule extends to any taxed base, including factors of production and asset supplies. In the present context, households supply savings of different liquidity types, and the Ramsey rule prescribes lower tax rates on the more elastic asset base. Intuitively, a more elastic base responds more strongly to taxation, generating a larger distortion in quantities and hence a larger welfare loss per unit of revenue raised.

In the present framework, the "commodities" of interest are aggregate positive liquid holdings and aggregate illiquid holdings. A capital income tax alters the after-tax return and thereby affects households' savings and portfolio choices, which in turn determine aggregate asset holdings. Under Ramsey's inverse-elasticity rule, the key sufficient statistic for the distortionary cost of each tax instrument is therefore the elasticity of the corresponding aggregate holding with respect to its after-tax return. Formally, I compute

$$\varepsilon_i = \frac{dX_i}{dr_i^{eff}} \frac{r_i^{eff}}{X_i} = \frac{d\log X_i}{d\log r_i^{eff}}, \tag{4.1}$$

where X_i denotes either aggregate positive liquid holdings M^{pos} or aggregate illiquid holdings A, and $r_i^{eff} = (1-\tau^i)r^i$ denotes the corresponding after-tax return, and both elasticities are evaluated at the symmetric baseline $\tau^m = \tau^a = 0.275$.

A caveat is in order. The model imposes taxes on capital income flows rather than on asset holdings, yet the elasticities computed in (4.1) measure the response of asset stocks A and M^{pos} to their after-tax returns, not the response of the capital income flows that form the actual tax base. This distinction does not affect the implication, however: when the rate of return is homogeneous within an asset class, the capital income flow is simply proportional to the asset stock, so a proportional tax on capital income and a wealth tax are equivalent up to a scaling factor (Guvenen et al., 2023). The elasticity of the tax base with respect to the after-tax return therefore equals the elasticity of the asset stock, and the Ramsey rule applies unchanged.[1]

The elasticities in (4.1) are computed by perturbing after-tax returns while holding the lump-sum transfer fixed and recomputing the stationary distribution. By keeping transfers constant, the exercise isolates the direct behavioral response of households to return wedges, while abstracting from fiscal feedback through government budget closure. This abstraction, however, is innocuous in the present setting: as Figure A.4 shows, capital income tax revenue is quantitatively small relative to total revenue over the policy range studied, with labor taxation accounts for the largest share of government revenue. The income effect arising from any transfer adjustment needed to close the budget is therefore negligible relative to the substitution effect.

Quantitatively, I obtain an elasticity of M^{pos} with respect to r_m^{eff} of approximately $\varepsilon_M \approx 3.07$ and an elasticity of A with respect to r_a^{eff} of approximately $\varepsilon_A \approx 6.73$. This means that a 1% increase in the after-tax liquid return raises aggregate positive liquid holdings by about 3.07%, while a 1% increase in the after-tax illiquid return implies a 6.73% increase in aggregate illiquid holdings.

At first glance, the larger elasticity of aggregate illiquid holdings with respect to the after-tax illiquid return may seem surprising, since illiquid assets are subject to adjustment costs. This result becomes clear once we recognize that aggregate illiquid holdings can change through two distinct margins. The *extensive margin* refers to how many households choose to adjust their illiquid position in a given period: a higher after-tax return makes adjustment more attractive, increasing the fraction of households who find it worthwhile to pay the fixed adjustment cost κ and rebalance their illiquid account. The *intensive*

[1] Computing elasticities of the capital-income tax bases with respect to the after-tax return yields the same qualitative pattern as the one described above.

margin refers to how much a household moves its illiquid position conditional on adjusting: a higher after-tax return raises the target illiquid wealth level that an adjusting household optimally moves toward, so each adjustment episode involves a larger change in the stock.

These two margins need not move in the same direction or by the same magnitude in response to a change in the after-tax return. The adjustment cost κ compresses the extensive margin response: since households pay a fixed cost to adjust, only those for whom the gain from rebalancing exceeds κ will do so, and this threshold is not very sensitive to moderate changes in the return. The intensive margin, by contrast, is unconstrained once the adjustment decision is made: a household that has already decided to pay κ will move all the way to its optimal target, and that target is highly sensitive to the after-tax return. To further characterize $\varepsilon_A \approx 6.73$, I compute two standalone marginal elasticities with respect to r_a^{eff}: the elasticity of adjustment frequency, $\varepsilon_{\text{adj}} \approx 1.27$, and the elasticity of mean illiquid holdings conditional on adjusting, $\varepsilon_{\mathbb{E}[a'|\text{adj}]} \approx 7.93$. Adjustment frequency is comparatively inert, while the conditional target position is highly sensitive to the after-tax return, confirming that the aggregate response is driven by the intensive rather than the extensive margin. The adjustment cost therefore concentrates rather than suppresses the aggregate response: it leaves the extensive margin relatively inert while the intensive margin absorbs nearly the entire return wedge among those households who do adjust.

Following the logic of Ramsey (1927), the optimal tax rate on capital income from liquid assets should exceed that on capital income from illiquid assets. The reason is that tax rates are proportional to the inverse of the relevant elasticities:

$$\tau^a \propto \frac{1}{\varepsilon_A},\, \tau^m \propto \frac{1}{\varepsilon_M} \quad \text{and} \quad \tau^a < \tau^m. \tag{4.2}$$

4.1. One-Dimensional Tax Experiment

Before considering the proportional tax rates implied by the elasticity estimates, this subsection conducts a transparent one-dimensional deviation from the baseline tax system.

Specifically, I vary one capital-income tax rate, τ^i with $i \in \{a, m\}$, while holding the other fixed at its baseline value $\tau^j = 0.275$ for $j \neq i$, corresponding to Austria's flat capital income tax (KESt). The objective of this exercise is to identify which behavioral margins each instrument predominantly affects in a two-asset environment.

In the Austrian tax code, capital income generated by many illiquid asset categories is typically taxed under the progressive personal income tax schedule (with statutory rates up to 55%), whereas liquid capital income is commonly subject to the flat KESt. I abstract from progressivity to maintain transparency, I approximate capital income taxation by a flat rate $\tau^i \in [0.15, 0.55]$ in increments of 2.5 percentage points. This stylized experiment therefore traces out the equilibrium and welfare implications of moving from a symmetric tax regime to increasingly asymmetric regimes in which one asset class is taxed taxed differently than the other.

To aggregate welfare, I follow Boar and Midrigan (2023). First, I compute a consumption-equivalence measure employing

$$V_i = \sum_{t=0}^{\infty} \beta^t \frac{\omega_i^{1-\theta}}{1-\theta}, \tag{4.3}$$

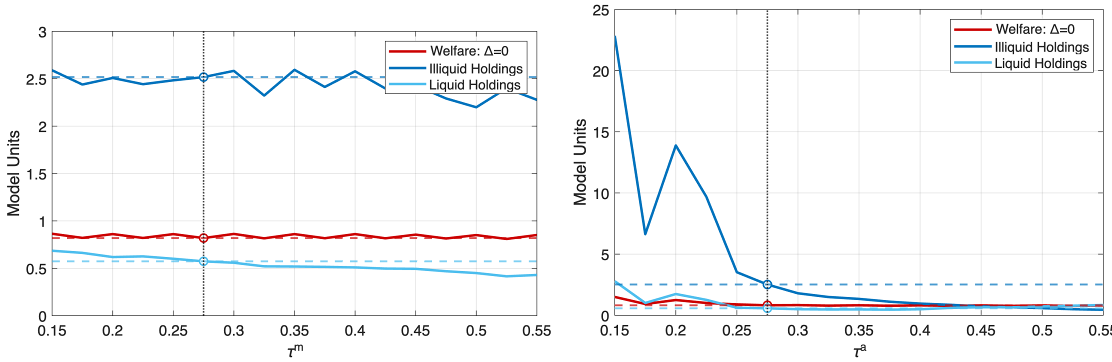
where V_i is the household's lifetime utility and ω_i is the constant consumption level that makes the household indifferent between its stochastic consumption path and a deterministic one. Individual welfare is then aggregated by

$$W = \left(\int_i \omega_i^{1-\Delta} \, \mathrm{d}i \right)^{\frac{1}{1-\Delta}}, \tag{4.4}$$

where Δ indexes the degree of inequality aversion of the social planner and governs the curvature of the social welfare function: higher values place greater weight on the welfare of worse-off households. Setting $\Delta = 0$ constructs average welfare, $\Delta = \theta$ corresponds to a Utilitarian planner whose weights coincide with the curvature of the utility function, and $\Delta \to \infty$ corresponds to a Rawlsian planner who maximizes the welfare of the worst-off household.[2]

[2] This aggregator nests the framework of Benabou (2002), who studies optimal redistribution under

Figure 4.1.: One-Dimensional Tax Change: Welfare and Aggregate Asset Holdings.



