On the Distributional Effects of International Tariffs

Daniel Carroll (FRB Cleveland)
Sewon Hur (FRB Cleveland)

Salento Macro Meetings 2019
Collegio Santa Chiara, Galatina

August 29, 2019

Introduction

- What are the distributional consequences of trade?
- Effect on labor markets: Autor, Dorn, Hanson, and Song (2014)
  - Low-skilled harmed more from opening to trade
- Effect on prices: Fajgelbaum and Khandelwal (2016); Carroll and Hur (2019a)
  - Poor most sensitive to tradable consumption prices

What we do

- Tradable goods/services constitute a larger fraction of expenditures for poor households (Carroll and Hur 2019a)
- Build a Ricardian trade model with
  - non-homothetic preferences
  - uninsurable income risk
  - skilled and unskilled labor
  - distortionary labor and capital income taxes
- Study the distributional effects of tariffs
  - without redistribution
  - with redistribution
    - reduce labor income tax
    - reduce capital income tax
    - lump-sum transfer

What we find

- What are the distributional consequences of bilateral tariffs?
- Answer: It depends on how tariff revenue is distributed
- Without redistribution . . .
  - large welfare losses for everyone, but especially hurts poor and skilled
- With redistribution . . .
  - labor income tax reduction generates a more equitable distribution of welfare losses
  - capital income tax reduction strongly favors the rich (really hurts the poor)
  - lump-sum rebating tariff revenue can produce a welfare gain on average, but at the expense of the skilled

Empirical analysis

Data

- We use two complementary datasets
- Consumer Expenditure Survey (CEX, 2004–14)
  - \+ detailed expenditure categories
  - \+ self-reported owner-equivalent rent
  - – can't compute net worth: only liquid wealth
- Panel Survey of Income Dynamics (PSID, 2004–14)
  - – more aggregated expenditure categories
  - – have to impute owner-equivalent rent
  - \+ detailed measures of wealth

Tradable expenditure shares (CEX)

- Total expenditures: 500+ expenditure categories
  - exclude mortgage interest, property taxes, home insurance
  - include self-reported owner's equivalent rent
- Tradable expenditures: 307 items
  - if imports or exports exceed 11 percent of production Examples
- 23,484 working-age household-year observations

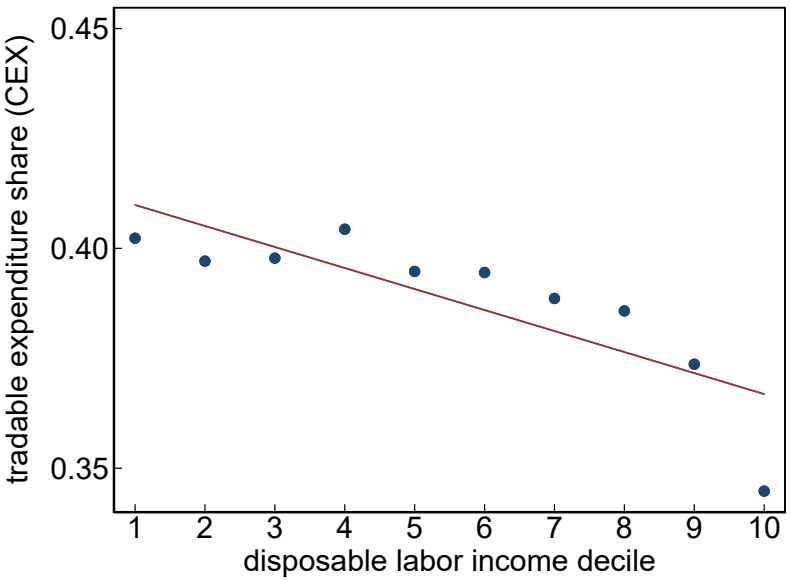
Tradable expenditure shares (PSID)

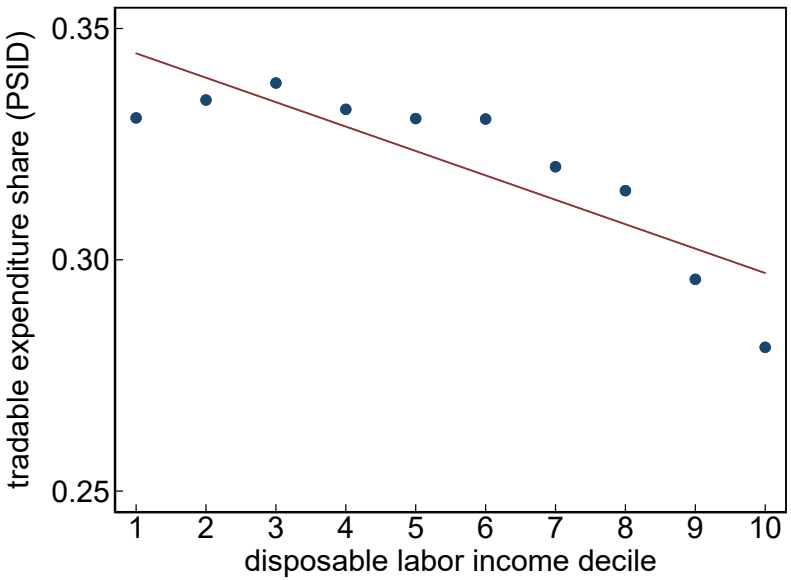
Exp. category	Tradable	Nontradable
Child care & education		✓
Clothing	✓	
Food	food at home	away from home
Health care	prescriptions	all other
Housing w/o repairs	furnishings	utilities, rent*
Transportation w/o repairs	gasoline, purchase and lease of cars and trucks	all other
Vacation/ent.	22 percent	all other
Repairs	21 percent	all other

- * : excludes mortgage, property taxes, and home insurance, but includes owner's equivalent rent, imputed by dividing state-level price-to-rent ratios from value of primary residence
- 30,244 working-age household-year observations

Tradable shares and disposable labor income

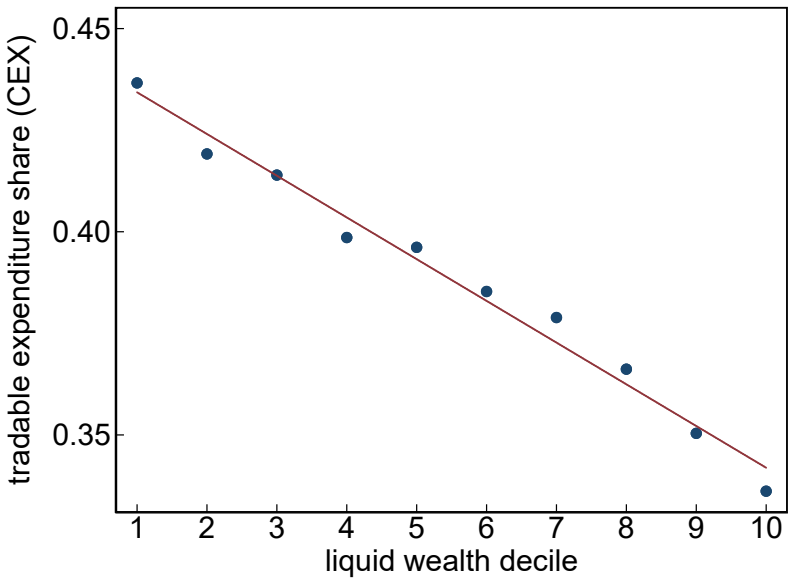
- Tradable shares decline with disposable labor income
- Level is higher in CEX

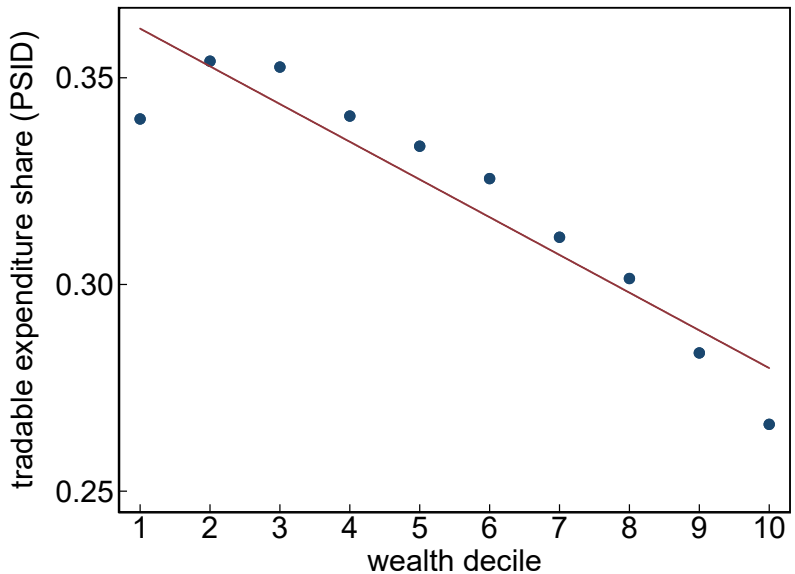




Tradable shares and wealth

- Tradable shares decline with wealth





Related empirical work

- Boppart (2014) uses CEX to show that goods expenditure shares decline with income
- Borusyak and Jaravel (2018) also use CEX to show that *import* expenditure shares are similar across income and education groups
- We focus on *tradable* expenditure shares since trade can impact prices of all tradable goods and services through
  - increased competition
  - input-output linkages
- Many other papers use barcode data, which cover a small fraction of overall household expenditures

Summary of empirical findings

- Tradable expenditure shares decline with income and wealth
- Robust to controlling for household characteristics: Regressions
  - household head age and education
  - household size
  - home ownership
- Robust to: Sensitivity
  - excluding all housing expenditures
  - no partial PSID adjustments (vacation/ent./repairs)
  - using total labor income
  - alternative tradability measures (to include indirect imports)

Summary of empirical findings

- Tradable expenditure shares decline with income and wealth
- Robust to controlling for household characteristics: Regressions
  - household head age and education
  - household size
  - home ownership
- Robust to: Sensitivity
  - excluding all housing expenditures
  - no partial PSID adjustments (vacation/ent./repairs)
  - using total labor income
  - alternative tradability measures (to include indirect imports)
- Motivates our model of
  - uninsurable income risk $\rightarrow$ wealth and income heterogeneity
  - non-homothetic preferences $\rightarrow$ different consumption baskets

