On the Optimal Design of Consumption Taxes

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Motivation: Heterogeneous Consumption Baskets

Expenditure shares of two example categories (Data: US CEX, 2001-2019)

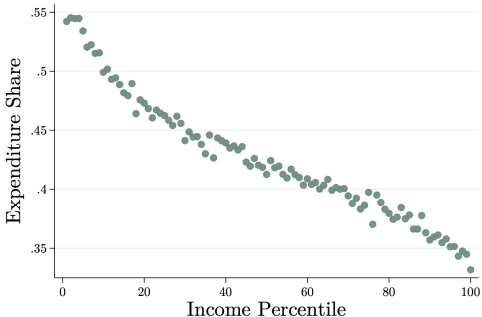

Figure 1: **Food at home**

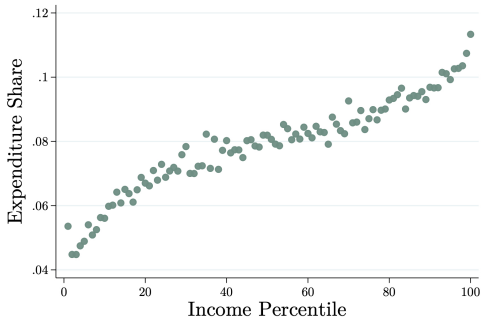

Figure 2: **Food away from home**

Motivation: Heterogeneous Consumption Tax Rates

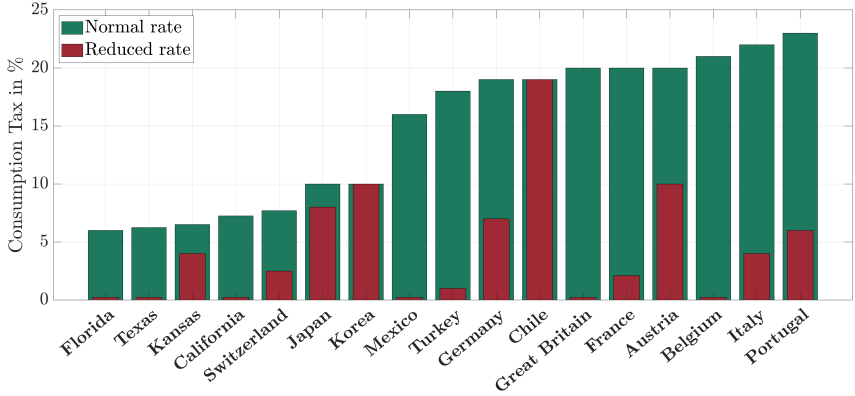

Figure 3: Normal and reduced consumption tax rates in the OECD and 4 US states
Source: OECD and collected by the author

Question

Consumption taxes are a crucial tax instrument to study

- Heterogeneous consumption baskets across the income and wealth distribution
- Differentiated tax rates ⇒ heterogeneous average tax rates
- Taxing luxuries (equity focus) vs. necessities (efficiency focus)
- Public finance literature highlights interaction with (labor) income taxes

How are consumption taxes optimally designed in the presence of (progressive) income taxation?

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What I do

- Revisit this question from a quantitative perspective
- Aiyagari-type **incomplete markets model**
  - non-homothetic preferences → heterogeneous consumption baskets
- **Estimation** using US data
  - Match consumption baskets along the income distribution
- Quantitative **Ramsey Problem**
  - Allow planner to jointly choose heterogeneous consumption tax rates and non-linear labor income tax

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What I find

- Optimal consumption taxes **highly non-uniform**
  - 7% tax on luxury goods
  - 52% subsidy on necessities
  - Even under optimal labor income tax
- Optimal policy **shrinks the economy**
  - GDP ↓ by 4.1%
- Extensive **welfare gains**
  - 3.1% increase in aggregate welfare
  - 73.3% approve the tax reform
  - Loss only for high-wealth-high-productivity households

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Literature

Joint design of consumption taxes
Atkinson and Stiglitz (1976), Cremer (2001), Saez (2002), Nishiyama and Smetters (2005), Conesa (2020), **Parodi (2023)**

→ Focus on the design of consumption taxes with realistic consumption behavior

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Optimal taxation in quantitative incomplete markets models
Kindermann and Krueger (2022), Boar and Midrigan (2022), Ferriere et al. (2023), Carroll et al. (2023), **Macnamara et al. (2023)**

→ Focus on the interaction of income and heterogeneous consumption taxes

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Heterogeneity in households' consumption choices
Aguiar and Bils (2015), **Jaimovich, Rebelo and Wong (2019)**, Oni (2023), Nord (2023)

→ Implications of differences in consumption baskets for optimal taxes

Consumption Taxes in Theory

Two concerns

- **Equity concerns**: Redistribute using consumption tax → tax luxuries?
- **Efficiency concerns**: Tax inelastic goods → tax necessities?

Role of other tax instruments

- Degree of redistribution can determine weight on each concern
- In simple setting: can make consumption taxes obsolete (Atkinson & Stiglitz, 1976)

→ Recent work highlights importance of consumption taxes in homothetic, 1-good, HA economies. What about when **consumption baskets differ**?

