Redistributing the Gains From Trade through Progressive Taxation

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Big Picture: The Backlash Against Trade

Hard to deny that the benefits of globalization have been under attack...

Motivating this attack (I think) is the perception that trade has imposed hardship on some segments of the population.

Autor, Dorn, and Hanson (2013) provide the most compelling evidence supporting this view... Chinese-import-exposed areas experienced:

- Drops in labor earnings,
- Decreases in labor force participation (and take up of transfer payments),
- Little out-migration (at least in the short/medium run).

Use Progressive Taxation to Insure the Losers from Trade?

One motive for progressive taxation: provide social insurance for privately uninsurable shocks (possibly trade related).

- Varian (1980) and Eaton and Rosen (1980).

But theses polices come with costs. . .

- Reductions in labor supply; reductions in migration. . .
- $\Rightarrow$ Losses in economic efficiency.

Our question:

How does openness to trade change this cost-benefit calculation?

Our Approach

Important model elements:

1. Dynamic, Ricardo-Viner trade model. Similar to Kambourov (2009), Artuç, Chaudhuri, and McLaren (2010), Caliendo, Dvorkin, and Parro (2015).
2. Households face labor income risk (possibly trade related), incomplete markets, but can self insure as in the standard incomplete market model.
3. Government uses a log-linear labor-income tax/transfer scheme as in Benabou (2002), Heathcote, Storesletten, and Violante (2014) and others.

Given a social welfare function, we measure

- How does optimal policy change with openness to trade?
- How does a progressive tax system enhance the gains from trade?

How We Connect with the Literature

Still learning, but a couple of comments. . .

- Our parallel work in Lyon and Waugh (2017); Focused on estimation and welfare evaluation of China shock (including transition dynamics).

- Antràs, De Gortari, and Itskhoki (2016). Different redistribution motive in our model—social insurance for uninsurable shocks, not inequality per se.

- Trade and labor market dynamics: Many of you in this room! Key departure: Labor income risk + incomplete markets.
  1. Opens door to role for government policy.
  2. Insurance motivates migration $\Rightarrow$ new tension between social insurance and distorting migration decision and allocative efficiency.

Model

Model: Overview

Time: Discrete time, infinite horizon.

- We'll drop time subscripts unless necessary.

Domestic Geography: A continuum of "islands" indexed by $\omega \in [0, 1]$.

On an island ω...

- Competitive producers on an island produce intermediate good ω.
- Households living on ω can work for those producers on the island.

International Trade: Focus on a Small Open Economy, where world prices for an island's intermediate good follow an exogenous, stochastic process.

Government: Uses a parametric, log-linear labor-income tax and transfer scheme to finance expenditures.

Model: Production

Island level intermediate good production:

$$q(\omega) = z(\omega)\ell.$$

Productivity z evolves according to:

$$\log z_{t+1} = \phi_z \log z_t + \epsilon_{t+1}$$

where $\epsilon_{t+1} \sim \mathcal{N}(0, \sigma_\epsilon)$. ϵ_{t+1} is independent across time and goods/islands.

Intermediate goods are aggregated according to:

$$Q = \left[\int_0^1 q_(\omega)^\rho d\omega\right]^{\frac{1}{\rho}}.$$

where $\theta = \frac{1}{1-\rho}$ is the elasticity of substitution.

Model: Production and Trade

Focus on a Small Open Economy (SOE). World prices for intermediate good ω evolve according to:

$$\log p_w(\omega)_{t+1} = \phi_w \log p_w(\omega)_t + \epsilon_{w,t+1}$$

where $\epsilon_{w,t+1} \sim \mathcal{N}(0, \sigma_w)$. $\epsilon_{w,t+1}$ is independent across t and w.r.t. z shocks.

Intermediate goods can be produced domestically, imported, or exported. Trade is subject to iceberg trade cost:

- To ship internationally, produce $\tau > 1$ to deliver one unit.
- International arbitrage $\Rightarrow$ domestic prices must lie between

$$\left[\frac{p_w(\omega)_t}{\tau} \ , \ \tau p_w(\omega)_t \right].$$

Island level state variable: $\mathbf{s} = \{ z_h, \ p_w \}$.

Model: Households

Unit mass of households. Individual households **live and work** on islands.