Model

Main ingredients of model

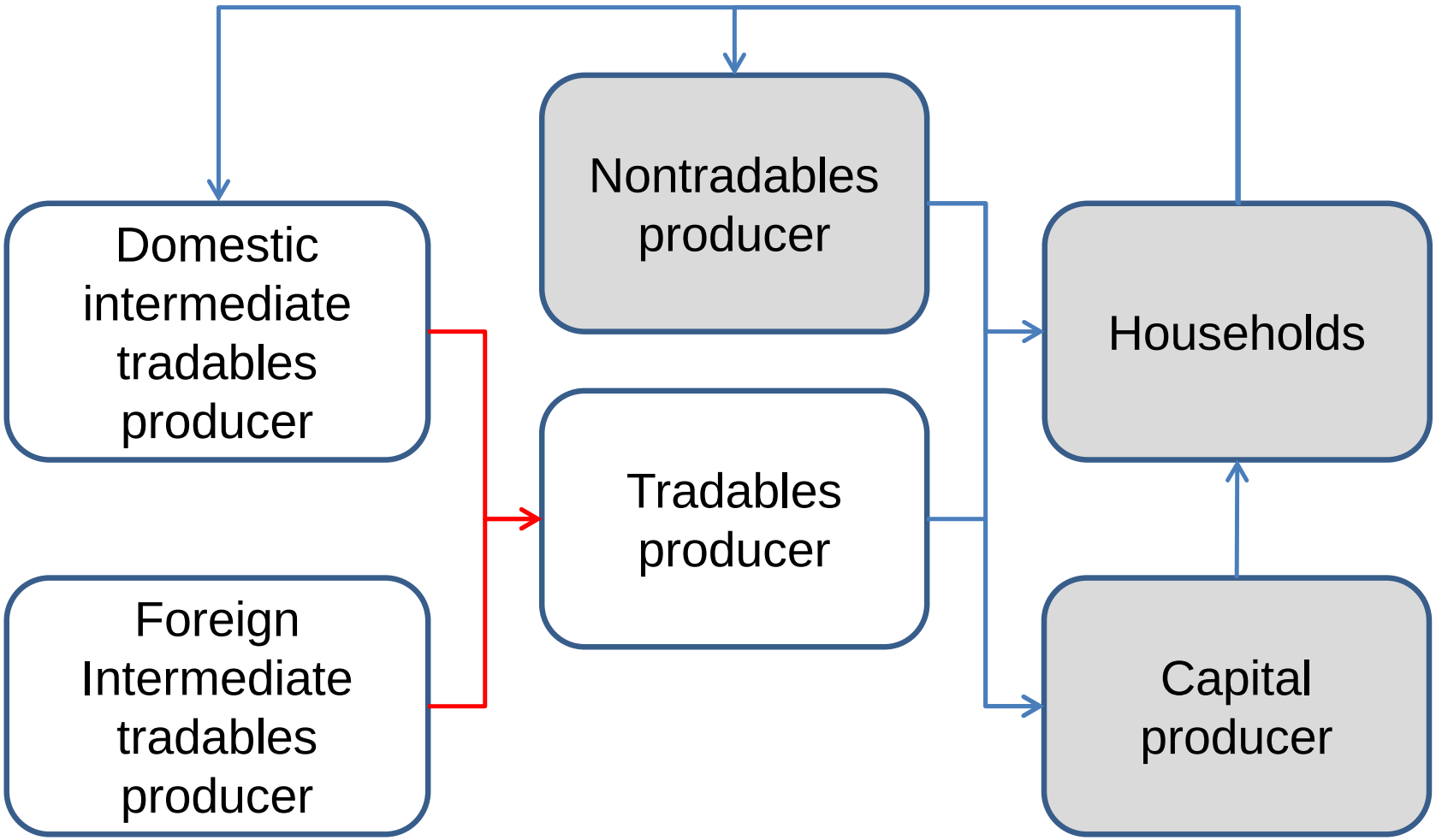
- Ricardian model of trade (Dornbusch-Fisher-Samuelson 1977)
- Uninsurable labor income risk (Aiyagari-Bewley-Hugget-Imrohoroglu)
- Capital-skill complementarity (Stokey, Krusell-Ohanian-Rios-Rull-Violante, Parro)
- Non-homothetic preferences (Stone-Geary)
- Linear labor and capital income taxes

Model

- Two symmetric countries indexed by $i = 1, 2$
- Households
  - consume, work, and save
  - 2 types: unskilled and skilled
  - face uninsurable labor income risk
- Production and Trade
  - tradables and non-tradables used for consumption and for investment
  - $\omega \in [0, 1]$ continuum of tradable intermediate goods
  - shipment of good ω from o to i faces trade costs τ_{oi}
  - τ_{oi} consists of a technological cost $\tau_{oi,T}$ and a tariff $\tau_{i,P}$
- Government taxes to finance wasteful spending

Outline of model

- We begin with the production of tradable goods



Final tradables producer

- A representative final tradables producer bundles the varieties of tradables $\{q_{oi}(\omega)\}_{\omega,o}$ into a final good, Y_{iT}, and solves

$$\max_{\{q_{oi}(\omega)\}_{\omega}} P_{iT} Y_{iT} - \int_0^1 \sum_{o=1,2} \left[\tau_{oi} p_o(\omega) q_{oi}(\omega)\right] d\omega$$

$$\text{s.t. } Y_{iT} = \left\{ \int_0^1 \left[\sum_{o=1,2} q_{oi}(\omega) \right]^{\rho} d\omega \right\}^{\frac{1}{\rho}}.$$

Final tradables producer

- A representative final tradables producer bundles the varieties of tradables $\{q_{oi}(\omega)\}_{\omega,o}$ into a final good, Y_{iT}, and solves

$$\max_{\{q_{oi}(\omega)\}_{\omega}} P_{iT} Y_{iT} - \int_0^1 \sum_{o=1,2} \left[\tau_{oi} p_o(\omega) q_{oi}(\omega)\right] d\omega$$

$$\text{s.t. } Y_{iT} = \left\{ \int_0^1 \left[\sum_{o=1,2} q_{oi}(\omega) \right]^{\rho} d\omega \right\}^{\frac{1}{\rho}}.$$

- Solution: $q_{oi}(\omega) \leq \left(\frac{\tau_{oi} p_o(\omega)}{P_{iT}} \right)^{-\theta} Y_{iT}$, $=$ if $q_{oi}(\omega) > 0$.
- Price: $P_{iT} = \left[\int_0^1 \min_o \left\{ \tau_{oi} p_o(\omega) \right\}^{1-\theta} d\omega \right]^{\frac{1}{1-\theta}}$ where $\theta = \frac{1}{1-\rho}$ is the elasticity of substitution across varieties.

Intermediate tradables producer

- Each intermediate firm produces a single tradable variety, ω
- Taking as given the price $p_i(\omega)$, it solves

$$\max_{h_i(\omega), l_i(\omega), k_i(\omega)} p_i(\omega) y_i(\omega) - w_{iH} h_i(\omega) - w_{iL} l_i(\omega) - r_i k_i(\omega)$$

$$\text{s.t. } y_i(\omega) = z_i(\omega) F(h_i(\omega), l_i(\omega), k_i(\omega))$$

Intermediate tradables producer

- Each intermediate firm produces a single tradable variety, ω
- Taking as given the price $p_i(\omega)$, it solves

$$\max_{h_i(\omega), l_i(\omega), k_i(\omega)} p_i(\omega) y_i(\omega) - w_{iH} h_i(\omega) - w_{iL} l_i(\omega) - r_i k_i(\omega)$$

$$\text{s.t. } y_i(\omega) = z_i(\omega) F(h_i(\omega), l_i(\omega), k_i(\omega))$$

- Zero-profit price:

$$p_i(\omega) = \frac{1}{z_i(\omega)}$$

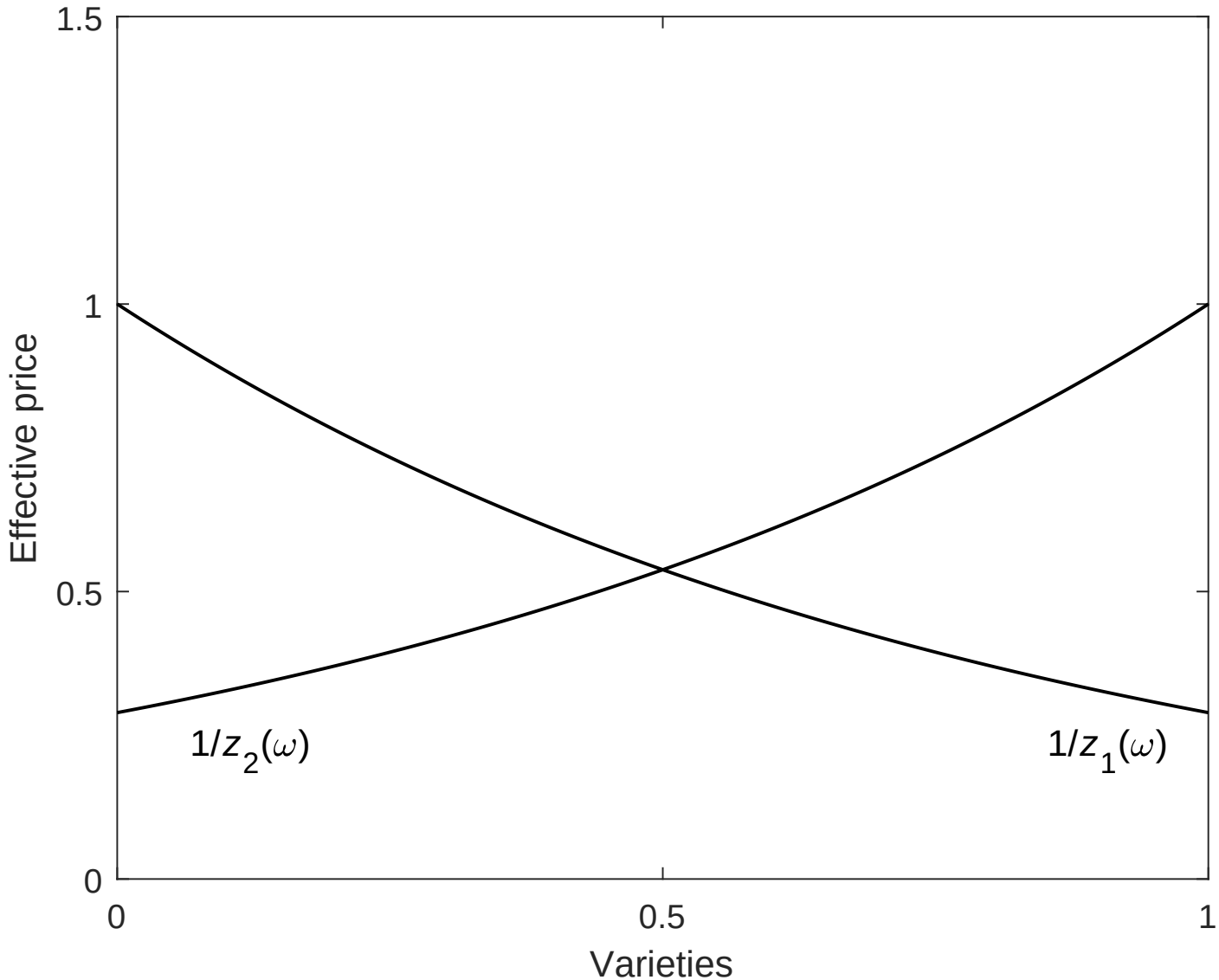
Productivity distributions in tradables production