Model

Aiyagari-type incomplete markets economy

- **Households**
  - Infinitely lived
  - Consume various goods and services
  - Labor supply
- **Government**
  - Collects various taxes
  - Pays targeted transfers
  - Debt
- **Firms**
  - Use capital and labor to produce various goods and services

Household Problem

$$V_t\left(z_t, a_t, s\right) = \max_{\{c_{jt}\}_{j=1}^{J}, c_{ot}, n_t, a_{t+1}} \left\{U\left(\{c_{jt}\}_{j=1}^{J}, c_{ot}\right) - v\left(n_t\right) + \beta\, \mathbb{E}_{z_{t+1}|z_t} V_{t+1}\left(z_{t+1}, a_{t+1}, s\right)\right\}$$

subject to budget constraint, $c_{jt}, c_{ot}, a_{t+1} \geq 0$ and $n_t \in [0, 1]$

with **states**:

- Idiosyncratic productivity $\mathbf{z_t}$
- Skill type $\mathbf{s}$
- Assets $\mathbf{a_t}$

and **choices**:

- Consumption bundle $\{\mathbf{c_{jt}}\}_{\mathbf{j=1}}^{\mathbf{J}}$
- Outside good $\mathbf{c_{ot}}$ Data
- Labor supply $\mathbf{n_t}$ and assets $\mathbf{a_{t+1}}$

Intertemporal Household Problem: a_{t+1}

$$\max_{\{\{c_{jt}\}_{j=1}^{J}, c_{ot}, n_t, a_{t+1}\}_{t=0}^{\infty}} \quad \sum_{t=0}^{\infty} \beta^t \, \mathbb{E}_0 \left\{ U(\{c_{jt}\}_{j=1}^{J}, c_{ot}) - v(n_t) \right\}$$

1. **Intratemporal Decision:** $E_{\mathcal{C}}$, E_o ▸ Details

$$U(\cdot) = \frac{(\mathcal{C}^{\eta}(c_o - \underline{c}_o)^{1-\eta})^{1-\theta}}{1-\theta}$$

2. **Intratemporal Decision:** c_j

$$\sum_{j=1}^{J} \Upsilon_j^{\frac{1}{\sigma}} \left(\frac{c_j}{\mathcal{C}\psi_j}\right)^{\frac{\sigma-1}{\sigma}} = 1$$

Budget Constraint

$$\underbrace{\sum_{j=1}^{J} c_{jt} p_{jt} \underbrace{(1+\tau_{jt})}_{\text{Cons. tax}}}_{E_{\mathcal{C}}} + \underbrace{c_{ot} p_{ot}(1+\tau_{ot})}_{E_o} + a_{t+1} + \underbrace{\mathcal{T}(wzsn)}_{\substack{\text{Labor income} \\ \text{tax/transfer}}} \leqslant (1 + \underbrace{(1-\tau_k) r_t}_{\substack{\text{Capital} \\ \text{income}}}) a_t + \underbrace{w_t z_t s n_t}_{\substack{\text{Labor} \\ \text{income}}}$$

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Consumption Bundles: Intuition

Relative consumption shares

$$\log\left(\frac{\omega_j}{\omega_k}\right) = (1-\sigma)\log\left(\frac{p_j(1+\tau_j)}{p_k(1+\tau_k)}\right) + (1-\sigma)\left(\psi_j - \psi_k\right)\left[\log\left(\frac{E_{\mathcal{C}}}{p_b}\right) + \frac{1}{1-\sigma}\log\omega_b\right] + \log\left(\frac{\Upsilon_j}{\Upsilon_k}\right)$$

- Assume $\psi_{\text{Food away from home}} > \psi_{\text{Food at home}}$
- Increase in income (expenditures) $\Rightarrow \frac{\omega_{\text{Food away from home}}}{\omega_{\text{Food at home}}} \uparrow$

Level

Budget Constraint $(\forall\, t)$

$$\sum_{j=1}^{J} C_j p_j \tau_j + C_o p_o \tau_o + \int Tax(wzsn) + r\tau_k K + D = (1+r)D_{-1} + G + \int Tr(wzsn)$$

Labor Income Tax

Bénabou (2002), Heathcote et al. (2017), Ferriere et al. (2023)

$$Tax(y) - Tr(y) \equiv \mathcal{T}(y) = y - \lambda(y)^{(1-\tau)} - T$$

- $\tau \uparrow \Rightarrow$ tax more progressive

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Firms

- Single firm produces output, households decide how to consume it
  - Choice determines utility and tax applied to good
- Cobb-Douglas technology

$$Y_t = AK_t^{\alpha} L_t^{(1-\alpha)}$$

- Labor hired at wage rate w_t
- Capital rented at rental rate $R_t = r_t + \delta$

Estimation & Calibration

Estimation

Need to estimate/calibrate **68 parameters**, related to households, government, and firms

3-step procedure

1. **Set externally** or estimate outside the model
   $\mu_1, \mu_2, \sigma_1, \sigma_2, \theta, \beta, \chi$, p_o, ω_s, δ, A, α, $\tau_o, \tau_k, g, d, \{\tau_j\}_{j=1}^{11}$

2. **GMM** using US micro data
   $\{\psi_j\}_{j=1}^{11}$, σ

3. **Target US data moments** using model
   $\{\Upsilon_j\}_{j=1}^{11}$, $\eta, B_l, \underline{c_o}$, T, τ, ϕ

Step 1: Assigned Parameters

Income Process

Guvenen, Karahan, Ozkan, and Song (2021), Ferriere et al. (2023)

$$\log z_t = \rho \log z_{t-1} + \xi_t$$

$$\xi_t \sim \begin{cases} \mathcal{N}\left(\mu_1, \sigma_1^2\right) & \text{with probability } p \\ \mathcal{N}\left(\mu_2, \sigma_2^2\right) & \text{with probability } 1-p \end{cases}$$