(a) Aggregate asset holdings (M and A) and welfare for varying τ^m, holding $\tau^a = 0.275$ fixed.

(b) Aggregate asset holdings (M and A) and welfare for varying τ^a, holding $\tau^m = 0.275$ fixed.

Notes: Dashed lines and open circles mark the symmetric-taxation baseline $\tau^m = \tau^a = 0.275$. The dotted vertical line indicates the baseline tax rate on the varied instrument.

Panels (a) and (b) of Figure 4.1 report aggregate welfare together with aggregate liquid and illiquid holdings when varying one tax rate at a time. When the liquid tax τ^m is varied holding $\tau^a = 0.275$ fixed (panel (a)), aggregate welfare is essentially flat over the explored range, and aggregate asset positions adjust only gradually. By contrast, varying the illiquid tax τ^a holding $\tau^m = 0.275$ fixed (panel (b)) generates a sharp response of illiquid wealth: increasing τ^a from low values to around the baseline leads to a pronounced contraction in A—with a spike at $\tau^a = 0.20$—, while the response of liquid holdings is more restrained. Consistent with this, welfare declines most visibly over the low-τ^a region and becomes much less sensitive once τ^a reaches moderate levels, despite continued (but smaller) balance-sheet adjustments.[3]

The welfare response to τ^m is restrained across the entire range, as is the response to comparatively high τ^a once illiquid wealth has already been eroded. Two features of the model account for this pattern. First, many households hold little wealth and therefore earn little capital income relative to labor earnings, so changes in the after-tax return affect only a small share of total household income. Second, and more fundamentally, the primary margin of adjustment in a two-asset model with adjustment costs is the

heterogeneous agents using a generalized social welfare function of this form.

[3]This qualitative pattern is robust across alternative social welfare specifications; see Figure A.3.

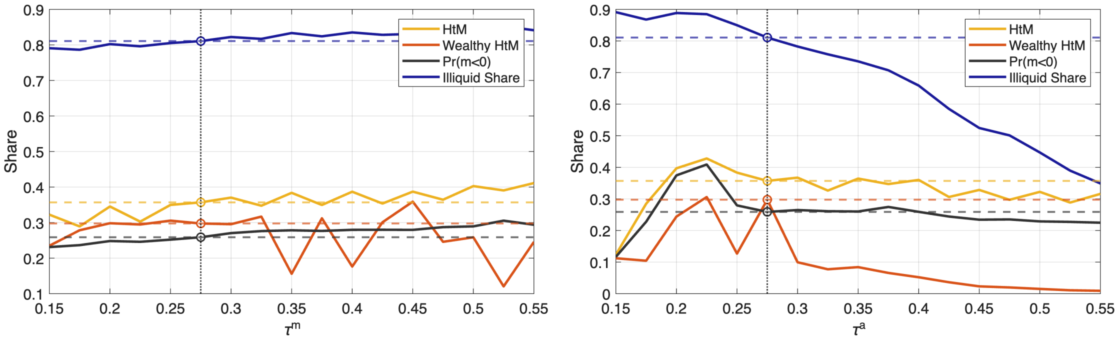
balance-sheet rather than consumption. When after-tax returns change, households do not immediately cut consumption; instead they reoptimize their portfolio—reducing liquid balances, adjusting debt, or moving to a new illiquid target position when in an adjustment window. These balance-sheet responses absorb the return wedge without requiring large changes in consumption paths, which is why welfare remains comparatively flat. The exception is the low-τ^a region, where the intensive margin of illiquid adjustment is large and the composition effect amplifies the welfare impact: at low τ^a households hold substantially more illiquid wealth, so capital income constitutes a larger share of total income and changes in τ^a directly affect a more economically relevant income component.

The limited substitution between liquid and illiquid assets on aggregate may further reflect portfolio adjustment costs and the prevalence of financially constrained households at corner solutions: if a sizable fraction holds zero illiquid wealth or minimal liquid balances, an interior portfolio-choice margin is absent and changes in relative after-tax returns generate only limited reallocation across asset classes.[4]

Panels (a) and (b) of Figure 4.2 turn to the liquidity/insurance margin by reporting the total hand-to-mouth (HtM) share and the wealthy-HtM share, alongside the probability of holding negative liquid wealth $\Pr(m < 0)$ and the illiquid share of aggregate wealth. Varying τ^m (panel (a)) yields a gradual and largely monotonic increase in the overall HtM share as τ^m rises above the baseline: taxing liquid returns reduces the attractiveness of liquid buffers, pushing more households toward low-liquid-wealth positions and weakening short-run self-insurance. The wealthy-HtM share responds in a markedly less regular way, exhibiting pronounced oscillations across the range, reflecting heterogeneous and sensitive portfolio adjustments among households with substantial illiquid positions. The illiquid share and $\Pr(m < 0)$ remain comparatively stable throughout, indicating that τ^m leaves the broad structure of illiquid accumulation largely intact. However, the comparatively stable $\Pr(m < 0)$ reveals that households who hold debt for large τ^m also do so when τ^m is comparatively small. Independent of the level of income taxation on liquid assets

[4] Only at comparatively high τ^a does visible substitution from illiquid to liquid assets on aggregate emerge, as the eroded return r^a induces households to reallocate toward liquid savings.

Figure 4.2.: One-Dimensional Tax Change: Liquidity Constraints and Portfolio Composition.



(a) Hand-to-mouth shares, debt participation, and illiquid wealth share for varying τ^m, holding $\tau^a = 0.275$ fixed.

(b) Hand-to-mouth shares, debt participation, and illiquid wealth share for varying τ^a, holding $\tau^m = 0.275$ fixed.

Notes: Dashed lines and open circles mark the symmetric-taxation baseline $\tau^m = \tau^a = 0.275$. The dotted vertical line indicates the baseline tax rate on the varied instrument.

within this experiment, it is optimal for approximately a quarter of households to be in debt.

Varying τ^a (panel (b)) produces a strikingly different pattern. The illiquid share falls sharply and monotonically as τ^a rises above the baseline, declining from roughly 0.9 at low τ^a to around 0.35 at the upper end of the range. Higher illiquid income taxation reduces illiquid accumulation and thus the mass of households with both low liquid wealth and sufficiently high illiquid wealth to be classified as wealthy HtM. Accordingly, the wealthy-HtM share falls and converges toward zero as τ^a rises well beyond the baseline, while the overall HtM share is comparatively flat and hovers near its baseline level across most of the range. $\Pr(m < 0)$ similarly stabilizes slightly below its baseline after an initial decline. Taken together, the four panels reveal a clear division of labor: τ^m operates primarily through the liquidity and self-insurance channel, gradually raising HtM prevalence while leaving portfolio composition broadly unchanged, whereas τ^a affects both margins, dramatically reshaping portfolio composition through the illiquid accumulation channel and converting wealthy HtM into poor HtM households as illiquid buffers erode under high τ^a.

These results are consistent with Ramsey's inverse-elasticity logic: illiquid holdings respond strongly to τ^a while liquid holdings and HtM shares exhibit a weaker and less systematic response to τ^m, directly motivating lower tax rates on the more elastic base.

4.2. Ramsey-Type Tax Policy

The elasticity estimates in the previous subsection suggest that liquid and illiquid asset taxes differ markedly in their distortionary effects, motivating a Ramsey-style restriction on their relative taxation. The restriction is best viewed as a benchmark that minimizes the distortion to aggregate asset holdings for a given amount of revenue raised, by tying relative tax rates to the observed elasticities of the asset supply.

The appeal of this restriction is twofold. First, it provides a transparent benchmark: by fixing relative tax rates according to the inverse-elasticity rule, the schedule holds the distortionary cost of the two instruments constant across values of ν, so that variation in welfare along the schedule reflects the insurance and liquidity margins rather than changes in relative distortions. Second, it keeps the policy analysis low-dimensional, which is valuable in the present setting where the two instruments load on different margins (see section 4.1): τ^m primarily affects liquidity and short-run self-insurance, while τ^a primarily affects long-run illiquid accumulation. The Ramsey schedule fixes the relative rates according to (4.2) and then varies only the overall intensity of taxation, allowing the subsequent analysis to assess how welfare and liquidity outcomes evolve along a clearly interpretable policy dimension.