- Productivities for variety ω are distributed according to

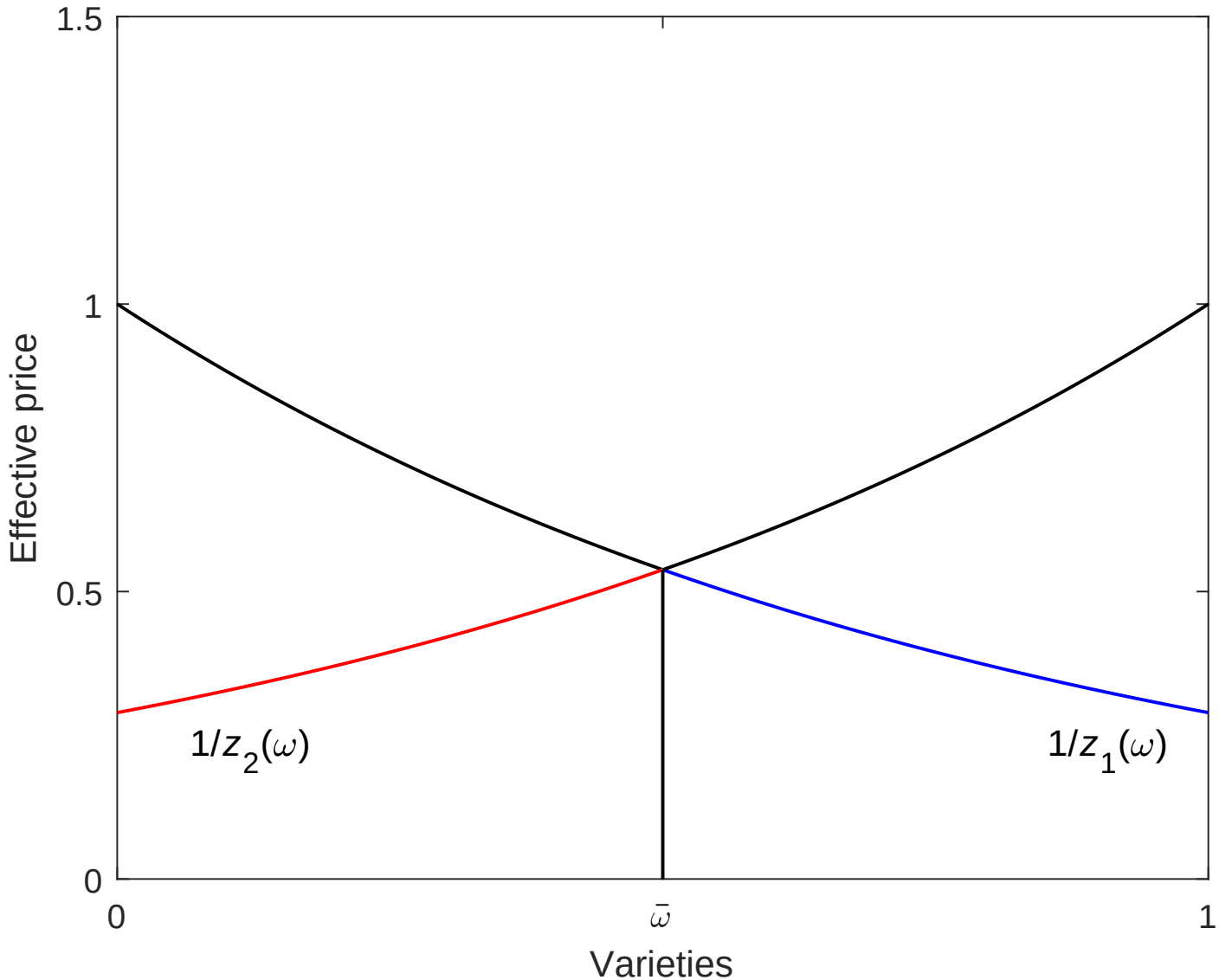
$$z_1(\omega) = e^{\eta\omega}$$
$$z_2(\omega) = e^{\eta(1-\omega)}$$

- Country $i = 1$ is more productive at producing high ω

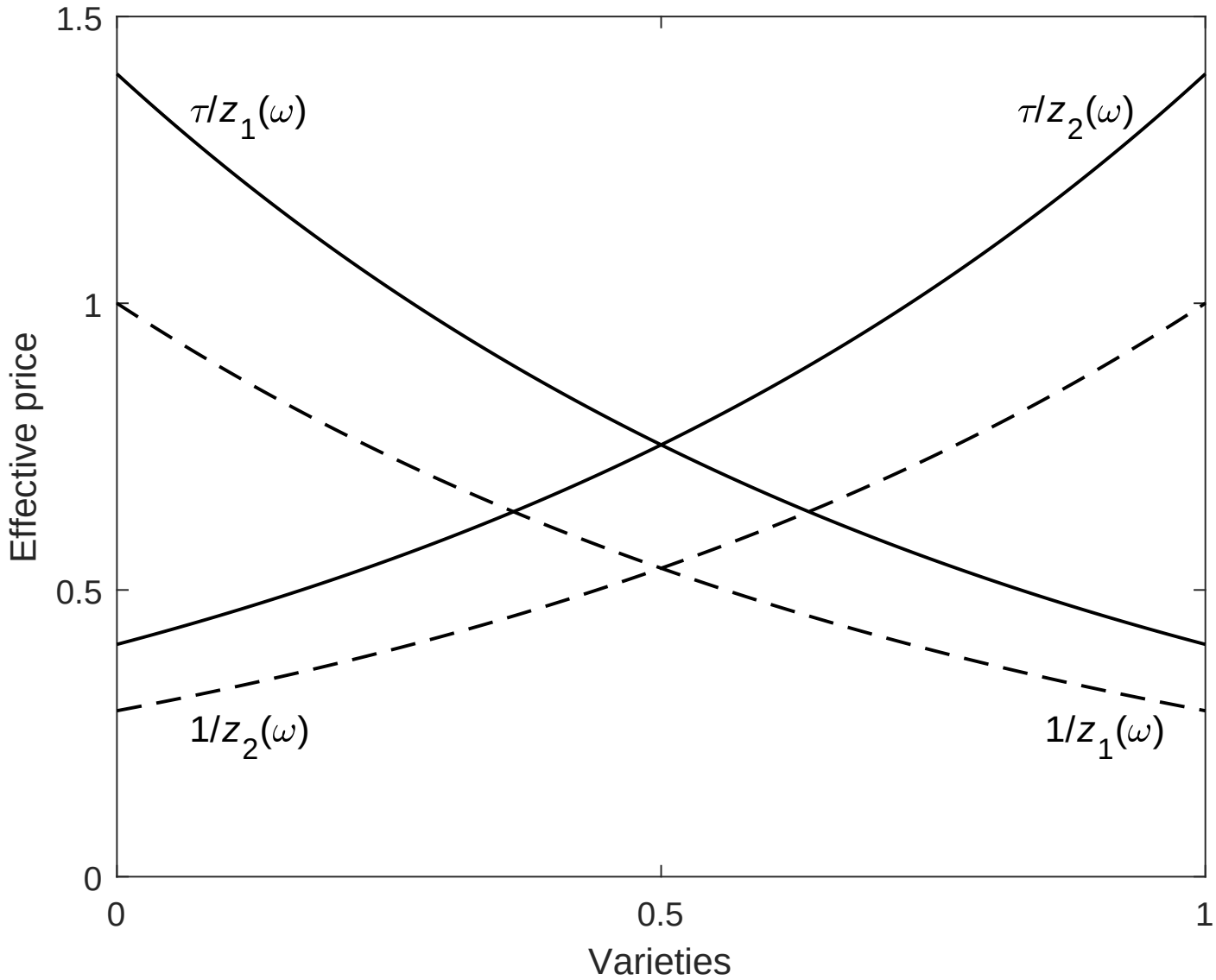
Pattern of production (free trade)



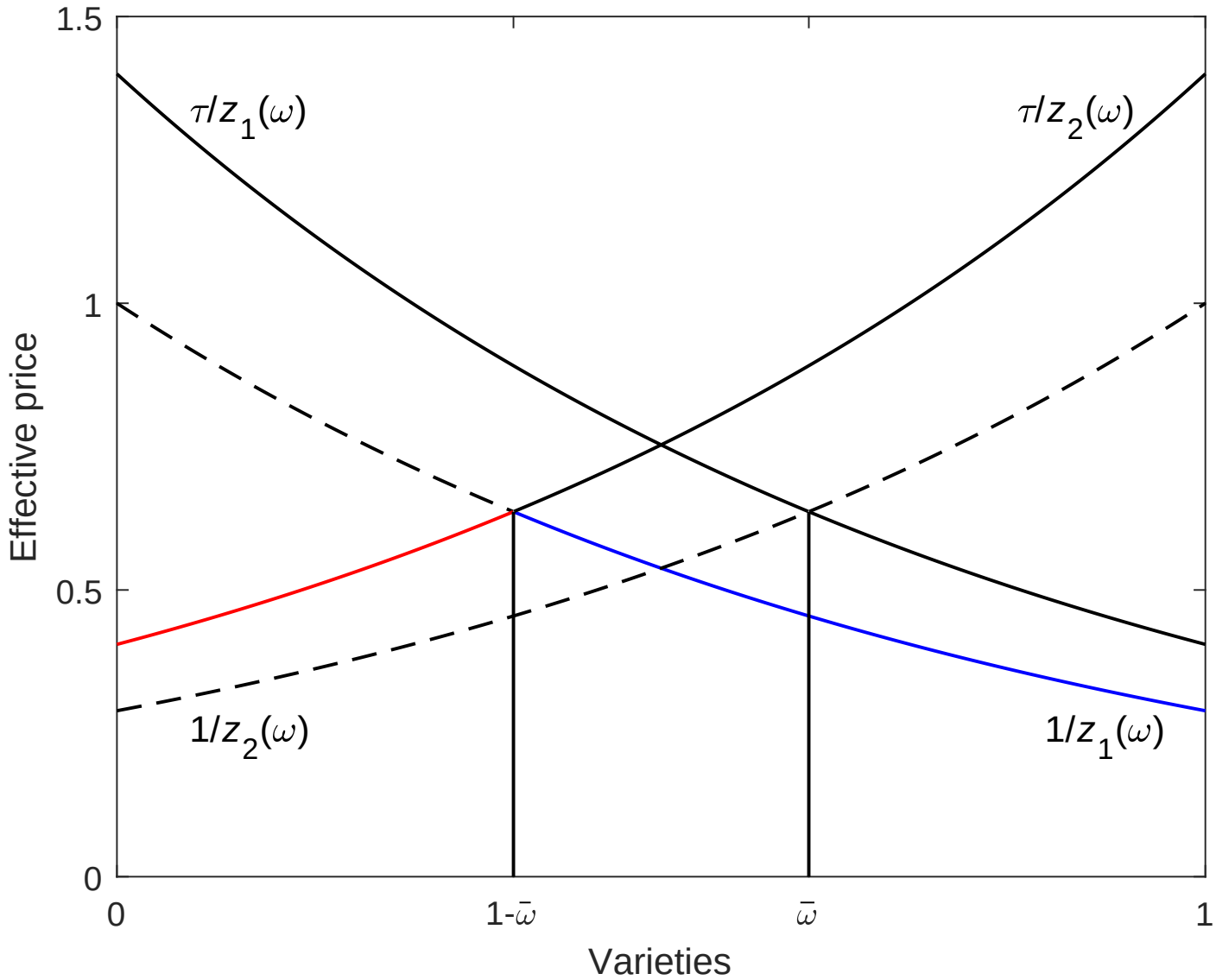
Pattern of production (free trade)