Government Parameters

Parameter	Description	Value	Source
τ_k	Capital Income Tax	0.36	Trabandt and Uhlig (2011)
g	Government Spending G/Y	0.218	Ferriere et al. (2023)
d	Public Debt D/Y	1.064	Ferriere et al. (2023)
τ_n	Consumption Tax Necessities	0%	Data
τ_j	Consumption Tax Luxuries	5%	Ferriere et al. (2023)
T	Lump Sum Transfer	11.43% of median income	estimated
τ	Progressivity Income Tax	0.12	estimated

as well as: $\{\beta, \omega_s, s, \theta, \underline{a}, \chi, p_o, p_j, \delta, \alpha, \gamma_j, \tau_o\}$ ▸ Values

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Step 2: "Demand Functions" using GMM

→ Empirical representation of relative expenditure share of **household** n, for **good** j, at **time** t Comin et al. (2021):

$$\log\left(\frac{\omega_{jt}^n}{\omega_{bt}^n}\right) = (1-\boldsymbol{\sigma})\log\left(\frac{p_{jt}^n(1+\tau_{jt}^n)}{p_{bt}^n(1+\tau_{bt}^n)}\right) + (1-\boldsymbol{\sigma})(\boldsymbol{\psi_j}-1)\log\left(\frac{E_{\mathcal{C}t}^n}{p_{bt}^n(1+\tau_{bt}^n)}\right) + (\boldsymbol{\psi_j}-1)\log\omega_{bt}^n + \xi_j^n + \epsilon_{jt}^n$$

- **Data:** US CEX (2001-2019) and regional price data ▸ More
- **Shares:** $\xi_j^n = log\left(\frac{\Upsilon_j^n}{\Upsilon_b^n}\right) \rightarrow \xi_j^n = \beta_j' X^n + \mu_{j,r}$
- **Instruments** for $E_{\mathcal{C}t}^n$ and p_{jt}^n ▸ More

Results

Variable	Estimates	$\eta_{j,1}$	$\eta_{j,5}$
σ	0.16 (0.03)		
ψ: **Food at home**	0.16 (0.01)	0.43	0.36
ψ: **Utilities**	0.36 (0.01)	0.77	0.61
ψ: **Housing Material & Communication**	0.48 (0.01)	0.98	0.76
ψ: **Public Transportation**	0.61 (0.02)	1.20	0.92
ψ: **Alcohol & Tobacco**	0.71 (0.02)	1.37	1.05
ψ: **Entertainment**	0.96 (0.02)	1.81	1.37
ψ: **Domestic Services**	1.00 (–)	1.87	1.42
ψ: **Personal Services**	1.31 (0.02)	2.41	1.81
ψ: **Vehicle Expenses**	1.32 (0.03)	2.42	1.82
ψ: **Food away from home**	1.49 (0.03)	2.71	2.03
ψ: **Recreation & Sports**	2.01 (0.04)	3.61	2.69

Comments: Estimated using GMM and CEX (2000-2019),

N = 89'187, clustered SE in parentheses (clustered at household level)

$\eta_{j,p}$: Expenditure elasticity for p-th income quintile implied by the estimates

Domestic Services constitutes the base category and its ψ is normalized to 1

Categorization

Estimated parameters

$$\sum_{j=1}^{J} \Upsilon_j^{\frac{1}{\sigma}} \left(\frac{c_j}{\mathcal{C}^{\psi_j}} \right)^{\frac{\sigma-1}{\sigma}} = 1$$

Exp. Elasticity $\eta_{j,q}$

$$\eta_{j,q} \equiv \frac{\partial log C_j}{\partial log E_{\mathcal{C}}} = \sigma + (1-\sigma)\frac{\psi_j}{\psi_q}$$

Step 3: Estimate Model

Estimate remanining parameters by targeting data moments

$$\hat{\Theta} = \arg\min_{\Theta} (\hat{M} - \hat{m}(\Theta))' W (\hat{M} - \hat{m}(\Theta))$$

where $\hat{\Theta} = \left\{ \{\Upsilon_j\}_{j=1}^{J}, T, \tau, \underline{c}_o, \phi, \eta, B_l \right\}$

- **Share parameters** nh-CES $\Upsilon_j \rightarrow$ avg. expenditure shares
- **Labor disutility** $B_l \rightarrow$ avg. $n = 0.33$
- **Tax-Transfer system** $T, \tau \rightarrow$ Tax-Tr. rate income Q1 and Q5
- **Parameters "outer utility"** $\eta, \underline{c}_o \rightarrow$ avg. shares of E_o in total E