Individual households have preferences:

$$E \sum_{t=0}^{\infty} \beta^t \left\{ \log(c_t) - B \frac{h_t^{1-\gamma}}{1-\gamma} \right\}$$

- c_t: consumption of the final good,
- h_t is hours worked.

Model: Households' Choices

1. Work or not...

- Constrain the choice of labor units to be $h_t \in \{0, \bar{h}\}$.
- If a household works, receive island level wage: $w(\mathbf{s})$; after tax $\tilde{w}(\mathbf{s})$
- If a household does not work, it receives (untaxed) home production.

2. Stay or move...

- By paying $m > 0$ in units of the final good, households migrate and move to a new island.
- Today — moving households arrive at a random island.

3. Save or borrow...

- Accumulate a non-state contingent asset a that pays gross return R.
- Face a lower bound on asset holding $-\bar{a}$.

Government

The government levies taxes and transfers to finance G. Government spending is not valued by households.

Net tax revenues is of the following parametric class:

$$T(w) = w - \delta w^{1-\tau_p}.$$

- δ parameter determines the average rate.
- The parameter τ_p controls the progressivity of the tax scheme.
  - $\tau_p = 0$: flat tax rate of δ, no redistribution
  - $\tau_p \in (0, 1)$: a **progressive** tax system.
  - $\tau_p < 0$: a regressive tax system.

Widely used, viewed as a good approximation to US tax system; Benabou (2002), Heathcote, Storesletten, and Violante (2014), Guner, Kaygusuz, and Ventura (2014), Antràs, De Gortari, and Itskhoki (2016)

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Given government policy $\{G, \tau_p\}$, δ is chosen such that government spending equals tax revenue. Optimal progressivity is the policy τ_p that maximizes social welfare.

Equilibrium: Overview

A Stationary Small Open Economy (SSOE) Equilibrium. Given world prices $\{p_w, R\}$ and government policy $\{G, \tau_p\}$, a stationary Small Open Economy Equilibrium is domestic prices $\{p_h(\mathbf{s}), P_h\}$, tax rate δ, policy functions $\{\ g_a(\mathbf{s}, a), \iota_n(\mathbf{s}, a), \iota_m(\mathbf{s}, a)\ \}$, a distribution over household states $\lambda(\mathbf{s}, a)$ such that

i Firms maximize profits; The policy functions solve the household's optimization problem;

ii Demand for the final and intermediate goods equals production;

iii The government budget is balanced;

iv The distribution $\lambda(\mathbf{s}, a)$ is a stationary distribution.

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The basic idea...

1. Households' consumption/savings, work, and moving decisions determine goods demand and labor supply.

2. Bounds on international arbitrage + firm optimization determine goods supply and labor demand.

Need **1.** and **2.** to be consistent.

Model Properties

Island-Level Wages and Trade

Wages and Trade Exposure: Real wages on an island with state $\mathbf{s}$ equal

$$w(\mathbf{s}) = \omega(\mathbf{s})^{\frac{1}{\theta}} \hat{\mu}(\mathbf{s})^{\frac{-1}{\theta}} z^{\frac{\theta-1}{\theta}} C^{\frac{1}{\theta}}.$$

where

$$\omega(\mathbf{s}) := \frac{p_h(\mathbf{s}) z \mu(\mathbf{s}) \bar{h}}{p_h(\mathbf{s}) z \mu(\mathbf{s}) \bar{h} \quad + \quad p_h(\mathbf{s}) \text{imports}(\mathbf{s}) - p_h(\mathbf{s}) \text{exports}(\mathbf{s})},$$

which is the "home share," and $\hat{\mu}(\mathbf{s}) = \frac{\mu_h(\mathbf{s})\bar{h}}{\pi(\mathbf{s})}$ is workers per market.