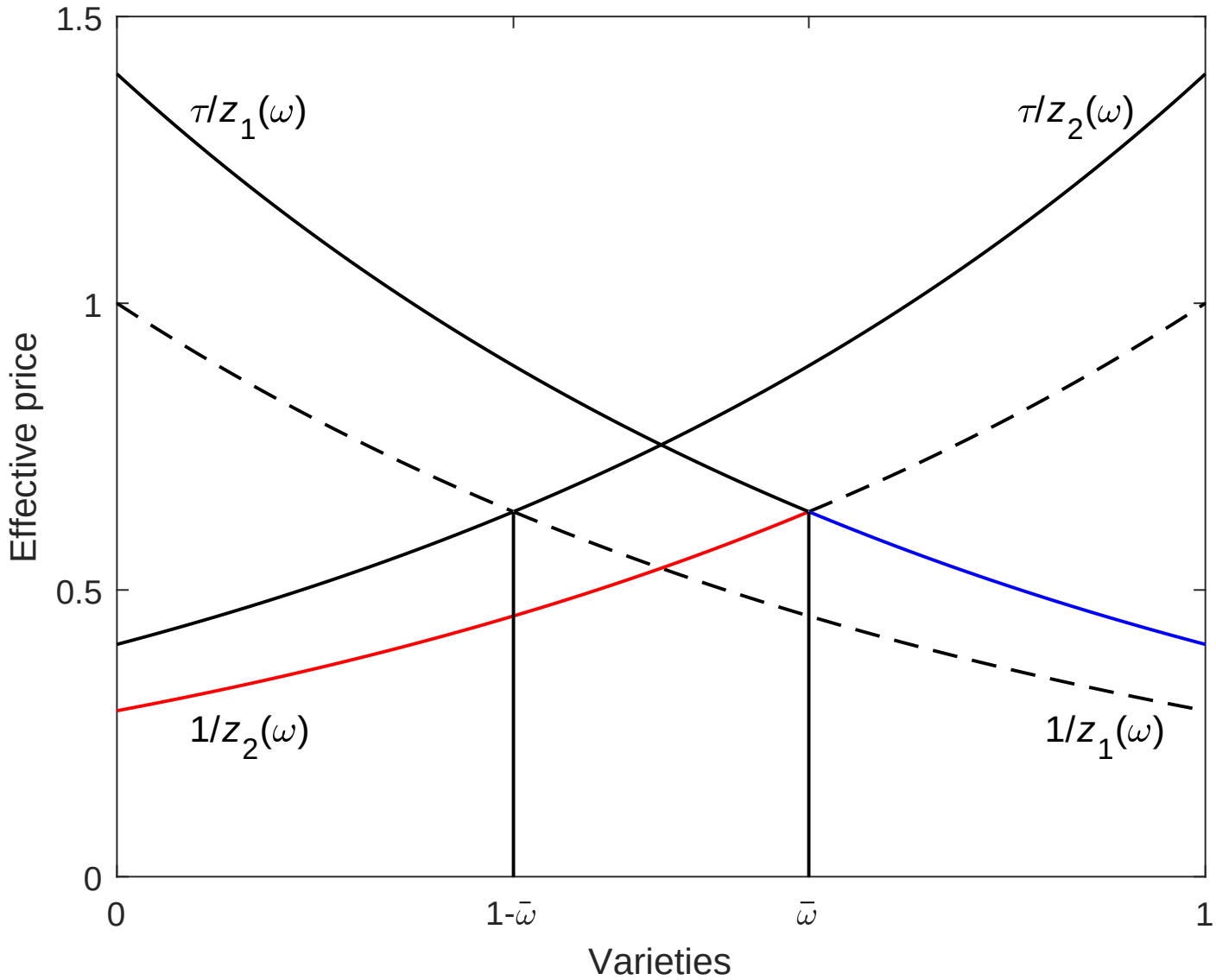
Pattern of production (costly trade)



Pattern of production (costly trade)

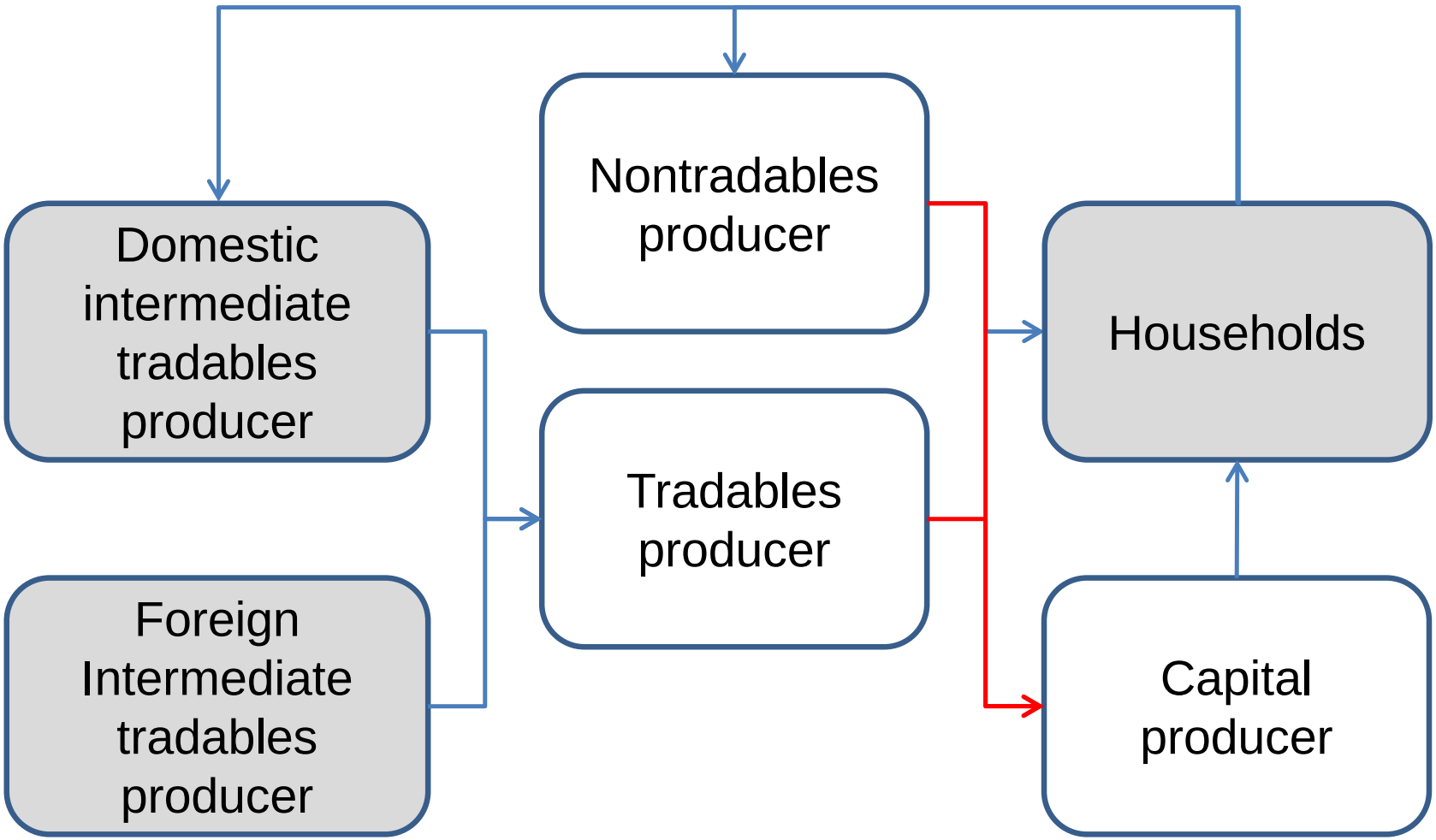


Pattern of production (costly trade)



Outline of model

- Let's discuss the production of nontradable goods and capital



Non-tradables producer

- A representative firm produces non-tradable output Y_{iN}
- It solves the static profit maximization problem

$$\max_{H_{iN}, L_{iN}, K_{iN}} P_{iN} Y_{iN} - w_{iHi} H_{iN} - w_{iL} L_{iN} - r_i K_{iN}$$
$$\text{s.t. } Y_{iN} = z_{iN} F\left(H_{iN}, L_{iN}, K_{iN}\right).$$

- Numeraire: set $P_{iN} = 1$

Capital producer

- A representative firm produces capital X_i, by solving

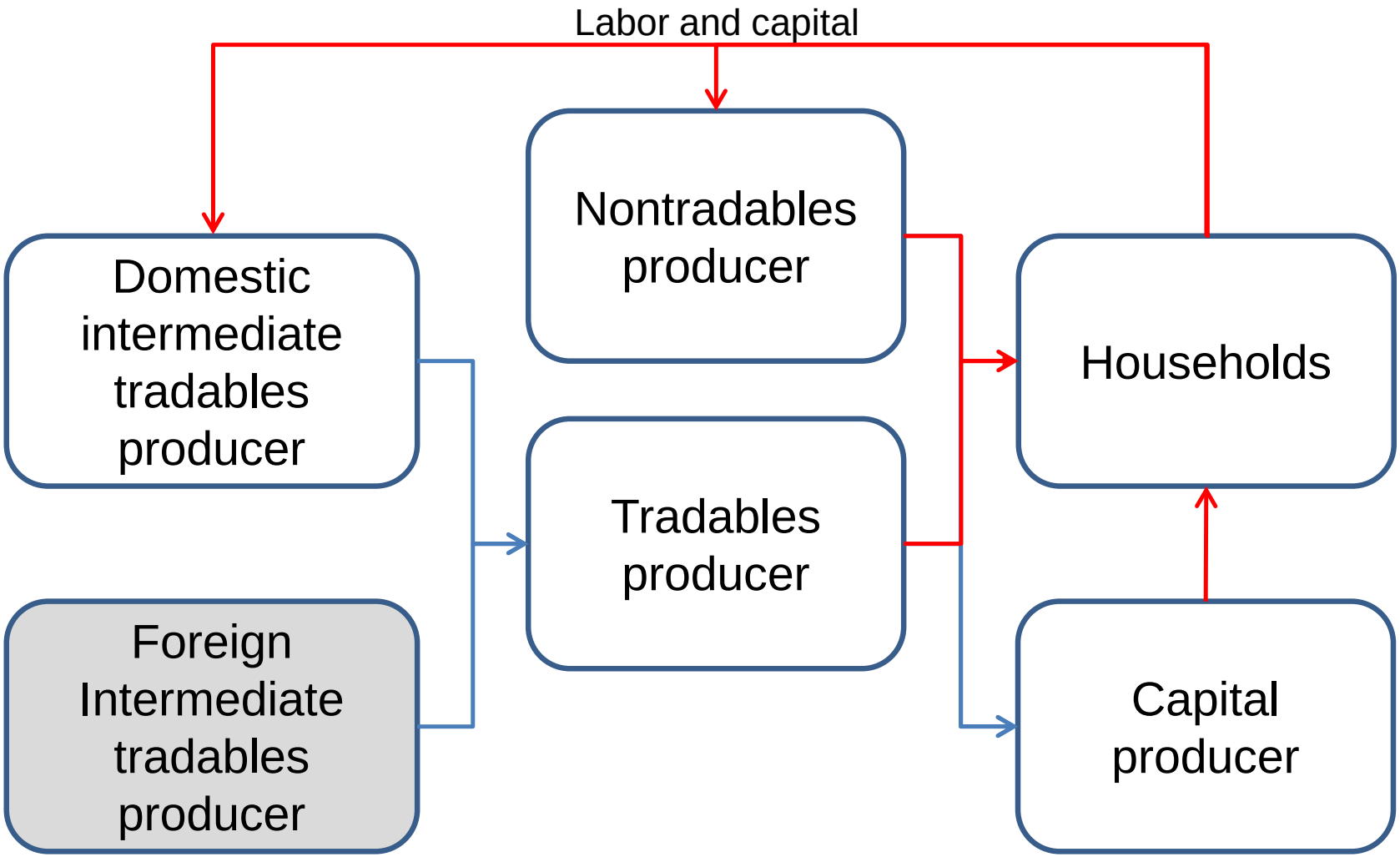
$$\max_{I_{iT}, I_{iN}} P_{iX} X_i - P_{iT} I_{iT} - I_{iN}$$
$$\text{s.t. } X_i = z_{iX} I_{iT}^{\kappa} I_{iN}^{1-\kappa}.$$

Government

- The government finances a constant stream of (wasteful) expenditures, G_i, by collecting
  - taxes on labor income, τ_{il},
  - taxes on capital income, τ_{ik},
  - and tariffs τ_{iP}

Outline of model

- Next, we discuss the household problem



Households

- Household with skill type, j, solves

$$V_{ij}(k,\varepsilon) = \max_{c_T, c_N, \ell, k'} u(c_T, c_N, \ell) + \beta E_{\varepsilon'|\varepsilon} V_{ij}(k', \varepsilon')$$

$$\text{s.t.} \quad P_{iT} c_T + c_N + P_{iX}(k' - k) \leq \tilde{w}_{ij} \ell \varepsilon + \tilde{r}_i k + T_i,$$

$$k' \geq 0$$

where $u(c_T, c_N, \ell) = \dfrac{\left(c_T^{\gamma}(c_N + \bar{c})^{1-\gamma}\right)^{1-\sigma}}{1-\sigma} - \psi \dfrac{\ell^{1+\nu}}{1+\nu}$