Match: Inequality

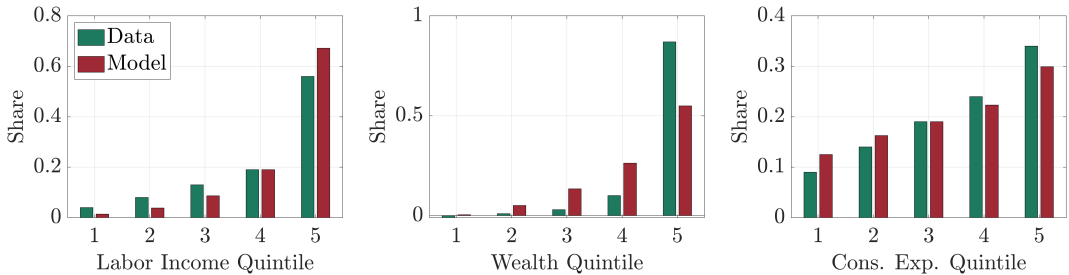
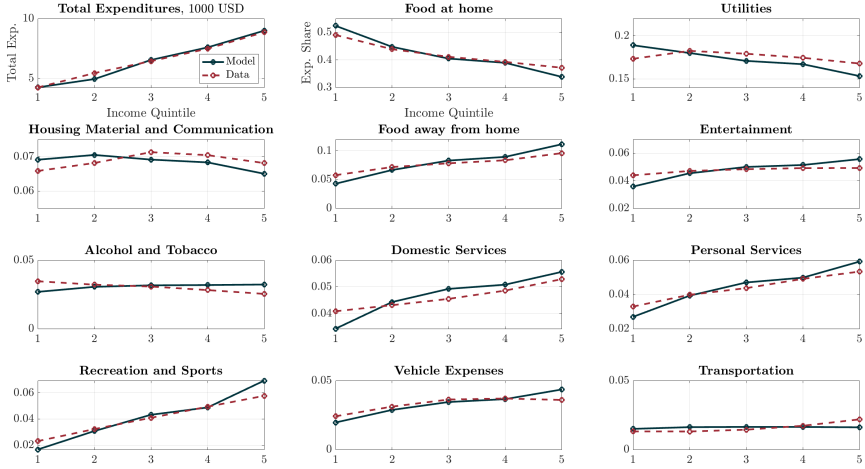


Figure 4: Data: *Labor Income* and *Wealth*: SCF, 2013, *Consumption Expenditures*: CEX, 2001-2019, ▸ Match E_C/E

Match: Tax System

Figure 5: Tax and Transfer Rate (Computed as percentage difference between pre and post-tax income), Data: CBO, 2019

Match: Consumption Behavior



Optimal Tax Problem

Government Objective

Utilitarian welfare function taking into account the **transition** from the calibrated to the final steady state:

$$\max_{\boldsymbol{\tau}} \ \mathcal{W}(\boldsymbol{\tau}) = \int V_0(a, z, s; \boldsymbol{\tau}) d\mu_0(a, z, s)$$

Tax instruments: $\boldsymbol{\tau} = \{\tau_n, \tau_l, \tau, \lambda\}$

- τ_n: Tax on necessities
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Optimal Policy

Necessities: Food at home, Utilities, Housing and communication material

Luxuries: Transportation, Alcohol and tobacco, Entertainment, Domestic services, Personal services, Vehicle expenses, Food away from home, Recreation and sports

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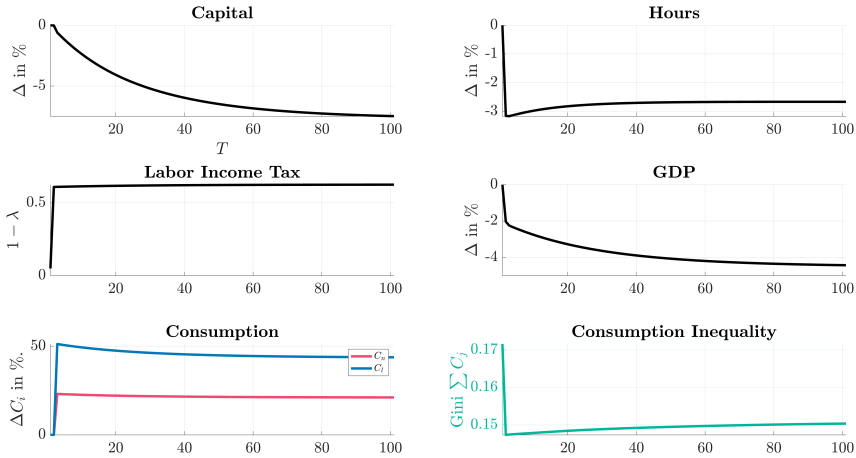
Optimal Policy

	Tax Instrument			
	τ_n	τ_l	τ	λ
Benchmark	0%	5%	0.12	0.95
$\tau_n = \tau_l$, $\tau = \tau_{SQ}$	-26%	-26%	0.12	0.63
$\tau = \tau_{SQ}$	-40%	0%	0.12	0.55
Optimal	**-52%**	**7%**	**-0.07**	**0.37**