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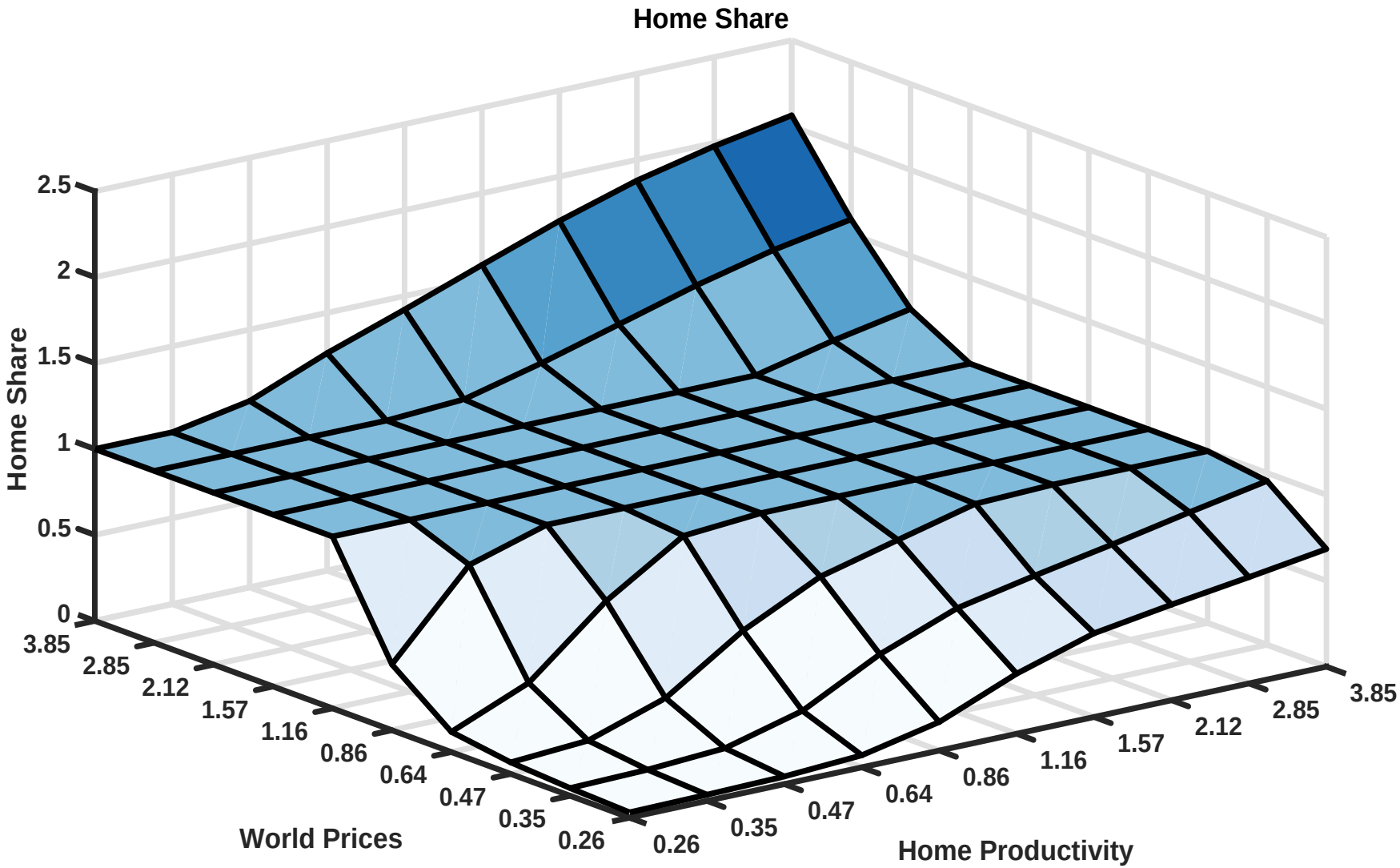
Important observation...