To be specific, I consider a one-parameter family of capital-income tax systems in which tax rates are inversely proportional to the relevant return elasticities. The guiding idea is that the more elastic base should face a lower tax rate, because taxing it induces a larger quantity distortion per unit of tax revenue. Letting $\nu \in [0.5, 2]$ index the overall intensity of capital income taxation along this restricted schedule, I impose

$$\tau^m(\nu) = \frac{\nu}{\varepsilon_M} \qquad \text{and} \qquad \tau^a(\nu) = \frac{\nu}{\varepsilon_A}, \tag{4.5}$$

where ε_M denotes the elasticity of aggregate positive liquid holdings M^{pos} with respect to the after-tax liquid return r_m^{eff} and ε_A denotes the elasticity of aggregate illiquid holdings A with respect to the after-tax illiquid return r_a^{eff}. Varying ν scales both tax rates up or down while keeping their ratio fixed at the Ramsey-implied value

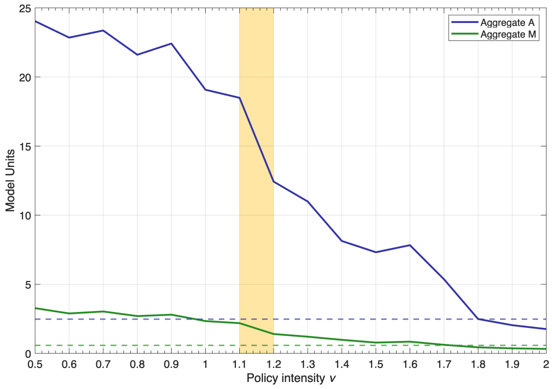
$$\frac{\tau^a(\nu)}{\tau^m(\nu)} = \frac{\varepsilon_M}{\varepsilon_A} < 1. \tag{4.6}$$

In what follows, I evaluate welfare, aggregate asset holdings M and A, and hand-to-mouth shares along the policy schedule (4.5); the complete tax schedule is reported in Table 4.1. This exercise is not meant to characterize a globally optimal tax system. Instead, it provides a transparent check of whether tying relative tax rates to the inverse-elasticity rule delivers sensible welfare predictions, given the asymmetric responses documented in section 4.1: both accumulation and liquidity margins respond strongly to τ^a, while responses to τ^m are moderate at best.

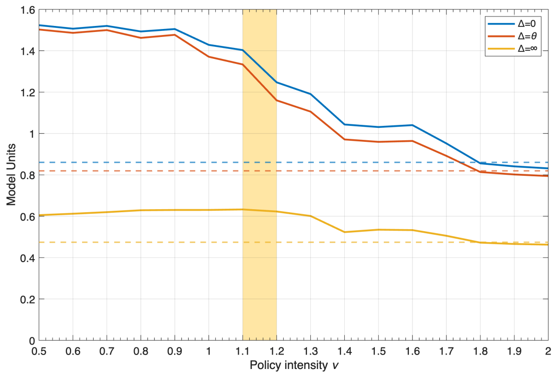
In Figure 4.3 panel (a) plots aggregate illiquid holdings (A) and aggregate liquid holdings (M) against ν; panel (b) plots the corresponding welfare under all three social preference criteria, with dashed horizontal lines marking the welfare each criterion assigns to the symmetric baseline $\tau^m = \tau^a = 0.275$. The two panels are best read together: the aggregate series in (a) identify the mechanisms, and the welfare series in (b) record their consequences.

The level difference between the Ramsey schedule and the symmetric baseline is the first thing to explain. At $\nu = 0.5$, panel (a) shows that aggregate illiquid holdings $A \approx 24$, roughly ten times the symmetric-baseline level of $A \approx 2.5$, and aggregate liquid holdings $M \approx 3.3$ also exceed their baseline of approximately 0.7. The Ramsey asymmetry by lowering τ^a disproportionately preserves the after-tax return on the asset households use for long-horizon accumulation and medium-run self-insurance, inducing high illiquid wealth that would not form under a symmetric tax. Simultaneously, the moderate liquid income tax leaves short-run buffers intact. Both the accumulation and liquidity channels operate closer to their undistorted configuration simultaneously, which accounts for the magnitude of the welfare gain visible in panel (b): average welfare $W^{avg} \approx 1.52$ lies

Figure 4.3.: Welfare and Aggregate Asset Holdings along the Ramsey Schedule.



(a) Aggregate liquid and illiquid asset holdings along the Ramsey schedule.



(b) Aggregate welfare under three social preference regimes along the Ramsey schedule.

Notes: Dashed lines correspond to the symmetric taxation baseline $\tau^m = \tau^a = 0.275$. Social preference regimes: (i) Average ($\Delta = 0$); (ii) Utilitarian ($\Delta = \theta$); (iii) Rawlsian ($\Delta \to \infty$). The orange band marks the liquidity threshold.

roughly 75% above its symmetric-baseline counterpart of $W^{avg} \approx 0.86$, and this gain is robust for the Utilitarian case. In the present setting, however, the welfare gains should be interpreted as an upper bound rather than a policy prediction, as the partial equilibrium model abstracts from any feedback on prices (and wages) that would partially offset the accumulation incentive in a general equilibrium.

Table 4.1 reveals how the high aggregate A at low ν is achieved. Adjustment frequency is low (≈ 0.09) while conditional size $\mathbb{E}[a' \mid \text{adj}]$ is large (≈ 19), i.e. households adjust infrequently but move to large target positions when they do. This is the intensive-margin amplification underlying $\varepsilon_A > \varepsilon_M$: the high after-tax illiquid return makes each adjustment episode worth moving far, even though adjustment costs keep frequency low. The adjustment cost concentrates rather than suppresses the response.

Panel (a) further shows that aggregate illiquid holdings are not monotone declining from $\nu = 0.5$: A rises to a local peak at $\nu = 0.7$, dips at $\nu = 0.8$, and partially recovers at $\nu = 0.9$ before falling sharply, while M is broadly flat over this range. This non-monotonicity in the accumulation margin is the mechanism behind the corresponding pattern in panel (b), where W^{avg} (and W^U) traces the same local peak and partial

Table 4.1.: Tax Rates, Adjustment Frequency, and Conditional Adjustment Size along the Ramsey Schedule

ν	$\tau^m(\nu)$	$\tau^a(\nu)$	Adj. freq.	$\mathbb{E}[a' \mid \text{adj}]$	Regime
0.5	0.163	0.074	0.087	18.99	Pre-threshold
0.6	0.195	0.089	0.097	18.15	Pre-threshold
0.7	0.228	0.104	0.093	18.44	Pre-threshold
0.8	0.260	0.119	0.115	14.94	Pre-threshold
0.9	0.293	0.134	0.112	15.54	Pre-threshold
1.0	0.326	0.149	0.174	8.85	Pre-threshold
1.1	0.358	0.163	0.240	6.35	Threshold
1.2	0.391	0.178	0.419	2.56	Threshold
1.3	0.424	0.193	0.423	2.31	Post-threshold
1.4	0.456	0.208	0.130	4.99	Post-threshold
1.5	0.489	0.223	0.448	1.45	Post-threshold
1.6	0.521	0.238	0.476	1.46	Post-threshold
1.7	0.554	0.253	0.427	1.00	Post-threshold
1.8	0.586	0.268	0.043	3.51	Post-threshold
1.9	0.619	0.282	0.044	2.93	Post-threshold
2.0	0.651	0.297	0.048	2.26	Post-threshold

Notes: $\tau^m(\nu) = \nu/\varepsilon_M$ and $\tau^a(\nu) = \nu/\varepsilon_A$ are the Ramsey tax rates from (4.5) with $\varepsilon_M \approx 3.07$ and $\varepsilon_A \approx 6.73$. Adj. freq. is the fraction of households adjusting their illiquid position in a given period. $\mathbb{E}[a' \mid \text{adj}]$ is the mean illiquid holding conditional on adjustment. Regime classification refers to the liquidity threshold at $\nu \approx 1.1$–1.2 (orange band in Figure 4.4). All quantities computed from the stationary distribution at each ν.

recovery.[5] The mechanism is a race between the rising cost of liquid buffers—τ^m rising from 0.163 to 0.293—and the growing lump-sum transfer financed by capital income tax revenue.[6]

[5]The Rawlsian criterion W^R peaks at the left edge of the liquidity threshold, $\nu \approx 1.1$. The logic is distinct: the worst-off household holds no capital, so it gains nothing directly from high aggregate illiquid holdings and is unaffected by the collapse of the accumulation channel. It benefits exclusively from the lump-sum transfer financed by capital income taxes. The Rawlsian planner therefore pushes ν further than the average or utilitarian planners—tolerating the accumulation decline visible in panel (a)—stopping only when the transfer itself begins to shrink as the capital income base erodes inside the band and simultaneously the HtM threshold is crossed. The Rawlsian peak at $\nu \approx 1.1$ is not a preference for moderate redistribution but an equilibrium constraint: redistribution through capital income taxation is bounded above by the point at which the instrument financing it destroys the base it draws upon.