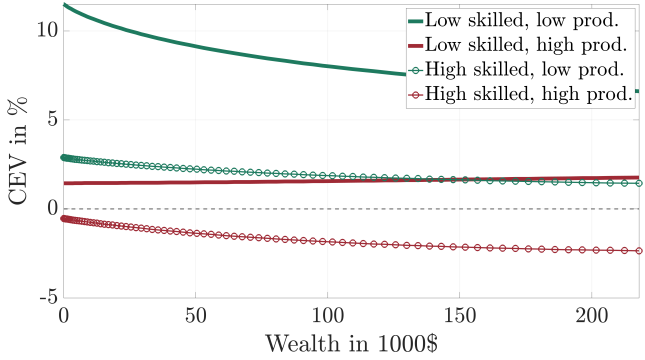
Aggregate Effects



Partial Reforms

Variable	Benchmark	$+\Delta\tau_n$	$+\Delta\tau_l$	$+\Delta\tau$
Taxes				
τ_n	0%	-52%	-52%	-52%
τ_l	5%	5%	7%	7%
τ	0.12	0.12	0.12	-0.07
λ	0.95	0.53	0.54	0.37
Aggregate				
Capital	103.5	-22.6%	+0.56%	+18.7%
Hours	1.9	-8.6%	+0.2%	+6.3%
GDP	27.36	-13.9%	+0.3%	+10.6%
Wage	9.0	-5.8%	+0.12%	+4.07%
Return	7.98%	+1.07pp.	-0.02pp.	-0.72pp.
Inequality				
Wealth Gini	0.55	-0.01	+0.00	+0.02
Earnings $(after-tax)$	0.39	+0.02	+0.00	+0.07
$\sum C_j$ *Gini*	0.17	-0.04	-0.01	+0.02
$\sum C_j + C_o$ *Gini*	0.23	-0.03	+0.00	+0.03

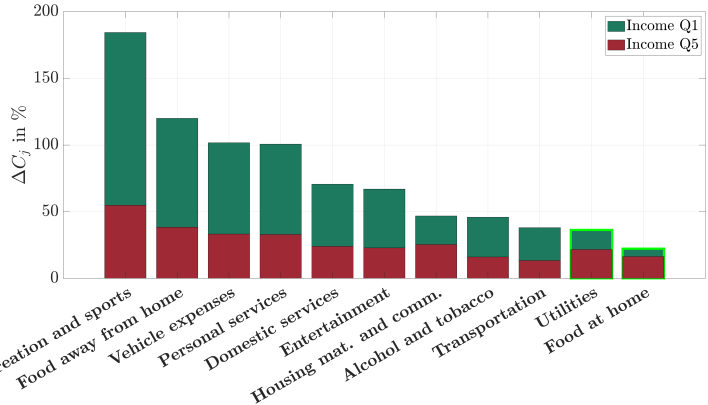
Distribution of Gains and Losses



- Overall, **73.3% of households benefit** from tax reform
- High labor-income taxes hurt productive households
- More wealth ⇒ higher share of luxuries ⇒ higher avg. consumption-tax ▸ Density

Mechanisms

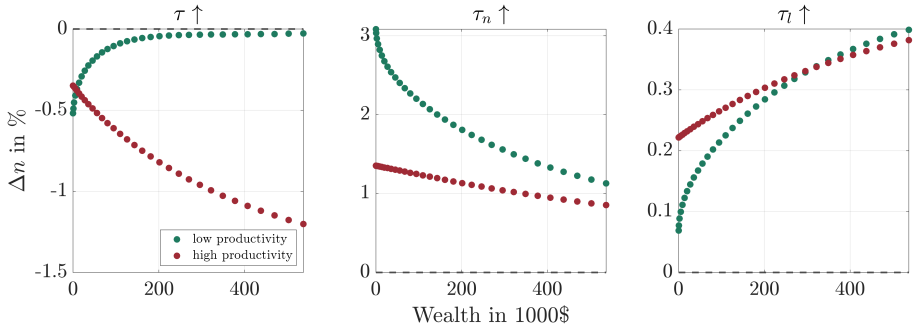
Redistribution



- Very large increases in C_j for low-income households
- Elastic luxury goods respond strongest
- Counteracted by Δc_o and reinforced by Δn Values

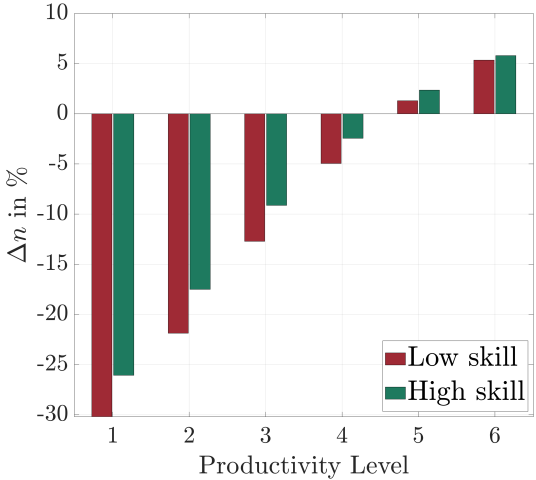
Labor Supply Responses: Partial Equilibirum

Δn conditional on **productivity** and **wealth**:



- $\tau \downarrow$ reduces **insurance** but **incentivizes labor supply** of productive HH
- $\tau_l \uparrow$ **incentivizes labor supply** of productive households

Labor Supply Responses: General Equilibirum



– Shift towards production using highly productive labor

⇒ Less hours for same output

– Reinforces redistribution

– ▸ Implicit Weatlh Tax

Conclusion

- Model captures **heterogeneous consumption behavior**
- Estimated to match various features of the US economy
- Optimal Policy
  - Substantial **rate differentiation**
  - Opitmal labor income tax regressive
- **Redistribution**, **implicit tax on initial wealth** and **labor supply effects** provide rationale for non-uniform rates
- Highlights settings where non-uniform rates are optimal by modeling empirically relevant trade-offs

Thank you!