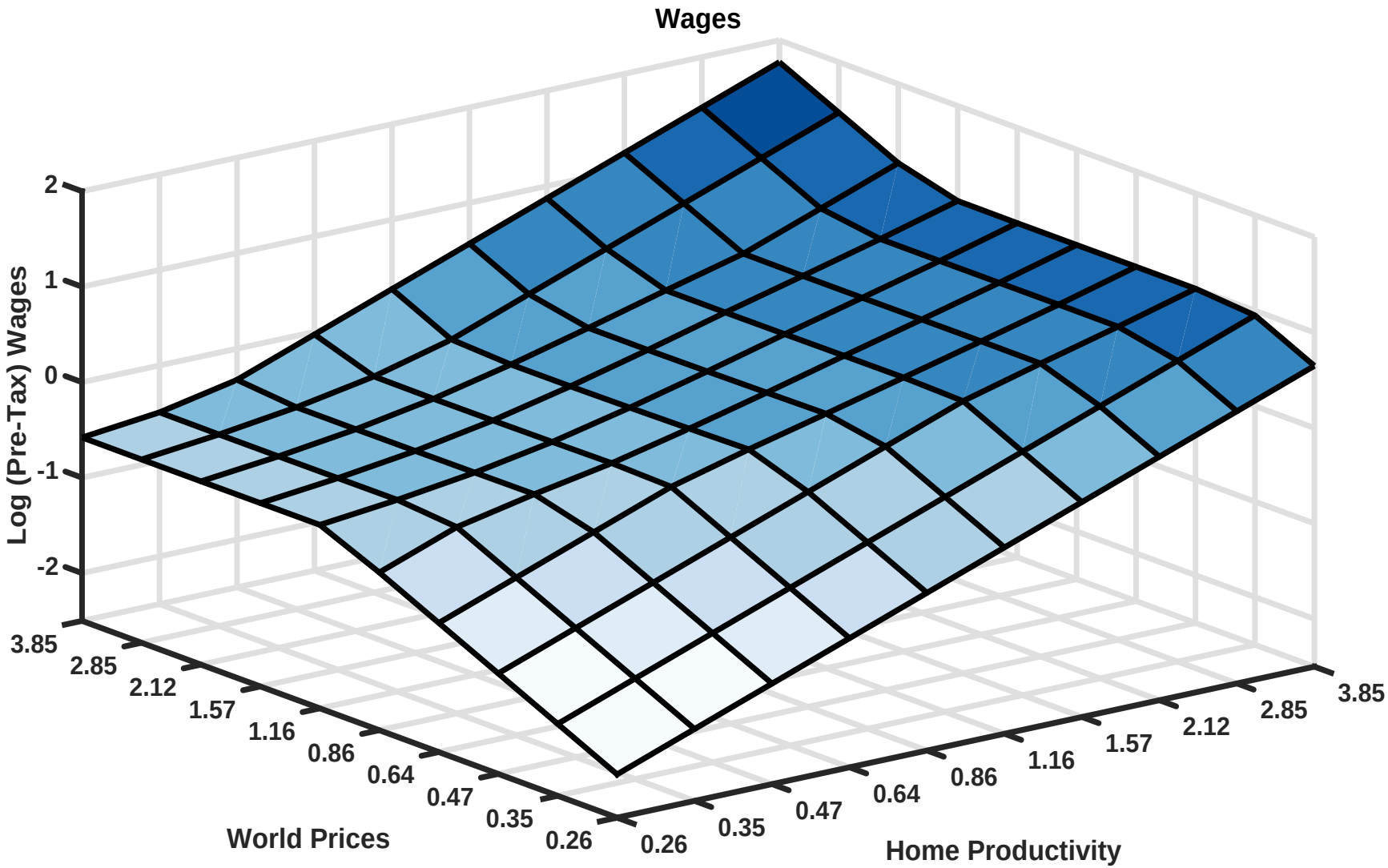
A **smaller** home share implies that wages are **lower** with elasticity $\frac{1}{\theta}$. The economics are easy to understand...

- More imports $\Rightarrow$ lower prices $\Rightarrow$ lower wages
- CES tightly connects the price with the home share and θ.

Home Share $\omega(\mathbf{s})^{\frac{1}{\theta}}$ Across Islands



Real Wages Across Islands



Quantitative Results

Overview of Quantitative Analysis

1. Calibrate parameters of the model.

2. Take a stand on the social welfare function.

3. Ask several questions:

- In choosing tax policy, what trade-offs does the planner face?
- How does openness to trade change optimal tax policy?
- How does openness change the benefits of a progressive tax system?

Calibration Overview

What we are doing currently in Lyon and Waugh (2017): estimate the model to match the ADH + related evidence...

- How wages respond to trade shocks,
- How labor supply and migration respond to trade-induced wage changes,
- Debt response from Barrot, Loualiche, Plosser, and Sauvagnat (2016).

Today: Not as ambitious (sorry)...

- Use some parameter values from various literatures and
- Calibrate some parameters so that the model matches cross-sectional and aggregate moments in US data.