[6]Figure A.4 plots tax revenue against ν, which resembles a Laffer curve peaking at $\nu \approx 0.9$. In the partial equilibrium setting, however, the majority of the tax burden is carried by labor income rather than capital income, a consequence of inelastic labor supply and the income normalization. The revenue figures should therefore be interpreted as illustrative of the distortionary pattern along the Ramsey

The critical event is the *liquidity threshold* (see below) between $\nu = 1.1$ and $\nu = 1.2$. Panel (a) shows that both aggregate illiquid holdings and aggregate liquid holdings collapse simultaneously. This simultaneous collapse, rather than a sequential failure of one channel after another, is the mechanism behind the sharp decline in welfare in panel (b). Both the accumulation channel and the liquidity channel are impaired at the same point because the Ramsey schedule ties the two tax rates together through the fixed ratio in (4.6): a rise in ν raises both rates proportionally, so the threshold that triggers the HtM jump (see Figure 4.4 panel (a)) and the level of τ^a that begins materially impairing illiquid investment are crossed almost simultaneously.

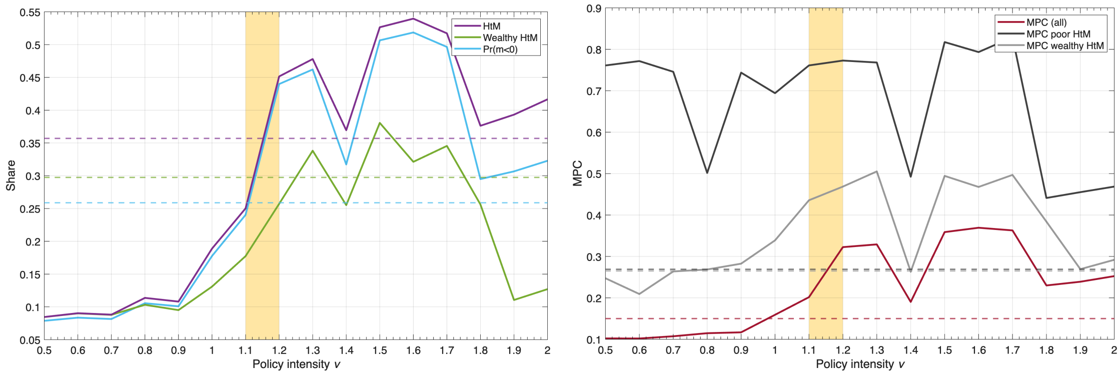
Figure 4.4 panel (a) plots total HtM, wealthy HtM, and $\Pr(m < 0)$ against ν, with dashed lines at their respective symmetric-baseline levels.

A central result is the *liquidity threshold*: between $\nu = 1.1$ and $\nu = 1.2$, total HtM and $\Pr(m < 0)$ jump from $\approx 25\%$ to $\approx 45\%$, with a gradual increase even before the threshold. This is not a smooth response to rising tax rates but a discrete regime shift. The mechanism is a bunching effect in the liquid wealth distribution: low τ^a has induced many households to hold thin liquid buffers alongside large illiquid positions, constructing a large mass near the zero-liquid-wealth boundary by design. When τ^m crosses the critical level inside the orange band, the net return on liquid savings falls below the cost of borrowing and these households drain their buffers simultaneously. That $\Pr(m < 0)$ jumps simultaneously in almost identical magnitude with total HtM confirms that the newly constrained households do not merely land at zero liquid wealth, they overshoot into borrowing. The threshold is therefore not a gradual erosion but a tipping point, and its size is a direct consequence of how compressed the pre-threshold distribution is.

The adjustments to the left the threshold are equally telling. At $\nu = 0.5$–1.0, total HtM is roughly 8–10%, less than one-quarter of the 36% symmetric-baseline level, while τ^m is not far from 27.5% in absolute terms. The gain comes entirely from low τ^a: a higher

schedule rather than as quantitative predictions about capital tax revenues. With inelastic labor supply, a planner would optimally shift all of the tax burden towards labor and leave capital income untaxed—a result that holds even in richer environments with heterogeneous agents, incomplete markets, and multiple asset classes, as Nakajima (2020) confirms in his robustness analysis.

Figure 4.4.: Hand-to-Mouth Shares and Consumption Behavior along the Ramsey Schedule.



(a) Hand-to-mouth shares and debt participation along the Ramsey schedule.

(b) Marginal propensity to consume for all households, poor hand-to-mouth, and wealthy hand-to-mouth along the Ramsey schedule.

Notes: The dashed lines correspond to the baseline value implied by symmetric taxation of $\tau^m = \tau^a = 0.275$; The orange bar marks the liquidity threshold.

after-tax illiquid return induces households who would otherwise sit at the liquid-wealth boundary to build deep illiquid buffers and exit the HtM region. The near-identity of $\Pr(m < 0)$ and total HtM at low ν further reveals that the households who remain constrained do so for structural reasons—income risk and the borrowing spread—not because of the tax system. This is the irreducible HtM share: the floor below which no feasible capital income tax policy can push the constrained fraction.

After the jump, the wealthy HtM share diverges from total HtM and $\Pr(m < 0)$, rising more gradually and with greater variability. These are households in mid-transition: liquid buffers exhausted but illiquid positions not yet eroded. As τ^a continues rising, illiquid positions drift down through particularly low adjustments, and wealthy HtM households progressively become poor HtM. This rotation is visible in Figure 4.4(a): wealthy HtM collapses sharply between $\nu = 1.7$ and $\nu = 1.9$, while total HtM drops less severely and partially recovers toward $\nu = 2.0$. Each step of this transition matters disproportionately for welfare: moving from wealthy to poor HtM does not merely relabel a household, it removes the only remaining insurance mechanism it possesses.

Figure 4.4 panel (b) reports aggregate MPC, MPC of poor HtM, and MPC of wealthy

HtM against ν. At the symmetric baseline $\tau^m = \tau^a = 0.275$, the model generates an aggregate MPC of 0.15, with poor and wealthy HtM households exhibiting near-identical baseline MPCs of 0.269 and 0.265 respectively; the MPC computation follows the transitory-shock procedure described in section A.2. The persistently high MPC of poor HtM households is not a policy result but a structural one. These households are at the borrowing limit and would optimally increase their debt position further if the constraint permitted: the windfall does not trigger debt repayment but is consumed immediately, since the constrained household's marginal utility of current consumption far exceeds the return to saving. What the tax system governs is how many such households exist, not their individual MPC. At $\nu = 0.5$ this group is tiny, and aggregate MPC ≈ 0.10 reflects this—well below its symmetric-baseline level.

The more informative series is MPC of wealthy HtM, which at low ν sits at or below its symmetric-baseline value of 0.27. These households are liquid-constrained but not wealth-constrained: the illiquid buffer provides a credible medium-run backstop against sufficiently severe or persistent income losses, functioning as a second-line buffer that activates only once the liquid account is exhausted and the shock is large enough to justify paying the adjustment cost.[7] Households therefore need not consume every windfall immediately, since they retain the option to adjust their illiquid position if conditions deteriorate sufficiently. Low τ^a raises the payoff to maintaining that committed position, further moderating their MPC, direct evidence that the accumulation channel is working: households self-insure through the illiquid asset even while short-run liquidity constrained. After the threshold, the MPC of wealthy HtM rises sharply to 0.43–0.51 as τ^a erodes the illiquid backstop, reflecting the progressive loss of second-line insurance as illiquid positions drift downward through non-adjustment.