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Literature

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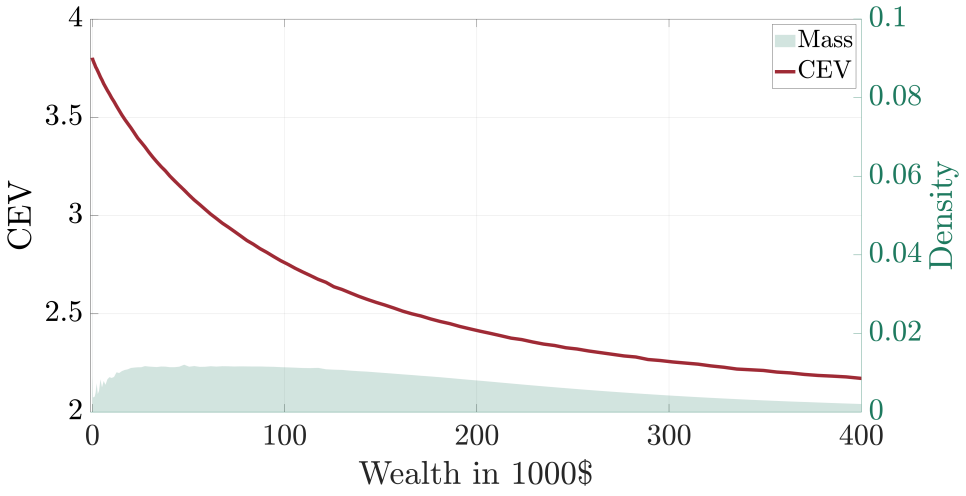
Welfare Gains and Density



back

Expenditure Behavior in the Data

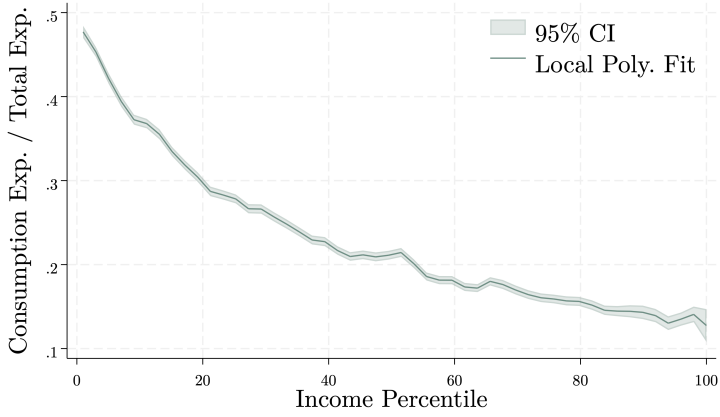


Figure 6: Share of consumption expenditures in total expenditures as a function of the income percentile, Data: CEX, 2001-2019 ▸ Composition Outside Good ▸ back

Implicit Tax on Wealth

- Consumption tax as an implicit tax on initial wealth (Nishiyama and Smetters, 2005)
- Differentiated consumption tax can "tag" households (Akerlof, 1978)
  - → High implicit wealth tax for high-wealth households back

	Income source		**Add. Wealth**	
	Capital	Labor	no wealth	with wealth
Post-tax Income	30.44	30.45	5.49	17.54
Labor income	1.10	14.95	1.55	1.55
Capital income	25.26	11.42	0.45	12.15
Wealth	494.27	223.39	0.87	234.69
Cons. share necessities	51%	56%	84%	60%
Cons. share luxuries	49%	44%	16%	39%

Split: Consumption Good - Outside Good

Problem

$$\max_{c_o, \mathcal{C}} \frac{(\mathcal{C}^{\eta}(c_o - \underline{c}_o)^{1-\eta})^{1-\theta}}{1-\theta} \quad \text{s.t.} \quad \mathcal{PC} + c_o(1+\tau_o)p_o = E$$

Analytical **solution** for split:

$$c_o = \underline{c}_o + \frac{1-\eta}{p_o(1+\tau_o)}(E - c_o(1+\tau_o)p_o) \tag{1}$$

which implies:

$$E_o = p_o(1+\tau_o)\underline{c}_o + (1-\eta)(E - c_o(1+\tau_o)p_o) \tag{2}$$

and consequently:

$$E_{\mathcal{C}} = E - E_o = \eta(E - p_o(1+\tau_o)\underline{c}_o)$$

which all follow from the Stone-Geary specification. See Sancho (2022) for details. back

Instruments

Issues

1. **Issue**: measurement error at product level results in large measurement error for aggregate E
2. **Issue**: Regional affects can affect both prices and expenditure shares

Instruments

1. **Instrument:** Use reported total income as instrument for $E \rightarrow$ one question and not the sum of many subquestions
2. **Instrument:** Construct price instrument in two steps:
   - 2.1 Compute price of subcategories of category j as average of all other regions.
   - 2.2 Obtain price index for HH n for category j using region-averages of the expenditure shares on each subcategory.
3. 2.1 addresses regional shocks whereas 2.2 alleviates issues related to measurement error (given that they cancel out)

back

Standard Errors

Variable	Estimates	$\eta_{j,1}$	$\eta_{j,5}$
σ	0.16 (0.03)		
ψ: **Food at home**	0.16 (0.01)	0.43	0.36
ψ: **Utilities**	0.36 (0.01)	0.77	0.61
ψ: **Housing Material & Communication**	0.48 (0.01)	0.98	0.76
ψ: **Public Transportation**	0.61 (0.02)	1.20	0.92
ψ: **Alcohol & Tobacco**	0.71 (0.02)	1.37	1.05
ψ: **Entertainment**	0.96 (0.02)	1.81	1.37
ψ: **Domestic Services**	1.00 (–)	1.87	1.42
ψ: **Personal Services**	1.31 (0.02)	2.41	1.81
ψ: **Vehicle Expenses**	1.32 (0.03)	2.42	1.82
ψ: **Food away from home**	1.49 (0.03)	2.71	2.03
ψ: **Recreation & Sports**	2.01 (0.04)	3.61	2.69