- $\tilde{w}_{ijt}$ and $\tilde{r}_{ijt}$ are after-tax returns:

$$\tilde{w}_{ij} = (1 - \tau_{il}) w_{ij}$$

$$\tilde{r}_i = (1 - \tau_{ik})(r_i - \delta P_{iX}).$$

Equilibrium

A *symmetric steady-state recursive equilibrium*, given fiscal policies $\{\tau_I, \tau_k, \tau_P, G, T\}$, is, for $j = H, L$

- Functions $\{V_j, g_{jT}, g_{jN}, g_{j\ell}, g_{jk}\}$,
- Nontradable producer plans $\{Y_N, H_N, L_N, K_N\}$,
- Final tradable producer plans $\left\{Y_T, \{q_{oi}(\omega)\}_{\omega\in[0,1],i=1,2,o=1,2}\right\}$,
- Intermediate producer plans $\{y_i(\omega), h_i(\omega), l_i(\omega), k_i(\omega)\}_{\omega,i}$,
- Capital producer plans $\{X, I_T, I_N\}$,
- Prices $\left\{w_H, w_L, r, P_T, P_X, \{p_i(\omega)\}_{\omega,i}\right\}$, and
- Invariant distributions $\{\mu_j^*\}_j$ such that:

1. Given prices, households optimize.
2. Given prices, firms optimize.
3. Goods markets clear.
4. Factor markets clear.
5. Balanced trade.
6. Gov't budget holds: $G + T = \tau_l \sum_j w_j \int \varepsilon g_{j\ell}(k, \varepsilon)\, d\mu_j(k, \varepsilon)$ $+\tau_k (r - \delta P_X) \sum_j \int k d\mu_j(k, \varepsilon) + \tau_P \int q_{oi}(\omega) d\omega$, for $o \neq i$.
7. For any $(\mathcal{K}, \mathcal{E}) \in \mathcal{B}$, the invariant distribution μ_j^* satisfies

$$\mu_j^*(\mathcal{K}, \mathcal{E}) = \int_S \sum_{\varepsilon' \in \mathcal{E}} 1_{\{g_{jk}(k,\varepsilon) \in \mathcal{K}\}} \Gamma(\varepsilon', \varepsilon)\, d\mu_j^*(k, \varepsilon).$$

Characterization of equilibrium

- The tradable price is given by $P_T = \frac{1}{\tilde{z}(\tau)}$,

  where $\tilde{z}(\tau)$ is a measure of aggregate productivity:

$$\tilde{z}(\tau) = \left[\int_0^{1-\bar{\omega}(\tau)} \left(\frac{z_2(\omega)}{\tau} \right)^{\theta-1} d\omega + \int_{1-\bar{\omega}(\tau)}^{1} z_1(\omega)^{\theta-1} d\omega \right]^{\frac{1}{\theta-1}}$$

- Trade costs distort ...

Characterization of equilibrium

- The tradable price is given by $P_T = \frac{1}{\tilde{z}(\tau)}$,

  where $\tilde{z}(\tau)$ is a measure of aggregate productivity:

$$\tilde{z}(\tau) = \left[\int_0^{1-\bar{\omega}(\tau)} \left(\frac{z_2(\omega)}{\tau} \right)^{\theta-1} d\omega + \int_{1-\bar{\omega}(\tau)}^{1} z_1(\omega)^{\theta-1} d\omega \right]^{\frac{1}{\theta-1}}$$

- Trade costs distort the extensive ...

Characterization of equilibrium

- The tradable price is given by $P_T = \frac{1}{\tilde{z}(\tau)}$,

  where $\tilde{z}(\tau)$ is a measure of aggregate productivity:

$$\tilde{z}(\tau) = \left[\int_0^{1-\bar{\omega}(\tau)} \left(\frac{z_2(\omega)}{\tau} \right)^{\theta-1} d\omega + \int_{1-\bar{\omega}(\tau)}^{1} z_1(\omega)^{\theta-1} d\omega \right]^{\frac{1}{\theta-1}}$$

- Trade costs distort the extensive and intensive margins

Characterization of equilibrium

- The tradable price is given by $P_T = \frac{1}{\tilde{z}(\tau)}$,

  where $\tilde{z}(\tau)$ is a measure of aggregate productivity:

$$\tilde{z}(\tau) = \left[\int_0^{1-\bar{\omega}(\tau)} \left(\frac{z_2(\omega)}{\tau} \right)^{\theta-1} d\omega + \int_{1-\bar{\omega}(\tau)}^{1} z_1(\omega)^{\theta-1} d\omega \right]^{\frac{1}{\theta-1}}$$

- The capital price is given by $P_X = \frac{1}{z_X} \left(\frac{P_T}{\kappa} \right)^{\kappa} \left(\frac{1}{1-\kappa} \right)^{1-\kappa}$
- Comparative statics:

$$\frac{d \log(P_T)}{d\tau} = -\frac{d \log(\tilde{z}(\tau))}{d\tau} > 0$$
$$\frac{d \log(P_X)}{d\tau} = -\kappa \frac{d \log(\tilde{z}(\tau))}{d\tau} > 0$$

Quantitative Analysis

Quantitative Analysis

- Calibrate model to match features of U.S. economy
- Experiment
  - impose a symmetric tariff of 20 percent (unilateral in progress)
  - compute transition to new steady state
- Various fiscal policies
  - increase government expenditure
  - reduce labor income tax
  - reduce capital income tax
  - lump-sum redistribute

Calibration

- Preferences:

Parameters	Values	Targets / Source
Discount factor β	0.96	Wealth-to-GDP: 4.8 (2014)
Risk aversion σ	2	Standard value
Tradable share γ	0.27	Tradable exp. share: 36% (2004–14)
Non-homotheticity $\bar{c}$,	0.09	Tradable exp. share of top wealth quartile: 31 percent (2004–14)
Disutility from labor ψ	440	Average hours: 30 percent
Frisch elasticity $1/\nu$	0.5	Standard value

Calibration

- Technology:

$$F(L, H, K) = \left[(1-\mu)\, L^{\zeta} + \mu[(1-\alpha)\, H^{\chi} + \alpha K^{\chi}]^{\frac{\zeta}{\chi}}\right]^{\frac{1}{\zeta}}$$

Parameters	Values	Targets / Source
Skilled fraction, $\bar{H}$	0.33	Skilled labor force: 33 percent
Capital weight, α	0.83	Capital income share: 36 percent
Skilled weight, μ	0.61	Skilled labor inc. share: 36 percent
Elasticity of substitutions,		
unskilled–capital, $1/(1-\zeta)$	1.67	Krusell et al. (2000)
skilled–capital, $1/(1-\chi)$	0.67	Krusell et al. (2000)

Calibration

- Assume $\tau_P = 0$ (less than 2% of gov't revenue in 2014)
- Other parameters:

Parameters	Values	Targets / Source
Elas. of subs. between tradable intermediates, θ	5.7	Trade elasticity: 4
Factor elasticity, κ	0.59	Tradable input shares in capital
Productivity distribution, η	1.29	Emp. share of top 17 percent of large mfg. est.: 32 percent
Iceberg cost, $(\tau - 1) \times 100$	0.27	Import share: 17 percent
Income tax, $\tau_\ell = \tau_k$	0.19	Gov't consumption: 15 pct. of GDP

Productivity shocks

- ε follows a finite-state Markov process which approximates the continuous process,

$$\log \varepsilon_t = \rho_\varepsilon \log \varepsilon_{t-1} + \nu_t, \nu_t \sim N\left(0, \sigma_\nu^2\right)$$

- We set $\rho_\varepsilon = 0.92$ and $\sigma_\nu = 0.21$ following Floden and Linde (2001)

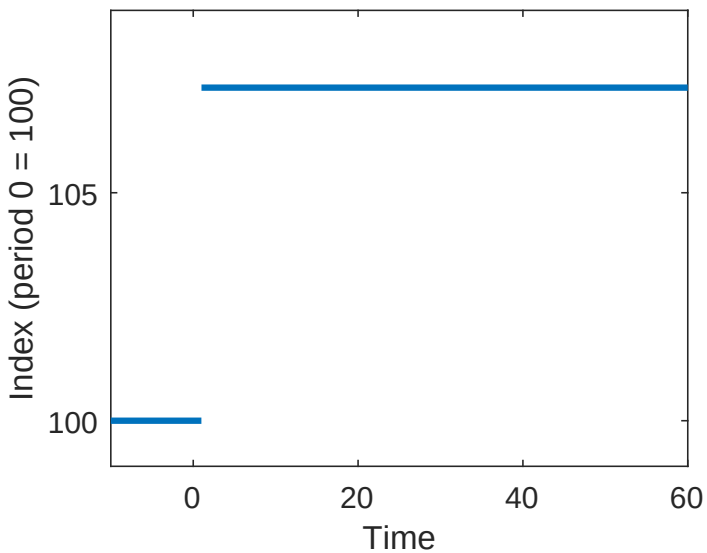
Main results

- Without redistribution
  - tariffs harm everyone
  - but skilled more than unskilled and poor more than rich
- With redistribution
  - labor income tax reduction delivers higher average welfare than capital income tax reduction, but also lower GDP
  - small average welfare increase from lump-sum redistribution, at the expense of the skilled

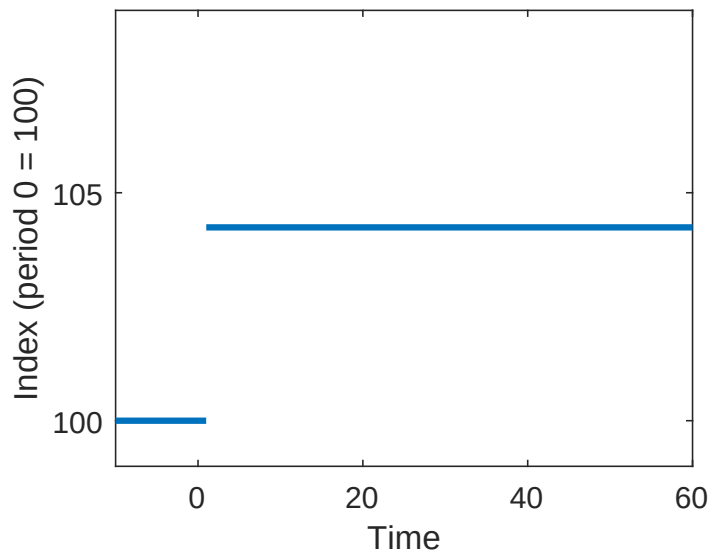
Effect of tariffs on prices

- Tradables price and investment price do not depend on how tariff revenue is spent