The simultaneous drop in all MPC series at $\nu \approx 1.8$ reflects an adjustment freeze: with virtually no household finding it optimal to incur the transaction cost, the rotation from wealthy to poor HtM that was driving aggregate MPC upward is ceased. Beyond this

[7] This inaction region—within which households absorb ordinary income fluctuations through the liquid account and leave the illiquid position intact—arises from the fixed adjustment cost κ and follows the upper-level–lower-level logic of Caballero (1993).

point, the after-tax return on illiquid assets no longer justifies paying the fixed adjustment cost κ: households neither accumulate illiquid wealth as a long-run store of value nor draw on it as a buffer against income losses, so the asset plays no active role in portfolio choice.

It should be noted, however, that the persistently higher MPC of poor HtM households relative to wealthy HtM stands in contrast to Kaplan et al. (2014), who find the reverse ordering empirically. As established above, poor HtM households in this model bind against the borrowing constraint with no offsetting buffer, generating a structurally elevated MPC. Kaplan et al. (2014) attribute the empirical reversal to mortgage leverage: debt service continuously drains the liquid account regardless of income, so windfalls are consumed immediately to meet the next payment rather than retained as a buffer—a channel the present model abstracts from.

Taken together, the results in this section have a clear implication for tax policy. The case for taxing illiquid capital income lightly is well understood from the Ramsey logic: since aggregate illiquid holdings are more elastic with respect to their after-tax return than aggregate liquid holdings are with respect to theirs, taxing illiquid capital income generates a larger quantity distortion per unit of revenue raised, and the optimal rate is therefore lower on the more elastic base. What the two-asset model adds is an insurance argument. Low τ^a not only reduces accumulation distortions but actively restructures who is liquidity constrained, compressing the HtM share to levels far below what any plausible liquid tax can achieve. This compression operates through the illiquid buffer mechanism established above: low τ^a raises the payoff to maintaining a committed illiquid position, extending the second-line insurance that keeps households out of the borrowing-constrained state in which the MPC is structurally elevated. The policy recommendation is therefore asymmetric in both direction and priority. Reduce the effective tax rate on illiquid capital income first, and calibrate the liquid rate second. This rule comes with an important qualification, however, as welfare is non-monotone in overall tax intensity, and beyond the liquidity threshold both channels deteriorate simultaneously, so the insurance gains from low τ^a are only realized at moderate levels of overall capital income taxation. Austria's current tax code may achieve the right sign of this asymmetry through exemptions and deductions on illiquid assets, a question taken up in the following section.

4.3. The Case of Austria

Table A.4 summarizes the current Austrian tax system for liquid and illiquid assets. Liquid assets are subject to the *Kapitalertragsteuer* (KESt), a flat tax of 25% or 27.5% on capital income depending on the specific asset type. The taxation of illiquid assets is more heterogeneous: capital gains from a primary residence are fully exempt under certain holding-period conditions; other real estate is subject to the *Immobilienertragsteuer* of 30%; self-constructed real estate is exempt entirely; and private company shares are taxed analogously to other capital gains. Business ownership and retirement accounts fall under progressive personal income taxation, for which the code provides substantial deductions—special expenses (*Sonderausgaben*) and extraordinary burdens (*außergewöhnliche Belastungen*)—that reduce the effective tax base. On paper, certain illiquid assets appear more heavily taxed because statutory rates under the progressive schedule can exceed the flat KESt. In practice, once exemptions and deductions are applied, the effective tax burden on illiquid capital income is frequently lower than on liquid capital income even for households in the highest marginal bracket.

This de facto asymmetry—lower effective rates on illiquid capital income—is qualitatively aligned with the Ramsey rule derived in section 4.2: the more elastic asset base should bear the lower tax rate, and illiquid holdings are roughly twice as elastic as liquid holdings in the model. To this extent, the Austrian tax code moves in the right direction. The asymmetry is achieved obscurely, however, through a patchwork of categorical exemptions rather than a coherent rate schedule, which raises two concerns. First, the effective degree of asymmetry varies substantially across asset categories and household types, so the average effective rate differential may be smaller or larger than the Ramsey-implied ratio in (4.6) for any given household. Second, the exemptions are concentrated on owner-occupied housing—the primary residence exemption is unconditional for self-constructed property and conditional on holding periods for others—which means the effective tax advantage accrues disproportionately to homeowners. This is consistent with Nakajima (2020), who shows in a calibrated U.S. overlapping-generations model that preferential tax treatment of owner-occupied housing implicitly subsidizes wealthier homeowners at the expense of lower-income renters—a distributional asymmetry that capital income tax policy alone cannot easily correct.

This creates a tension with the insurance logic developed in the previous section. The model predicts that low τ^a is welfare-improving primarily through its effect on the equilibrium wealth distribution, as it converts liquidity-constrained households into self-insured ones by making illiquid accumulation attractive. For this mechanism to operate broadly, the tax advantage must be accessible to households across the wealth distribution who are considering illiquid investment. A tax exemption concentrated on owner-occupied housing is accessible only to households who already own or can afford to purchase their primary residence. In Austria, this is roughly half the population: Fessler et al. (2025) report a homeownership rate of approximately 48.2% in the HFCS 2023, and by Eurostat Austria's rate of 54.5% remains well below the EU average of 69.1% in 2024. Moreover, Fessler et al. (2025) note that in Austria homeownership is often achieved through intergenerational transfers rather than saving out of current income, further concentrating the tax advantage among already-wealthy households. The households most in need of illiquid accumulation incentives—those currently renting and asset-poor—are precisely those least able to access the primary residence exemption.

Recent policy assessments reinforce this concern. Fessler et al. (2023) state that the tax system favors home-ownership over renting. Causa et al. (2019) reach similar conclusions and argue that the design is grounded in neither efficiency nor equity considerations. IMF (2025) find that property tax revenues in Austria are far below the EU average and property valuations are outdated. Hence, they recommend elevating the property tax, shifting part of the fiscal burden from labor toward property and inheritance. Taken together, these evaluations suggest that the current asymmetry in capital income taxation—while directionally correct from a Ramsey standpoint—is both insufficiently large and poorly targeted: it subsidizes a particular form of illiquid wealth accumulation (homeownership) rather than illiquid capital income broadly, and it does so in ways that reproduce rather than reduce existing wealth concentration—captured by the highly unequal distribution of wealth in Austria.

The findings in this thesis should be interpreted with the partial-equilibrium scope of the analysis in mind. Asset returns, wages, and equilibrium asset supplies are taken as exogenous throughout: the model isolates household-side responses to tax wedges but abstracts from the general-equilibrium feedback that a tax reform would trigger. In general equilibrium, a reduction in τ^a would raise the after-tax return to illiquid accumulation, increase household demand for illiquid assets, and through higher asset prices compress the pre-tax return, which dampens the accumulation incentive the policy intends to create. Further, in a general equilibrium model higher illiquid capital raises the capital-labor ratio and wages, which benefits labor-income-dependent households and reinforces the insurance channel. These two forces work in opposite directions, and the partial-equilibrium framework cannot resolve their net effect.

Further, the model treats illiquid wealth as a single, homogeneous asset. In reality, however, the illiquid asset space is heterogeneous in liquidity, return profiles, adjustment costs, and motives for holding: business equity, retirement accounts, real estate, and vehicles differ conceptually and empirically in ways that a single asset cannot capture. Fessler et al. (2019) document that participation rates vary sharply across these categories in Austria—vehicle ownership is near-universal while self-employment equity is concentrated at the top of the wealth distribution—so a uniform adjustment cost and return profile is a strong simplification. On the tax side, the heterogeneity is equally pronounced: effective rates differ across categories once exemptions and deductions are applied, as discussed above. The Ramsey rule applies to the aggregate elasticity ε_A, which pools all illiquid assets into a single behavioral response, and disaggregating it across asset categories would require cross-asset elasticities that the present data and model cannot separately identify.

5. Conclusion

Under prevalence of high wealth inequality, stagnating real median income, and elevated consumption sensitivity in Austria, this thesis studied the welfare and distributional effects of asymmetric Ramsey-type capital income taxation in a two-asset incomplete markets model calibrated to Austrian household data. Austria's current tax code potentially aligns with what the analysis recommends, but does so obscurely: illiquid asset income benefits from categorical exemptions and deductions that reduce the effective burden below the statutory rate, while liquid asset income faces a flat tax with no equivalent relief.