Comments: Estimated using GMM and CEX (2000-2019),

N = 89'187, clustered SE in parentheses (clustered at household level)

$\eta_{j,p}$: Expenditure elasticity for p-th income quintile implied by the estimates

Domestic Services constitutes the base category and its ψ is normalized to 1

back

Estimated parameters

$$\sum_{j=1}^{J} \Upsilon_j^{\frac{1}{\sigma}} \left(\frac{c_j}{\mathcal{C}^{\psi_j}} \right)^{\frac{\sigma-1}{\sigma}} = 1$$

Exp. Elasticity $\eta_{j,q}$

$$\eta_{j,q} \equiv \frac{\partial log C_j}{\partial log E_{\mathcal{C}}} = \sigma + (1-\sigma)\frac{\psi_j}{\bar{\psi}_q}$$

Data

US Consumption Expenditure Survey

- Interview survey
- 2001-2019, $\sim$ 6000 households per quarter

Prices

- Regional price data
- Construct household specific price per category

Instruments

- Total expenditures $E_{\mathcal{C}}$: reported income
- Prices p_j^n: Hausman price instruments

$\Rightarrow$ identify income elasticities using within-region covariation between expenditure shares and total household expenditures (controlling for household characteristics)

back

Estimated preference parameters

- Target average expenditure share of 1^{st} and 5^{th} income quintile
- Easy to implement under the condition that the levels of consumption in the model match the data (Step 3)

Variable	**Estimated Υ_j**
Food at home	2.22
Utilities	1.14
Housing Material & Communication	0.51
Public Transportation	0.15
Alcohol & Tobacco	0.26
Entertainment	0.55
Domestic Services	0.59
Personal Services	0.72
Vehicle Expenses	0.51
Food away from home	1.34
Recreation & Sports	1.17

Table 1: $\{\Upsilon_j\}_{j \in J}$ as estimated by targeting economy-wide average expenditure shares

Calibration

Variable	Description	Value
General		
ϕ	Scaling of economy	3.354
p_o	Price outside good	1.0
Households		
θ	Elasticity of substitution	2.0
η	Share outer utility	0.22
β	Elasticity of substitution	2.0
χ	Inverse Frisch elasticity	2.5
B_l	Labor disutility	2.03
$\underline{c}_o$	Subsistence outside good	-8.14
ω_s	Share skilled	0.37
s	Skill productivities	1.0ϕ and 1.8ϕ
Firms		
δ	Depreciation	1.5%
A_p	Aggregate productivity	1.0ϕ
γ_j	Transformation technology	1.0 $\forall\, j$

Table 2: Calibrated values of remaining parameters

Responses in n and c_o

	Variable	
Income Quintile	c_o	n
Q1	-33.08	-15.2
Q2	-24.24	-9.7
Q3	-20.06	-7.9
Q4	-16.16	-7.5
Q5	-11.59	-5.8

Table 3: Labor supply and outside good response when changing to optimal policy (by total post-tax income quintile and in %)

back

Consumption Bundles

Level of consumption of good j

$$c_j = \Upsilon_j \left(\frac{p_j(1+\tau_j)}{E_{\mathcal{C}}} \right)^{-\sigma} \mathcal{C}(E_{\mathcal{C}})^{(1-\sigma)\psi_j}$$

Relative consumption shares

$$\begin{aligned} \log\left(\frac{\omega_j}{\omega_k}\right) =& (1-\sigma)\log\left(\frac{p_j(1+\tau_j)}{p_k(1+\tau_k)}\right) \\ &+ (1-\sigma)(\psi_j - \psi_k)\left[\log\left(\frac{E_{\mathcal{C}}}{p_b}\right) + \frac{1}{1-\sigma}\log\omega_b\right] + \log\left(\frac{\Upsilon_j}{\Upsilon_k}\right) \end{aligned}$$