Calibration: Parameters, Values, and Moments

Parameter	Value	Target Moment/Notes
Time Frequency	Yearly	—
Discount Factor, β	0.95	—
Time Endowment, $\bar{h}$	1.00	Normalization
Home production, h	0.00	—
Persistence of z and p_w process, ϕ	0.95	—
Std. Dev. of innovations to z and p_w	0.17	—
World Interest Rate, R	1.02	—
Tax Progressivity, τ_p	0.18	HSV (2014), ADI (2017)
Demand Elasticity, θ	4.00	—
Disutility of work, B	1.74	60 % participation rate
Migration Cost, m	0.81	3 % migration rate
Borrowing Limit, $\bar{a}$	1.01	40 % households with $\leq$ 0 net worth
Tax Parameter, δ	0.86	Government = 20 % of GDP
Trade Cost, τ	2.29	Imports = 10 % of GDP

Social Welfare Function

Focus on a utilitarian planner placing equal weight on households within the domestic economy:

$$W(\tau_p,\ \tau) = \int_{\mathbf{s}} \int_{a} V(a,\ \mathbf{s}) \lambda(\mathbf{s}, a).$$

- $V(a,\ \mathbf{s})$ is optimal value function of households with assets a, island state $\mathbf{s}$; $\lambda(\mathbf{s}, a)$ is the distribution across these states;
- τ_p indexes progressivity of the tax system;
- τ indexes how open the economy is.

Optimal progressivity is:

$$\tau_p^*(\tau) = \arg\max\ W(\tau_p,\ \tau).$$

Overview of Quantitative Analysis

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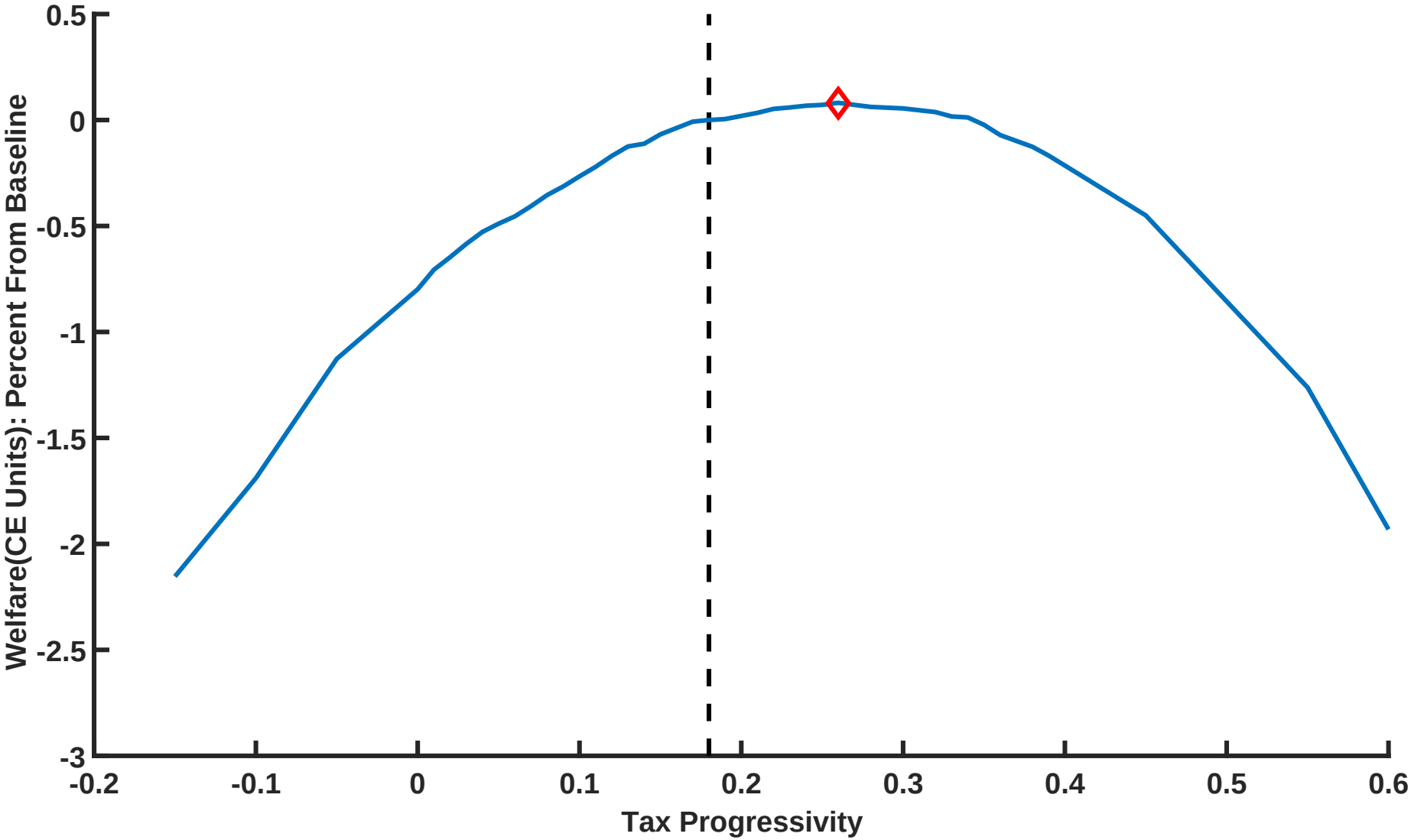
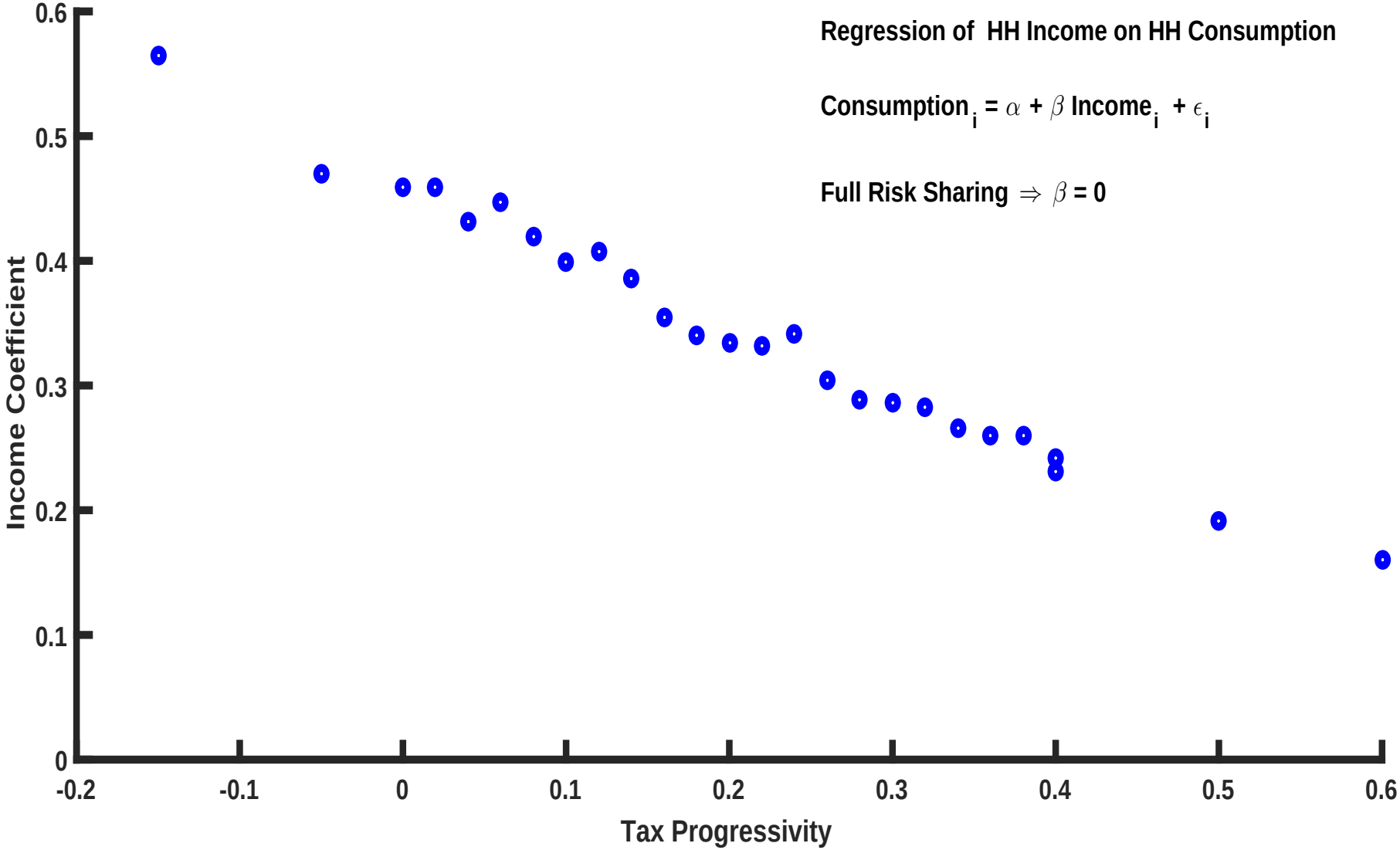
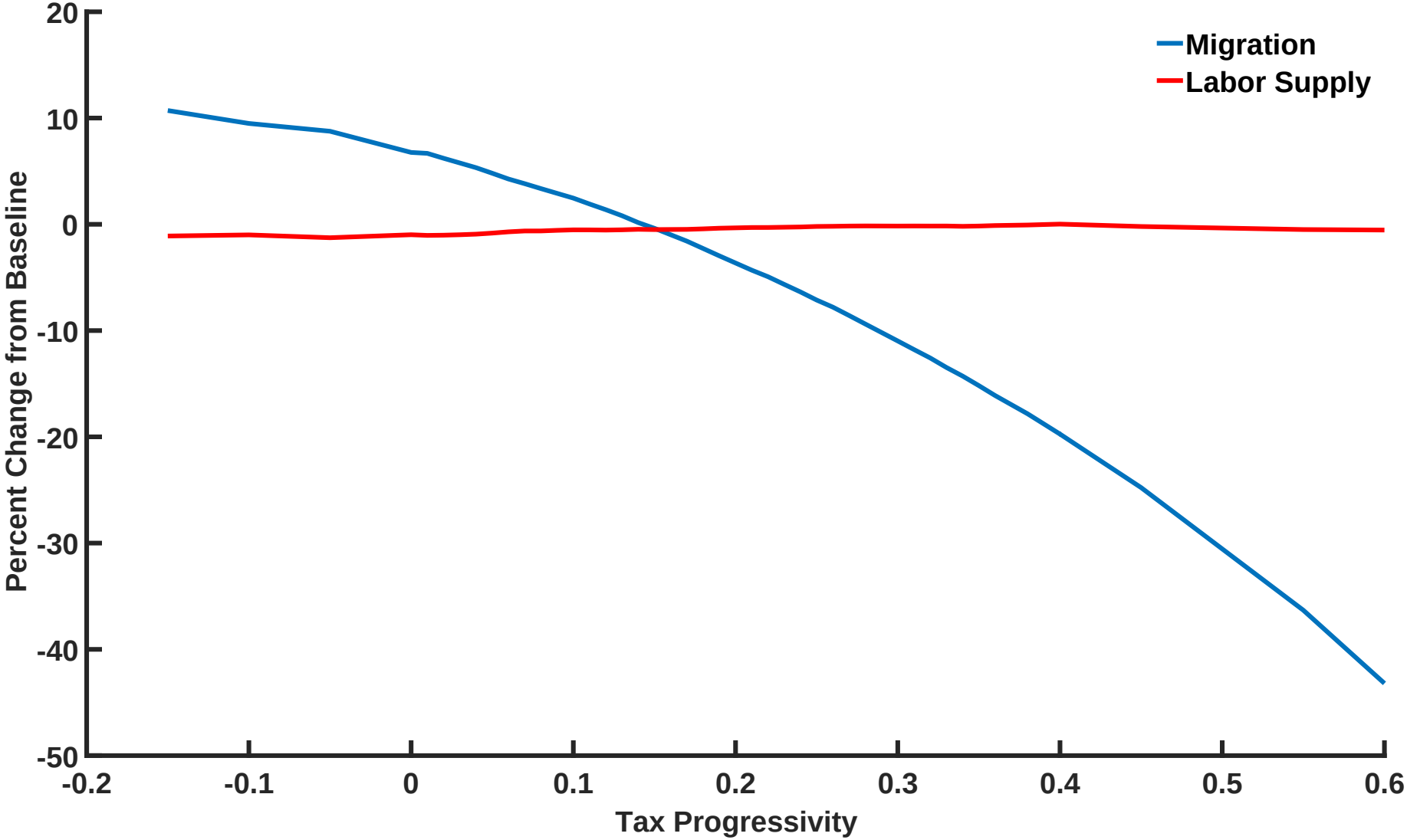
Social Welfare and Tax Progressivity