The model generates a higher aggregate elasticity for illiquid than for liquid asset holdings with respect to the corresponding after-tax return, implying under the Ramsey rule that illiquid capital income should bear the lower tax rate. This result is driven by the intensive margin—the size of illiquid adjustments conditional on adjusting—rather than by adjustment frequency, which responds only modestly. Illiquid assets are therefore more elastic with respect to their after-tax return than liquid assets despite infrequent rebalancing: when households do adjust, they move in large discrete steps.

Imposing the Ramsey rule along a one-parameter schedule indexed by overall tax intensity ν, the analysis identifies a critical liquidity threshold at $\nu \approx 1.1$–1.2. Below the threshold, welfare gains are substantial across all three social preference criteria, with the aggregate welfare measure reaching an upper bound of approximately 1.52 at $\nu = 0.5$ against a symmetric baseline of 0.86. This improvement is driven by two reinforcing channels. Low τ^a raises the payoff to illiquid accumulation, compressing the hand-to-mouth share from around 36% at the symmetric baseline to below 10% at low policy intensity. Simultaneously, the illiquid buffer functions as a second-line insurance device:

households facing severe or persistent income losses draw on their illiquid position rather than cutting consumption immediately, moderating the MPC of wealthy hand-to-mouth households.

Beyond the threshold, both channels deteriorate simultaneously as both tax rates rise proportionally along the schedule. The hand-to-mouth share jumps from approximately 10% to 45%, debt participation rises in lockstep, and aggregate illiquid holdings collapse. A further consequence is a rotation within the hand-to-mouth population: as τ^a erodes illiquid holdings, wealthy hand-to-mouth households transition into poor hand-to-mouth status, losing the illiquid backstop that moderated their consumption response.

Evaluated against the Austrian tax code, the Ramsey rule is directionally consistent with current practice but points to two deficiencies. The asymmetry is achieved obscurely through categorical exemptions concentrated on owner-occupied housing, benefiting the approximately 55% of Austrian households who own their home while leaving renters—precisely the households most in need of illiquid accumulation incentives—without equivalent relief. The effective tax asymmetry implied by current Austrian rates may also be insufficiently large, though the partial-equilibrium scope and the homogeneous treatment of illiquid wealth limit the precision of this comparison.

These constraints bound the quantitative magnitude of the findings but not their direction: the insurance-channel mechanism and the Ramsey prescription for lower effective rates on illiquid relative to liquid capital income survive as qualitative benchmarks. Two natural extensions follow: disaggregating illiquid wealth into productive and non-productive components to permit asset-specific Ramsey tax rates, and embedding the model in general equilibrium with a firm sector, which would endogenize asset returns, wages, and the capital stock and allow the welfare gains to be evaluated net of asset-price feedback.

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A. Appendix

A.1. Solving the Households' Problem

To solve the households' optimization problem $V_{it}(\mathbf{s}_{it}) = \max\{V_{it}^0(\mathbf{s}_{it}), V_{it}^1(\mathbf{s}_{it})\}$ we must analyze (3.4) and (3.5) separately.

(i) No-Adjustment-case: The Lagrangian (written recursively) is

$$\begin{aligned}\mathcal{L}(c, m'; \lambda, \gamma) = \frac{c^{1-\theta}}{1-\theta} &+ \beta\,\mathbb{E}[V'] + \lambda[(1-\tau^y)\,w\,y + \big(1+\tilde{r}^m(m)\big)\,m \\ &+ T - \big((1+\tau^c)\,c + m'\big)] + \gamma[a' - (1+(1-\tau^a)\,r^a)a] \\ &- \mu(m' + \underline{m'}(y)).\end{aligned} \tag{A.1}$$

The corresponding first-order conditions are

$$\frac{\partial \mathcal{L}}{\partial c} = c^{-\theta} - \lambda(1+\tau^c) \overset{!}{=} 0 \;\Leftrightarrow\; \lambda = \frac{c^{-\theta}}{1+\tau^c}; \tag{A.2}$$

$$\frac{\partial \mathcal{L}}{\partial m'} = \beta\mathbb{E}[V'_{m'}] - \lambda - \mu \overset{!}{=} 0; \tag{A.3}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = (1-\tau^y)\,w\,y + \big(1+\tilde{r}^m(m)\big)\,m + T - (1+\tau^c)c - m' \overset{!}{=} 0;$$

$$\frac{\partial \mathcal{L}}{\partial \gamma} = a' - (1+(1-\tau^a)\,r^a)\,a \overset{!}{=} 0;$$

$$\frac{\partial \mathcal{L}}{\partial \mu} = m' \geq -\underline{m'}(y). \tag{A.4}$$

The Kuhn-Tucker system for m' is

$$\begin{cases} m' > -\underline{m'}(y) : \mu = 0 \Rightarrow \beta\mathbb{E}[V'_{m'}] = \lambda; \\ m' = -\underline{m'}(y) : \mu > 0 \Rightarrow \beta\mathbb{E}[V'_{m'}] \leq \lambda. \end{cases}$$

From the Envelope theorem it follows that (A.3) can be expressed as

$$\beta\mathbb{E}[V'_{m'}] = \beta\,\mathbb{E}[\lambda'\big(1 + \tilde{r}^m(m')\big)]. \tag{A.5}$$

Importantly, when the adjustment branch is considered later, it will become clear that the marginal value of an additional unit of m' in the next period does not depend on whether the household adjusts or not. Combining (A.2), (A.5), and the Kuhn-Tucker conditions yield the Euler (in)equality

$$1 \begin{cases} = \beta\mathbb{E}[\big(\frac{c'}{c}\big)^{-\theta}\big(1 + \tilde{r}^m(m')\big)] \text{ if } m' > -\underline{m'}(y); \\ \geq \beta\mathbb{E}[\big(\frac{c'}{c}\big)^{-\theta}\big(1 + \tilde{r}^m(m')\big)] \text{ if } m' = -\underline{m'}(y), \end{cases} \tag{A.6}$$

which characterizes the households' optimal behavior in the no-adjustment case. The (interior) Euler equation is standard: it links today's consumption choice to tomorrow's expected consumption via the after-tax return on liquid assets.

(ii) Adjustment-Case: The Lagrangian (written recursively) is given by

$$\begin{aligned} \mathcal{L}(c, m', a'; \lambda, \gamma, \mu) = {} & \frac{c^{1-\theta}}{1-\theta} + \beta\,\mathbb{E}[V'] + \lambda\Big((1-\tau^y)\,w\,y + \big(1 + \tilde{r}^m(m)\big)\,m \\ & + (1 + (1-\tau^a)\,r^a)\,a + T - \big((1+\tau^c)\,c + m' + a' + \kappa(a')\big)\Big) \\ & - \mu\big(m' + \underline{m'}(y)\big) - \gamma a'. \end{aligned} \tag{A.7}$$

The first-order conditions for c, m' and μ are analogous to (A.2), (A.3) and (A.4).

The remaining conditions are

$$\begin{aligned}\frac{\partial \mathcal{L}}{\partial a'} &= \beta\,\mathbb{E}[V'_{a'}] - \lambda(1+\bar{\kappa}) - \gamma \overset{!}{=} 0; \\ \frac{\partial \mathcal{L}}{\partial \lambda} &= (1-\tau^y)\,w\,y + \big(1+\tilde{r}^m(m)\big)\,m + (1+(1-\tau^a)\,r^a)\,a + T \\ &\quad - \big((1+\tau^c)\,c + m' + a' + \kappa(a')\big) \overset{!}{=} 0; \\ \frac{\partial \mathcal{L}}{\partial \gamma} &= a' \geq 0.\end{aligned} \tag{A.8}$$

The Kuhn-Tucker system for a' is

$$\begin{cases} a' > 0 : \gamma = 0 \Rightarrow \beta\frac{\mathbb{E}[V'_{a'}]}{1+\bar{\kappa}} = \lambda; \\ a' = 0 : \gamma > 0 \Rightarrow \beta\frac{\mathbb{E}[V'_{a'}]}{1+\bar{\kappa}} \leq \lambda. \end{cases}$$