(a) Tradables price



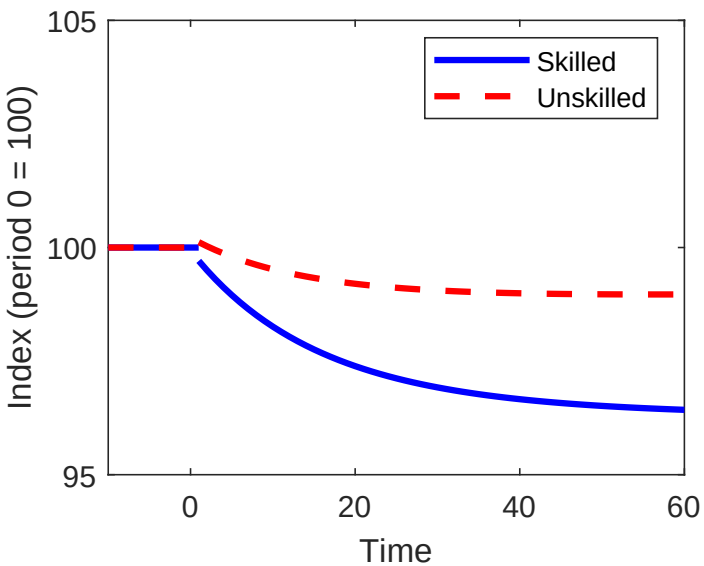
(b) Investment price



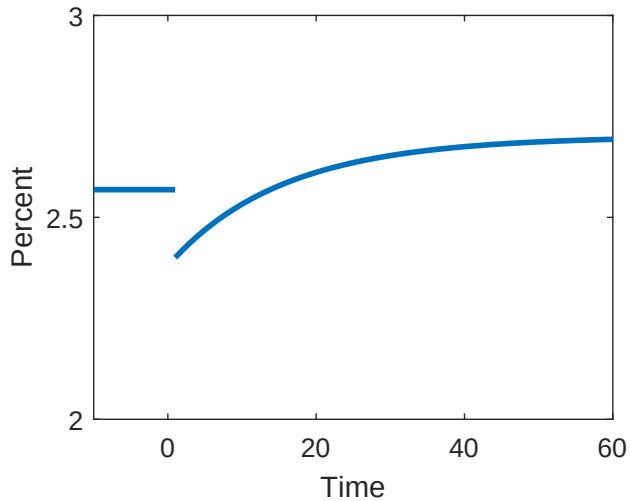
Effect of tariffs on factor prices (no redistribution)

- Skilled wages fall by more
- Net return to capital rises after initial drop

(a) After-tax wages

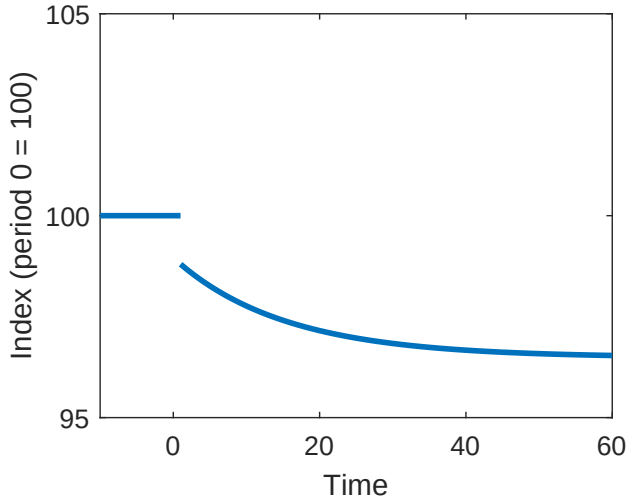


(b) After-tax net return

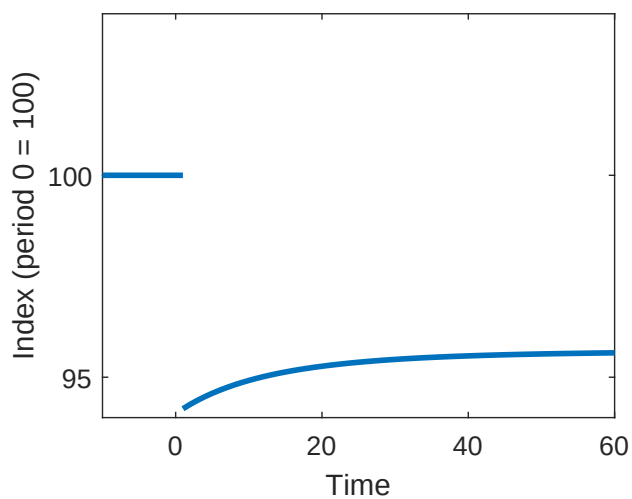


Effect of tariffs on aggregates (no redistribution)

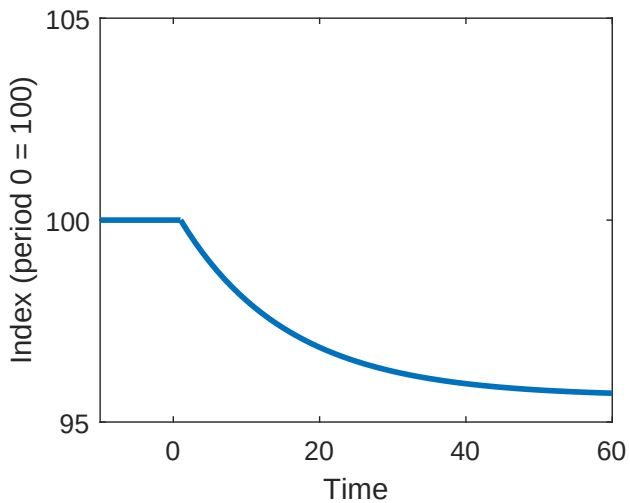
(a) Consumption



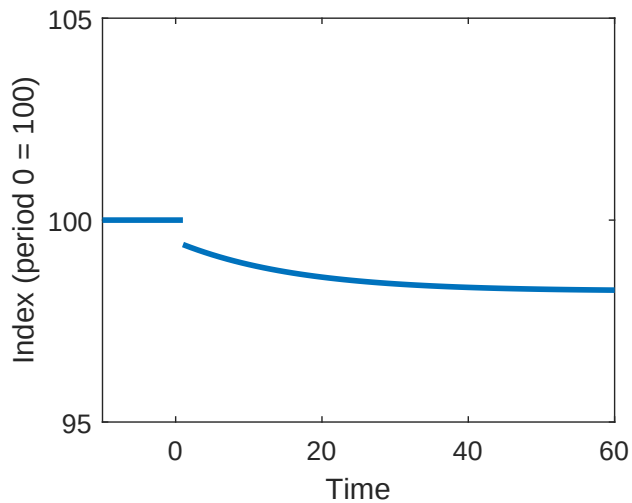
(b) Investment



(c) Capital



(d) GDP



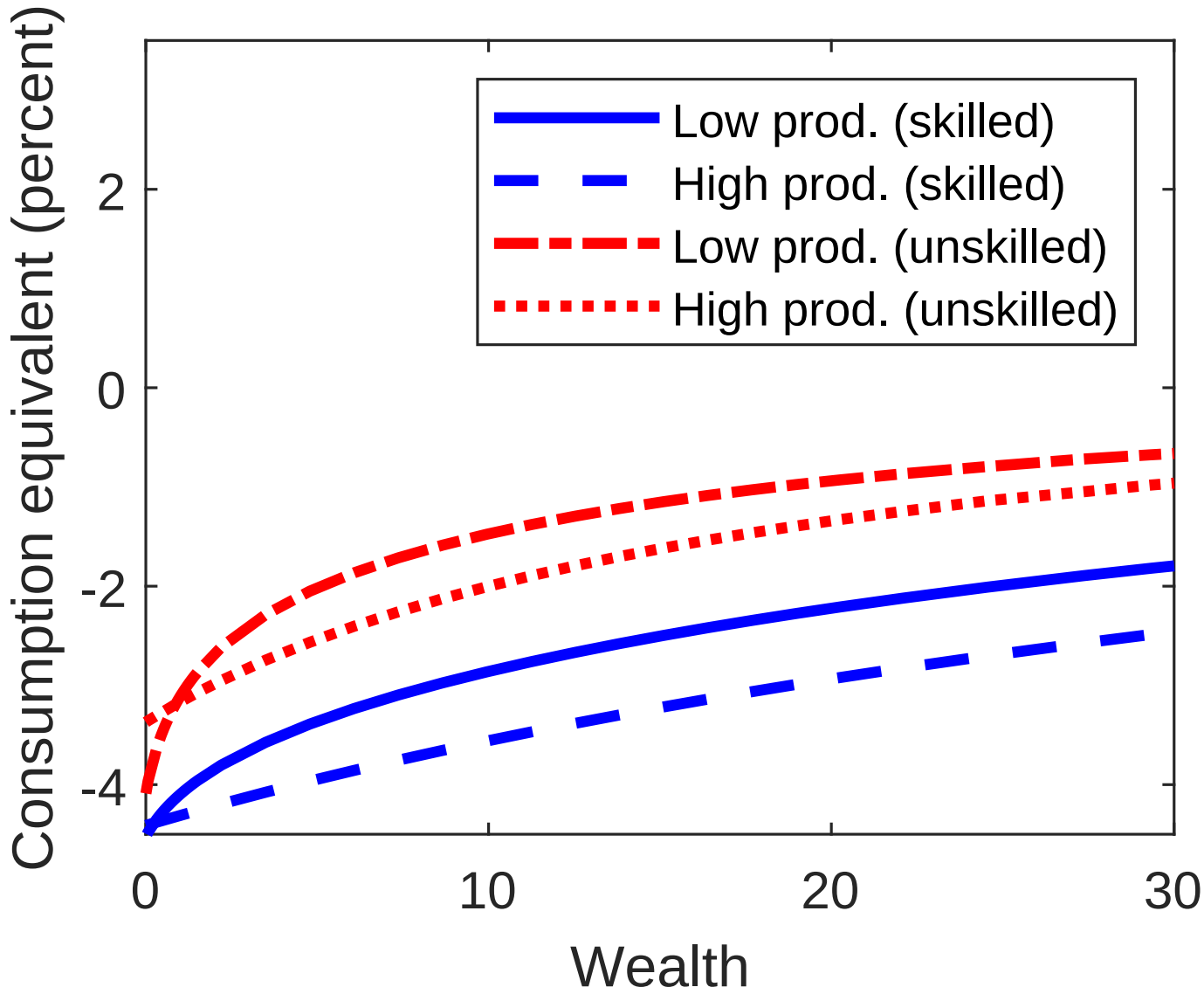
Welfare Calculation

- For each household, we compute the consumption equivalence, Δ
- How much would initial steady state consumption have to be permanently increased for a household to be indifferent between raising tariffs or not?
- Solve for Δ such that $V_{j\Delta}(k,\varepsilon) = V_{j,t=1}(k,\varepsilon)$

$$\begin{aligned} V_{j\Delta}(k,\varepsilon) =& u\left((1+\Delta)\, g_{jT}^{ss}(k,\varepsilon), (1+\Delta)\, g_{jN}^{ss}(k,\varepsilon), g_{j\ell}^{ss}(k,\varepsilon)\right) \\ &+ \beta E_{\varepsilon'|\varepsilon} V_{j\Delta}\left(g_{jk}^{ss}(k,\varepsilon), \varepsilon'\right). \end{aligned}$$

- If $\Delta > 0$, then the household supports tariffs. If $\Delta < 0$, then it does not.