back

Match E_C/E

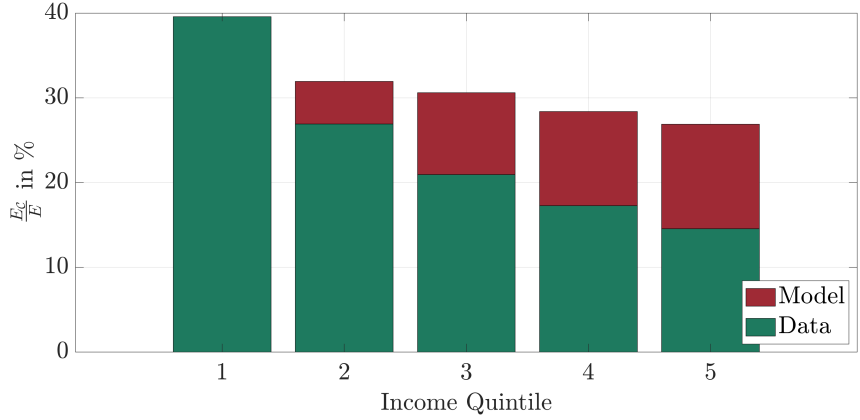


Figure 7: $\frac{E_C}{E}$ in the data and the model counterpart

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Composition Outside Good

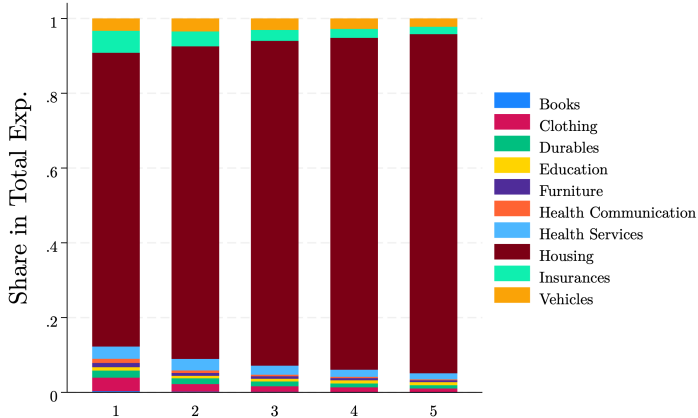

Figure 8: Composition of the outside good in the data (by income quintile), Data from the CEX, 2001-2019 back

Categorization of Goods and Services

Name	Code	Category
FOOD OR BOARD WHILE AT SCHOOL	190901	foodaway
FOOD OUT OF TOWN TRIPS	190903	foodaway
ALC. BEV. PURCHASED ON TRIPS	200900	alcaway
PLMB/WTR HEAT LABOR/MAT OWND	230113	domserv
ALCOHOL AT RESTAURANTS ETC	790420	alcaway
MGMT SERVICES/IMP OF OTH PROP	790620	domserv
Dinnerware, glassware, serving pieces	320345	furniture

Table 4: Manual assignment of expenditure items to consumption categories (example items), total number of items: 844, back

Average Consumption Tax

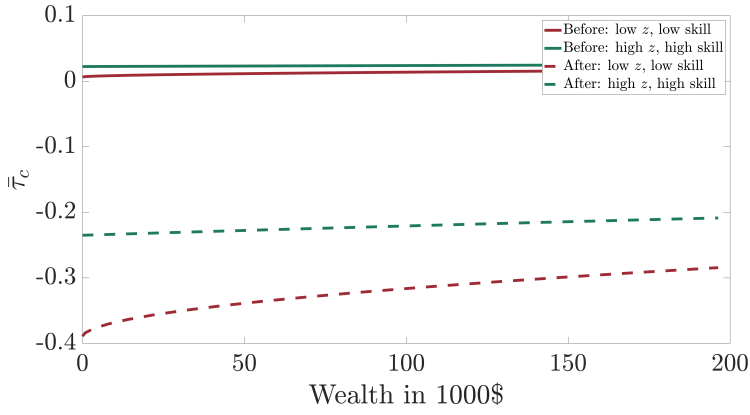

Figure 9: Average Consumption Tax before and after reform (green: minimum productivity in sample, red: maximum productivity) back

Average Labor Income Tax: with Lump-Sum

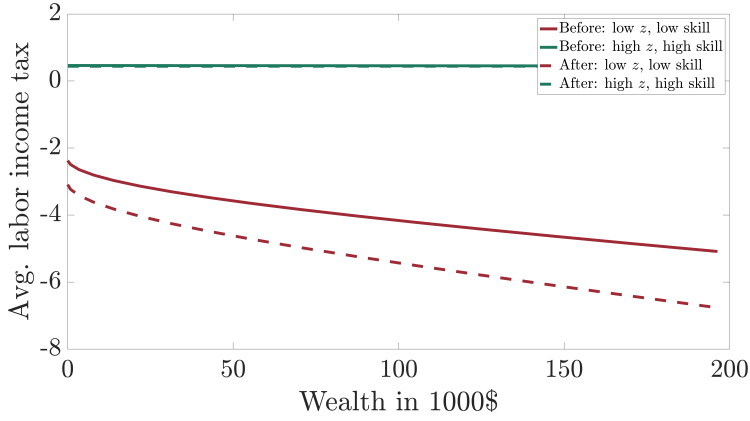

Figure 10: Average Labor Income Tax before and after reform (green: minimum productivity in sample, red: maximum productivity), including lump-sum transfer back

Average Labor Income Tax: without Lump-Sum

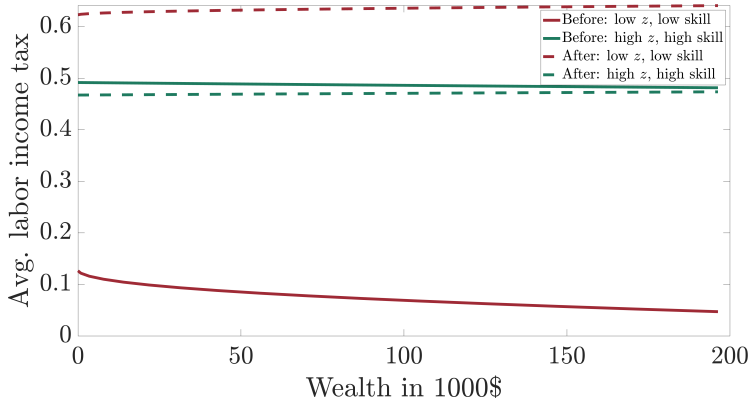

Figure 11: Average Consumption Tax before and after reform (green: minimum productivity in sample, red: maximum productivity), excluding lump-sum transfer back