Applying the Envelope theorem to compute $\mathbb{E}[V'_{a'}]$, note that the marginal value of an additional unit of illiquid assets depends on whether the household adjusts in the next period. This stands in contrast to m', whose marginal value is independent of the next-period branch, as capital income of liquid wealth enters the budget constraint either way. We therefore distinguish between the adjustment and no-adjustment cases

$$V'_{a'} = \begin{cases} \gamma' \cdot (1+(1-\tau^a)r^a) & \text{if household does not adjust the next period} \\ \lambda' \cdot (1+(1-\tau^a)r^a) & \text{if household adjust in the next period} \end{cases}$$

and unify them in a single expression given by

$$V'_a = (1+(1-\tau^a)r^a)\big(\mathbb{1}_{\text{adjust}_{t+1}}\,\gamma' \cdot + (1-\mathbb{1}_{\text{adjust}_{t+1}})\,\lambda'\big).$$

Following Kaplan and Violante (2014), households face two optimality conditions in the adjustment case. The first is the standard Euler equation, (A.6). The second is a portfolio condition, which equates the marginal value of investing in the two different assets. This condition is obtained by equating (A.3) and (A.8) under an interior solution ($m' > -\underline{m}'(y)$, $a' > 0$), yielding

$$\frac{\mathbb{E}[V_{a'}]}{1+\bar{\kappa}} = \mathbb{E}[\lambda'\big(1+\tilde{r}^m(m')\big)]. \tag{A.9}$$

Thus, at an interior optimum, households are indifferent between allocating an additional unit of resources to liquid or illiquid assets. The portfolio condition is non-trivial because the shadow value of illiquid wealth depends on the next-period adjustment decision: in the no-adjustment branch, illiquid wealth never enters the liquid budget constraint and its marginal value is governed by γ', the shadow value of the illiquid accumulation equation, whereas in the adjustment branch it enters the budget constraint directly and its marginal value equals λ'. Since $\gamma' \neq \lambda'$ away from an adjustment point, the expectation $\mathbb{E}[V'_{a'}]$ aggregates two conceptually distinct shadow values across future states. Intuitively, the portfolio condition equates the marginal utility gain from liquid capital income with the expected compound value of illiquid wealth accumulation: in states where the household does not adjust, the marginal value of illiquid wealth is $\gamma'(1+(1-\tau^a)r^a)$, reflecting pure accumulation at the after-tax illiquid return; in states where the household adjusts, it is $\lambda'(1+(1-\tau^a)r^a)$, as the illiquid return is directly converted into consumption utility through the budget constraint. Each unit of liquid resources allocated to illiquid saving purchases only $\frac{1}{1+\bar{\kappa}}$ units of illiquid wealth after paying the proportional transaction cost.

A.2. Hand-to-Mouth Classification and MPC

The MPC is computed by applying a small transitory income shock Δy to each household in the stationary distribution and comparing consumption before and after. For a household in state (m, a, z), baseline consumption $c_0(m, a, z)$ and shocked consumption $c_1(m, a, z)$ are derived from the optimal policy functions, with the household choosing whether to adjust its illiquid position by comparing V^A against V^N in each case. The aggregate MPC is then

$$\text{MPC} = \frac{\mathbb{E}_{\mu}[c_1] - \mathbb{E}_{\mu}[c_0]}{\Delta y}, \tag{A.10}$$

where the expectation is taken over the stationary distribution μ. The shock is purely transitory: it raises current disposable income by Δy but leaves the policy functions unchanged, so the MPC captures the within-period consumption response to a windfall holding the continuation value fixed. Group-specific MPCs are obtained by restricting the expectation to the relevant subset of μ—poor HtM, wealthy HtM, and non-HtM households respectively.

A household is considered HtM at the *zero kink* if it holds little liquid wealth relative to income. In particular, household i is poor HtM if

$$a_{it} \leq 0 \quad \text{and} \quad 0 \leq m_{it} \leq \frac{y_{it}}{2 \cdot f}, \tag{A.11}$$

and wealthy HtM if

$$a_{it} > 0 \quad \text{and} \quad 0 \leq m_{it} \leq \frac{y_{it}}{2 \cdot f}, \tag{A.12}$$

where y_{it} denotes annual income, a_{it} average illiquid wealth over year t, m_{it} average liquid wealth over year t and f the payment frequency, i.e. $f = 12$ for monthly, $f = 26$ for bi-weekly and $f = 52$ for weekly. Thus, a household is classified as HtM whenever its liquid wealth is non-negative but does not exceed one-half of weekly, bi-weekly or monthly income.

When liquid wealth is negative, Kaplan et al. (2014) classify households as HtM relative to the relevant *borrowing limit*. Specifically, household i is poor HtM if

$$a_{it} \leq 0, \; m_{it} < 0 \quad \text{and} \quad m_{it} \leq \frac{y_{it}}{2 \cdot f} - \underline{m}(y_{it}), \tag{A.13}$$

and wealthy HtM if

$$a_{it} > 0,\ m_{it} < 0 \quad \text{and} \quad m_{it} \leq \frac{y_{it}}{2 \cdot f} - \underline{m}(y_{it}), \tag{A.14}$$

where $\underline{m}(y_{it})$ denotes the borrowing constraint (credit limit).

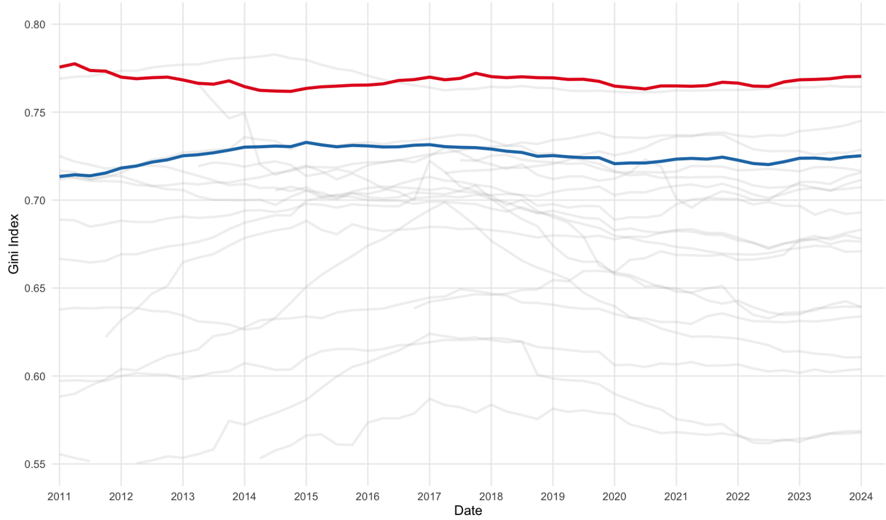
A.3. Supplement Tables and Figures

Table A.1.: Inequality Measures and Wealth Distribution Based on Net Wealth in Austria (2010–2023)

	2010	2014	2017	2021	2023
Inequality measures					
Gini coefficient	0.76	0.73	0.73	0.69	0.70
P75/P25	24.3	28.6	21.6	21.7	25.9
P90/median	7.1	6.0	6.3	5.5	6.4
P90/P10	581.1	521.2	262.0	297.8	276.7
Top wealth shares (%)					
Top 1%	22.9	25.4	22.6	16.3	16.8
Top 5%	47.6	43.4	43.1	37.1	37.2
Top 10%	61.1	55.5	56.4	51.5	51.4
Top 20%	76.6	72.1	72.8	69.7	70.1
Bottom 50%	2.8	3.2	3.6	4.6	3.8

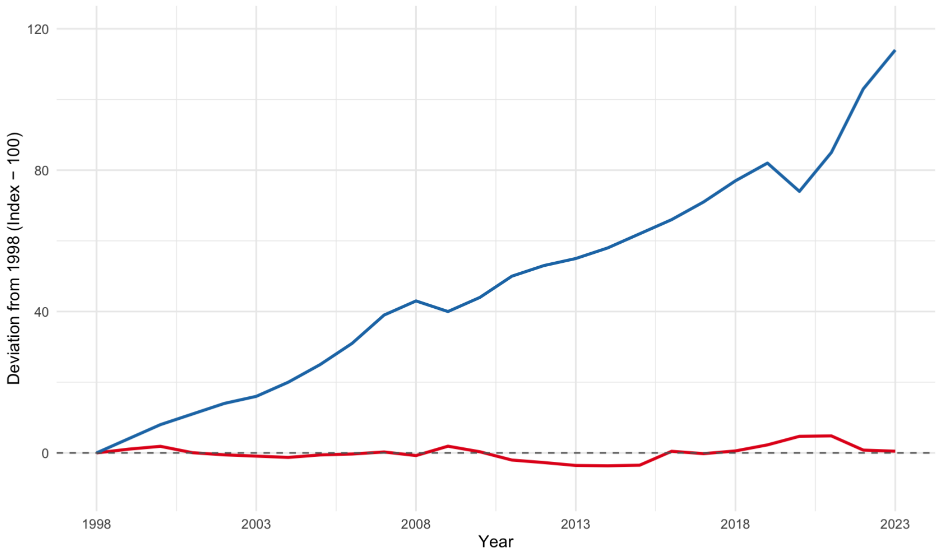
Source: HFCS Austria 2010–2023, OeNB; Fessler et al. (2025).