Welfare effects of tariffs (no redistribution)



Decomposing welfare changes

We conduct three partial equilibrium exercises to isolate effects on welfare from three channels

$$P_T c_T + c_N + P_X(k' - k) \leq \tilde{w}_j \ell \varepsilon + \tilde{r}k + T$$

- Expenditure channel: $P_T \uparrow$ makes tradable consumption more expensive.
- Poor vs. Wealthy

Decomposing welfare changes

We conduct three partial equilibrium exercises to isolate effects on welfare from three channels

$$P_T c_T + c_N + P_X(k' - k) \leq \tilde{w}_j \ell \varepsilon + \tilde{r}k + T$$

- Investment channel: $P_X \uparrow$ makes accumulating capital more expensive
- Savers vs. Dissavers

Decomposing welfare changes

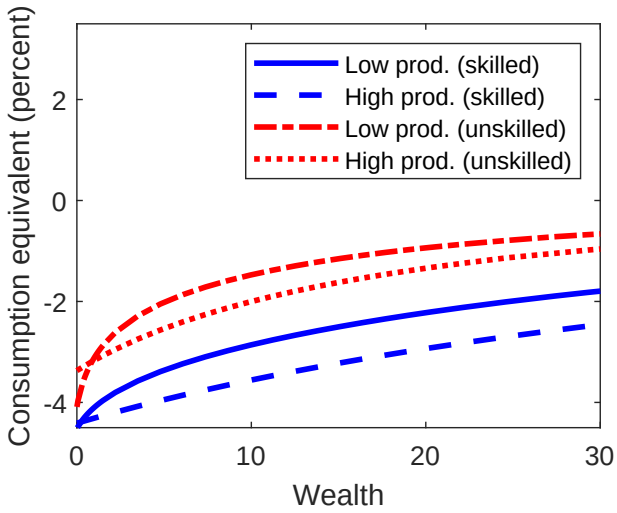
We conduct three partial equilibrium exercises to isolate effects on welfare from three channels

$$P_T c_T + c_N + P_X(k' - k) \leq \tilde{w}_j \ell \varepsilon + \tilde{r} k + T$$

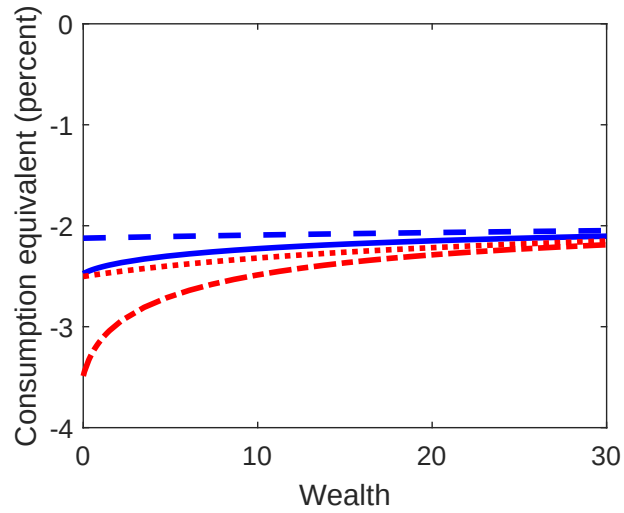
- Factor price channel: $\tilde{w}_j$ and $\tilde{r}$ change
- Labor vs Capital
- Skilled vs Unskilled

Welfare decomposition (no redistribution)

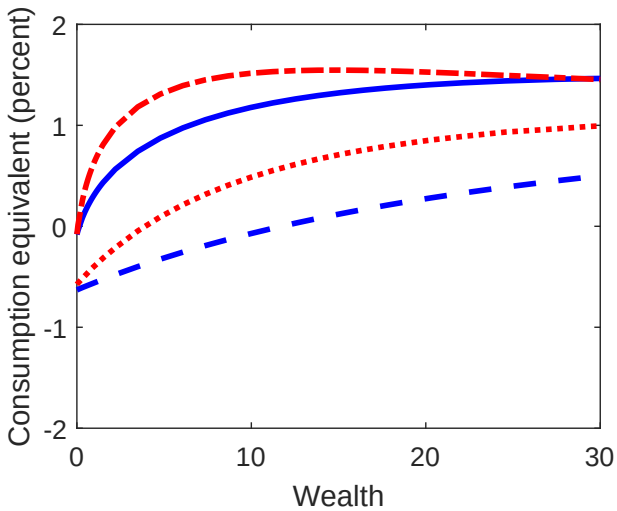
(a) Total



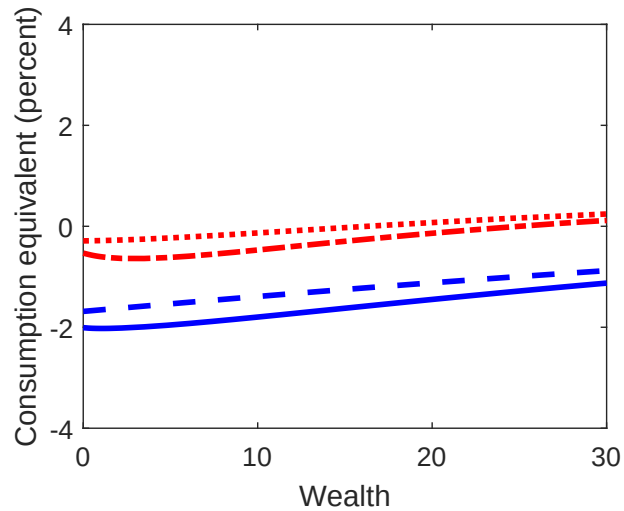
(b) Expenditure



(c) Investment

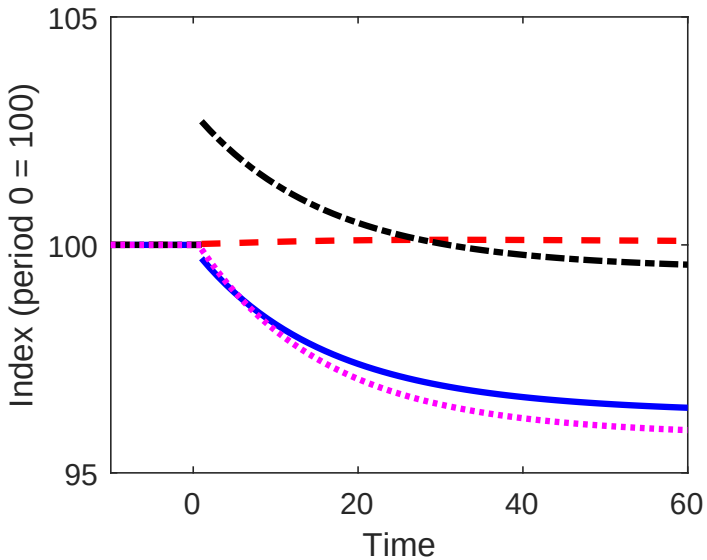


(d) Factor price

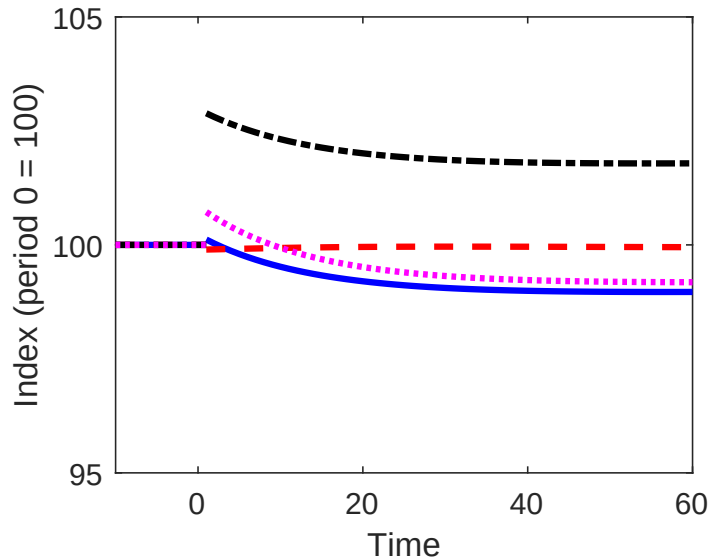


With redistribution – prices

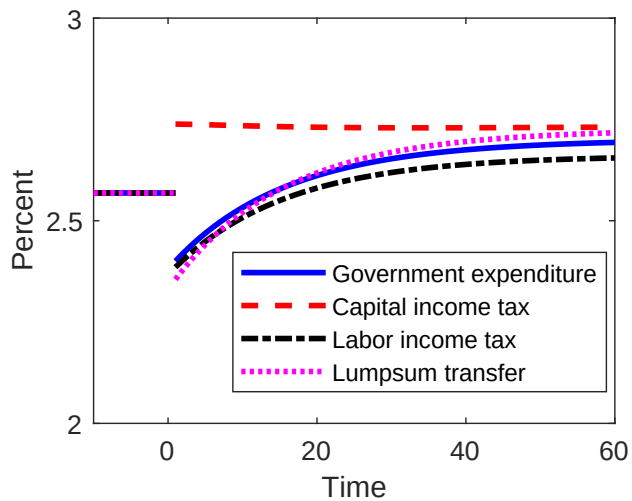
(a) After-tax skilled wage



(b) After-tax unskilled wages

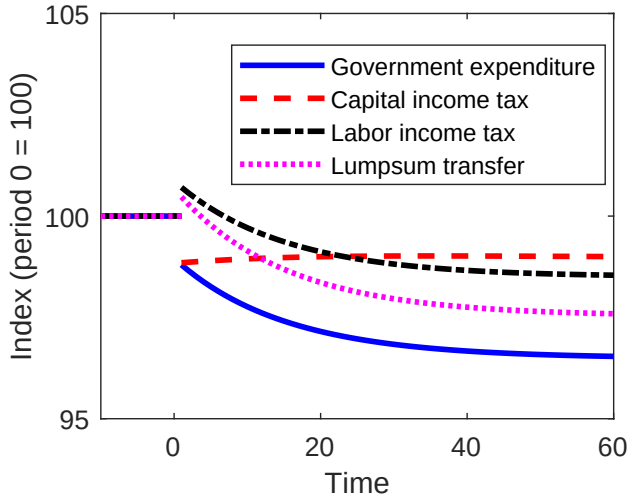


(c) After-tax net return

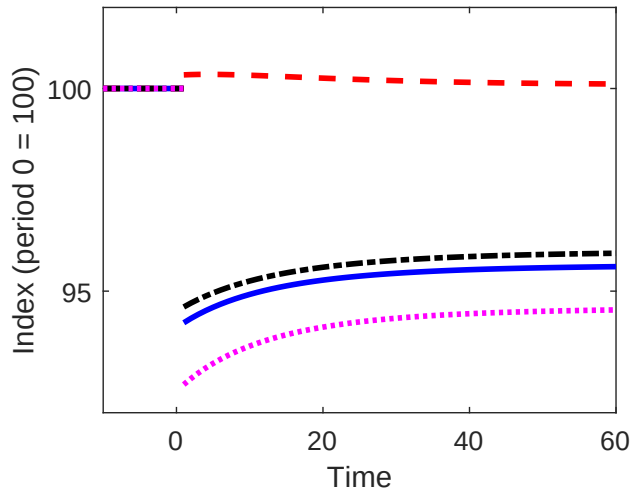


With distribution – quantities

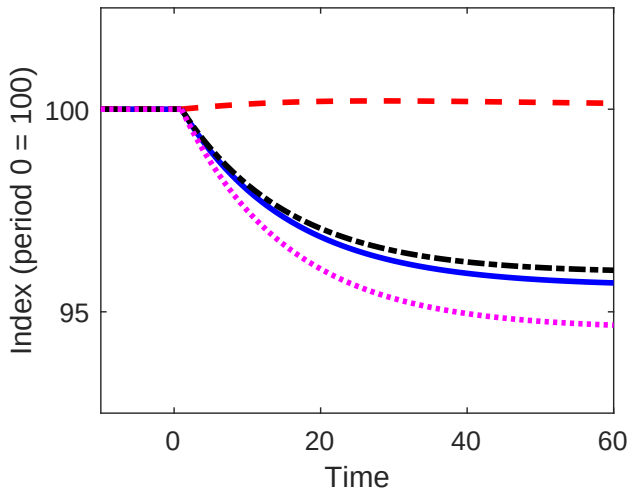
(a) Consumption



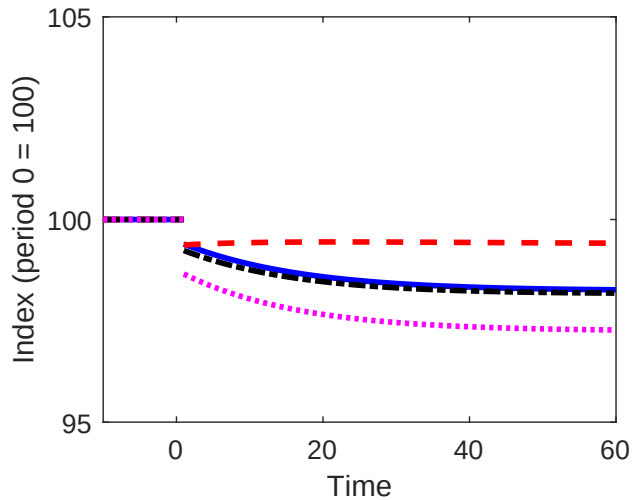
(b) Investment



(c) Capital



(d) GDP



Welfare

- lowest average welfare with wasteful government spending
- labor income tax reduction delivers higher average welfare than capital income tax reduction.
- small average welfare increase from lump-sum redistribution

Table: Average Welfare

Govt expenditure	−3.13
Capital inc. tax	−1.52
Labor inc. tax	−0.98
Lump-sum tax	0.23

Units: percent.