Figure A.1.: Net Wealth Gini Coefficient: Austria (red) vs. Euro Area Average (blue) vs. Euro Area Countries (light gray) (2011–2024)



Source: Distributional Wealth Accounts, ECB.

Figure A.2.: Inflation-adjusted median annual income of employed persons (red) and real GDP per capita (blue), indexed to the base year 1998.



Source: Austrian Court of Audit (2024); Statistik Austria, gross domestic product and main aggregates.

Table A.2.: Household Income, Liquid and Illiquid Wealth Holdings and Portfolio Composition in Austria (2017)

Variable	**Uncond. median**	**Pos. frac.**
Wages or replacements income	39,040	0.990
Net wealth	82,681	0.991
Net liquid assets	12,937	0.983
Deposits	12,724	0.961
Shares, publicly traded	0	0.050
Bonds	0	0.026
Credit line/overdraft and credit card debt	0	0.122
Net illiquid assets	50,247	0.877
Real estate net of mortgages	16,031	0.511
Public and occupational pension plans	0	0.074
Voluntary pension/whole life insurance	0	0.123

Source: HFCS Austria 2017, OeNB; Albacete et al. (2024).

Table A.3.: Robustness to the Illiquid-Asset Adjustment Cost (κ_0)

	$\kappa_0 = 0$	$\kappa_0 = 0.001$	$\kappa_0 = 0.002$	$\kappa_0 = 0.003$
Gini coefficient (net wealth)	0.7285	0.7215	0.7234	0.7272
Median ratios (unconditional)				
Med(A)/Med($Income$)	2.0215	1.7522	1.4732	1.5611
Med(M)/Med($Income$)	0.4877	0.5467	0.5980	0.5467
Top 10% net-wealth share	0.493	0.4856	0.491	0.4978
Middle 40% net-wealth share	0.439	0.4451	0.440	0.4346
Bottom 50% net-wealth share	0.067	0.0694	0.069	0.0676
90/50 wealth ratio	8.65	8.19	8.26	8.53
75/25 wealth ratio	12.66	12.12	12.17	12.15
Participation rates				
Net wealth: $Pr(a > 0 \vee m \neq 0)$	0.997	0.999	0.998	0.998
Illiquid asset ownership: $Pr(a > 0)$	0.900	0.918	0.896	0.877
Debt participation: $Pr(m < 0)$	0.271	0.260	0.259	0.262
Non-positive net wealth: $Pr(a + m \leq 0)$	0.188	0.179	0.179	0.182

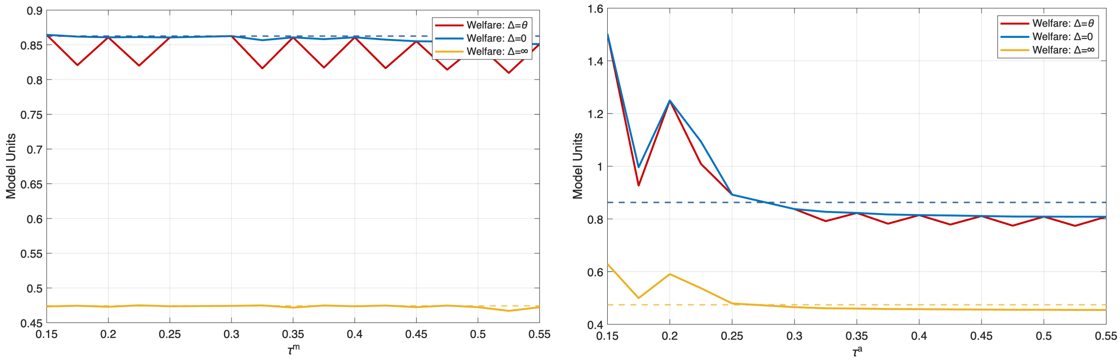
Notes: $\kappa_0 = 0.002$ is the baseline value.

Table A.4.: Taxation of Liquid and Illiquid Assets of Private Households in Austria

Asset class		Tax Instrument	Tax Rate
Liquid Asset	Bank Deposits	*Kapitalertragsteuer* (KESt)	25% on interest
	Bonds, Shares, ETFs, Derivatives and Mutual Funds	KESt	27.5% on dividends and capital gains
Illiquid Asset	Main residence	Exempt (*Hauptwohnsitzbefreiung*); Property Tax	0%; 0.2% annually of assessed value
	Other Real Estate	*Immobilienertragsteuer* (ImmoESt); Property Tax	30% on disposal, 0% if self-constructed; 0.2% annually of assessed value
	Private Company Shares (*GmbH*) (not listed on stock markets)	KESt	27.5% on gains
	Private Business Ownership (self-employment, partnerships)	Progressive personal income tax	0–55%
	Retirement Accounts	Progressive personal income tax	0–55%
	Other Financial Assets	Progressive personal income tax	0–55%

Source: Ministry of Finance, Austria; https://www.bmf.gv.at/public.html

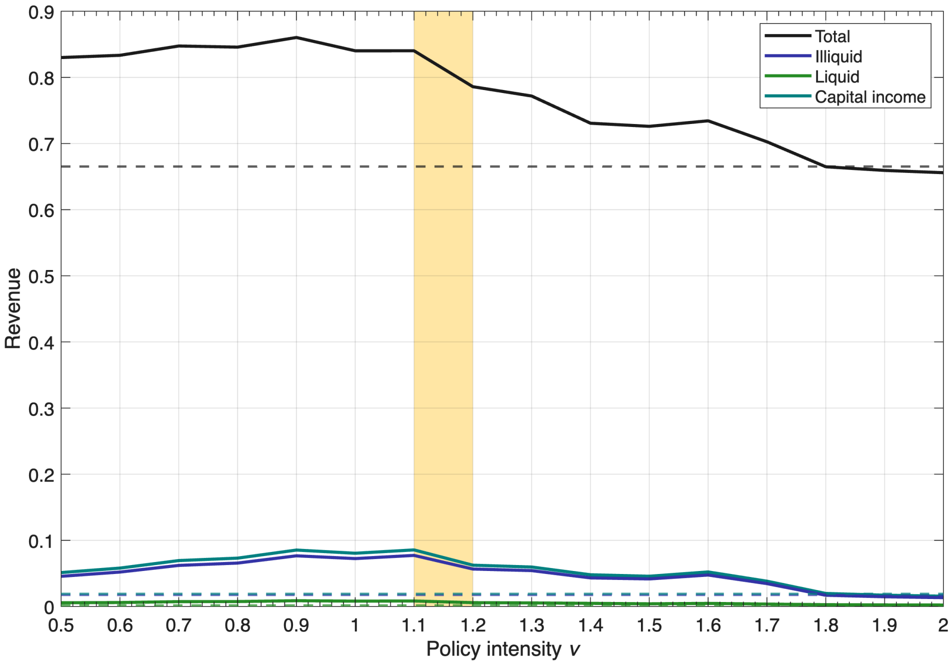
Figure A.3.: Impact of an one-dimensional tax change consumption-equivalence welfare measure based on three different social preferences parameter: Utilitarian ($\Delta = \theta$); Average welfare ($\Delta = 0$); Rawslian ($\Delta = \infty$).



(a) Impact of varying τ^m on welfare, holding $\tau^a = 0.275$ fixed.

(b) Impact of varying τ^a on welfare, holding $\tau^m = 0.275$ fixed.

Figure A.4.: Tax Revenue Decomposition along the Ramsey Schedule.



Notes: Total revenue comprises labor income tax revenue and capital income tax revenue; the latter is further decomposed into illiquid and liquid asset components. Dashed lines correspond to the symmetric-taxation baseline $\tau^m = \tau^a = 0.275$. The orange band marks the liquidity threshold.