Welfare across skill type

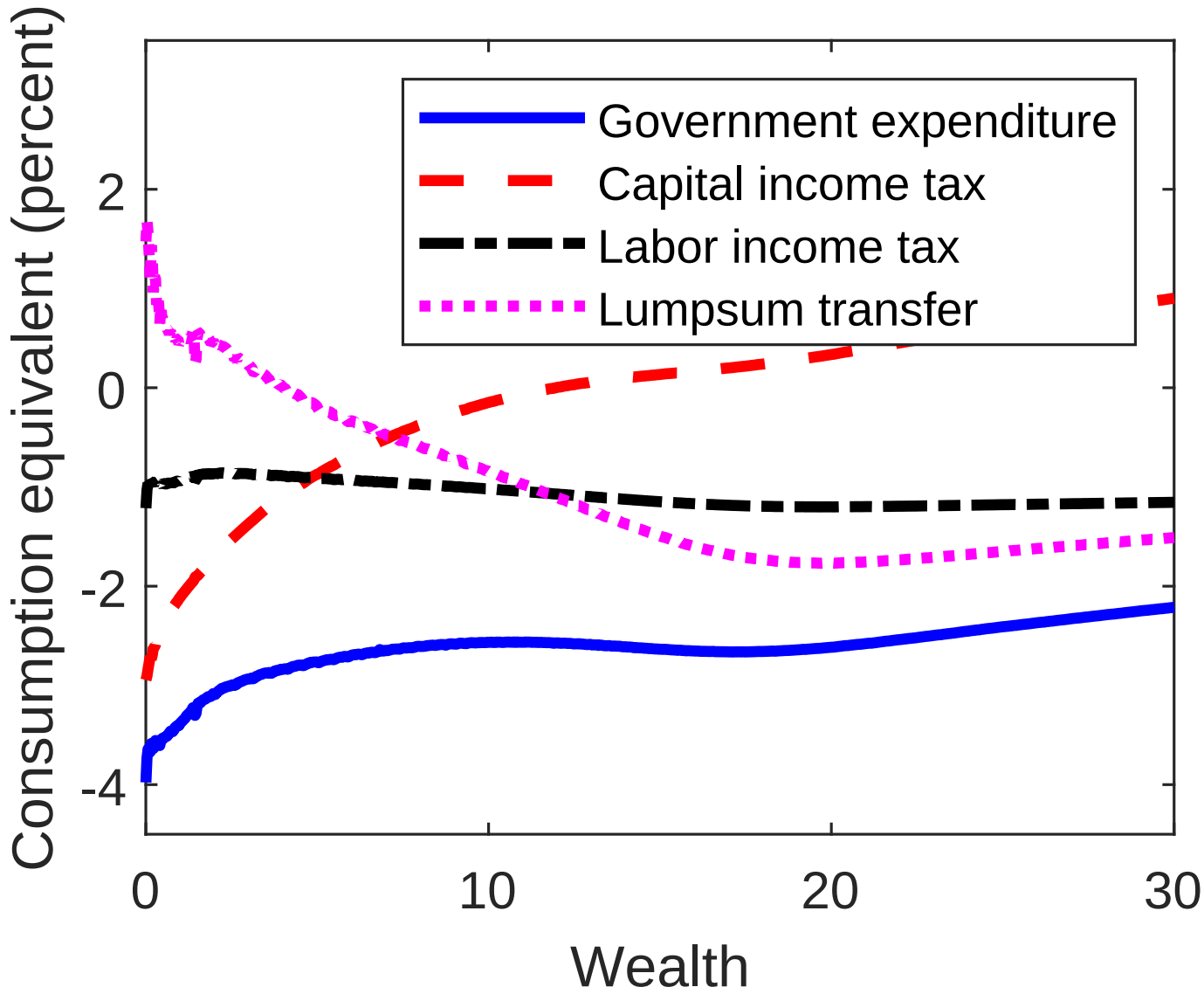
- absent redistribution, tariffs harm skilled more than unskilled and poor more than rich
- unskilled benefit from lump-sum redistribution at the expense of the skilled

Table: Average welfare by skill level

Fiscal policy	unskilled	skilled
Govt expenditure	−2.91	−3.57
Capital inc. tax	−1.80	−0.96
Labor inc. tax	−0.80	−1.35
Lump-sum tax	1.47	−2.30

Units: percent.

Welfare across wealth



Decomposition of welfare changes for unskilled

	Low wealth		High wealth		
Channels	Low prod.	High prod.	Low prod.	High prod.	Average
Expenditure	−3.49	−2.50	−2.40	−2.27	−2.75
Investment	−0.08	−0.58	1.54	0.67	0.32
Factor price					
Govt Expend	−0.53	−0.29	−0.35	−0.04	−0.47
Capital inc. tax	0.09	0.90	2.13	2.45	0.71
Labor inc. tax	2.24	2.34	0.18	0.86	1.69
Lump-sum redist.	−0.15	0.14	−0.34	0.13	−0.18
All					
Govt Expend.	−4.09	−3.37	−1.25	−1.69	−2.91
Capital inc. tax	−3.49	−2.28	1.14	0.67	−1.80
Labor inc. tax	−1.40	−0.81	−0.70	−0.78	−0.80
Lump-sum redist.	3.98	−0.05	1.20	0.29	1.47

Units: percent.

Decomposition of welfare changes for skilled

Table: Decomposition of welfare changes for skilled

	Low wealth		High wealth		
Channels	Low prod.	High prod.	Low prod.	High prod.	Average
Expenditure	−2.48	−2.12	−2.16	−2.06	−2.20
Investment	−0.08	−0.63	1.35	0.34	0.37
Factor price					
Govt Expend	−2.01	−1.69	−1.51	−1.03	−1.74
Capital inc. tax	0.21	1.12	1.41	2.17	0.95
Labor inc. tax	1.04	1.19	−0.26	0.47	0.52
Lump-sum redist.	−2.20	−1.82	−1.76	−1.15	−1.95
All					
Govt Expend.	−4.52	−4.41	−2.35	−2.78	−3.57
Capital inc. tax	−2.36	−1.74	0.52	0.28	−0.96
Labor inc. tax	−1.55	−1.61	−1.09	−1.30	−1.35
Lump-sum redist.	−1.94	−3.45	−1.28	−2.08	−2.30

Units: percent.

Conclusion

- Without redistribution . . .
  - bilateral tariffs generate large welfare losses regardless of income/wealth/skill, but especially hurts the poor
  - raises the cost of their consumption
  - do not benefit from selling capital
  - their wage falls
- With redistribution . . .
  - capital income tax reduction leads to highest aggregate economic activity, but lowest average welfare (really hurts the poor)
  - Lump-sum rebating tariff revenue can produce a welfare gain on average, but at the expense of skilled

Appendix

Tradability measures back

CEX item	IO item	$\frac{\max(exp, imp)}{production}$	$\frac{exp + imp^*}{production}$	Tradable
Men's suits	Apparel manufacturing	5.60	7.35	yes
Calculators	Other comm and service industry machinery mfg.	0.23	0.57	yes
Airline fares	Air transportation	0.20	0.36	yes
Plastic dinnerware	Oth. plastics prod. mfg.	0.12	0.29	yes
Paint, wallpaper, and supplies	Paint and coating mfg.	0.09	0.13	no
Office furniture	Office furniture, custom architectural woodwork, and millwork mfg.	0.08	0.11	no
Newspaper subscr.	Newspaper publishers	0.03	0.03	no
Dining out	Restaurants	0.00	0.00	no

- * : direct and indirect imports

Tradable shares, wealth, and income back

	Tradable expenditure share (percent)			
	(1) PSID	(2) PSID	(3) CEX	(4) CEX
ln(Wealth)	–1.03***	–0.64***	–1.12***	–0.37***
	(0.04)	(0.05)	(0.04)	(0.04)
ln(Income)	–0.20**	–0.46***	–0.24*	–1.17***
	(0.09)	(0.10)	(0.13)	(0.14)
College		–2.77***		–3.31***
		(0.15)		(0.19)
Homeowner		–1.31***		–6.06***
		(0.19)		(0.21)
Other controls	no	yes	no	yes
N	30244	30228	23484	23484
Adj. R^2	0.036	0.066	0.076	0.167

Standard errors in parentheses. All regressions include year fixed effects. Other controls include fixed effects for age and household size.

$*$ $p < 0.10$, $**$ $p < 0.05$, $***$ $p < 0.01$

Sensitivity analysis back

	Tradable expenditure share (percent)					
	(1) PSID no housing	(2) PSID no partial adj.	(3) PSID total lab. inc.	(4) CEX no housing	(5) CEX total lab. inc.	(6) CEX alt. tradability
ln(Wealth)	–0.84***	–0.76***	–0.76***	–1.00***	–0.34***	–0.17***
	(0.07)	(0.05)	(0.05)	(0.04)	(0.04)	(0.04)
ln(Income)	–2.14***	–0.66***	–0.41***	–2.50***	–1.03***	–0.24*
	(0.14)	(0.10)	(0.08)	(0.15)	(0.11)	(0.14)
N	30220	30228	28212	23387	21934	23484
Adj. R^2	0.047	0.079	0.072	0.254	0.167	0.163

Standard errors in parentheses. $*$ $p < 0.10$, $**$ $p < 0.05$, $***$ $p < 0.01$

All regressions include year, age, household size, education, and homeowner fixed effects.

Wealth distribution

- Wealth Gini in model: 0.59

Figure: Data

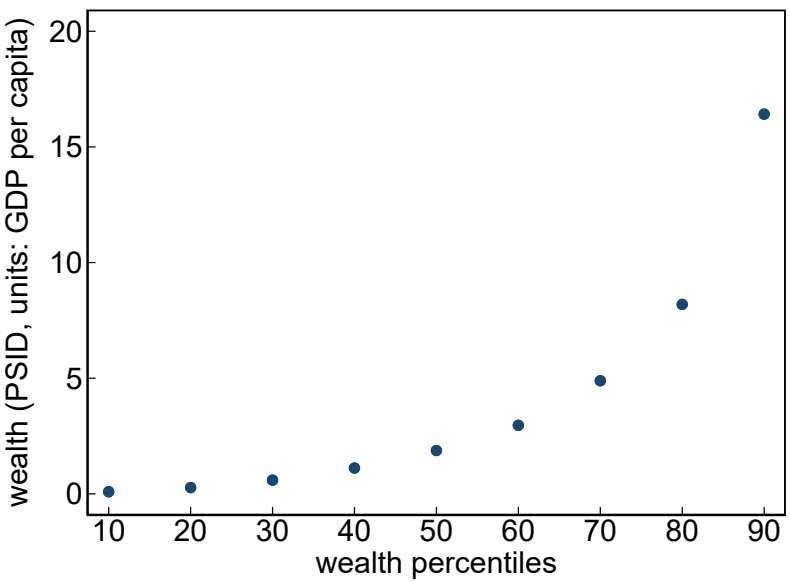


Figure: Model