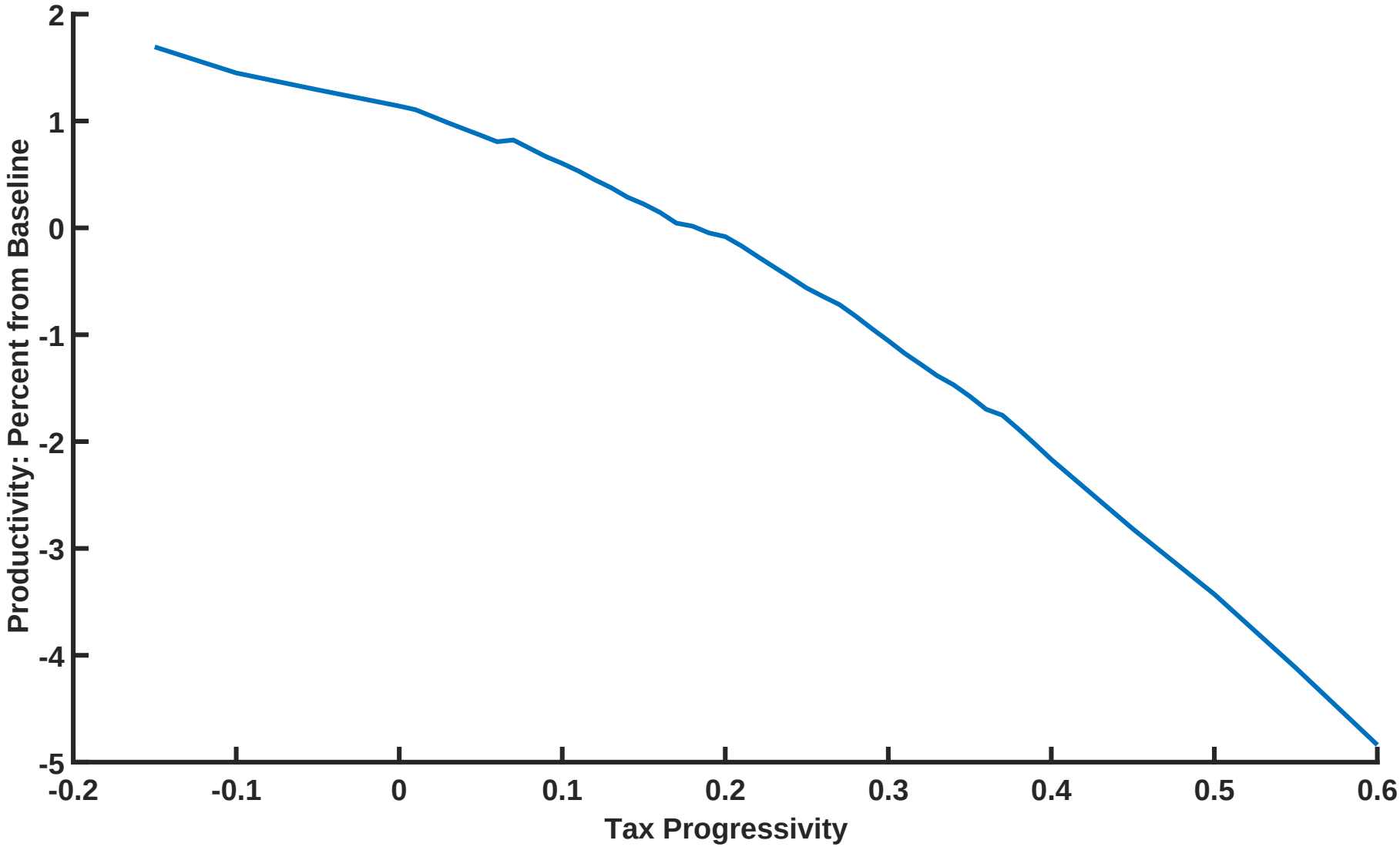
Insurance Improves with Progressivity. . . Great!



No Change in Labor Supply, But Huge Decline in Migration...



Less Migration ⇒ Lower Productivity (Y/L)...Not So Great



Summary of Trade-off

In choosing tax policy, what trade-offs does the planner face?

Better insurance...

Little change in labor supply, but much less migration.

- Labor supply response was setup to be very inelastic.
- Migration responds as it is a vehicle for insurance.

$\Rightarrow$ Reduction in aggregate productivity and the "size of the pie."

Overview of Quantitative Analysis

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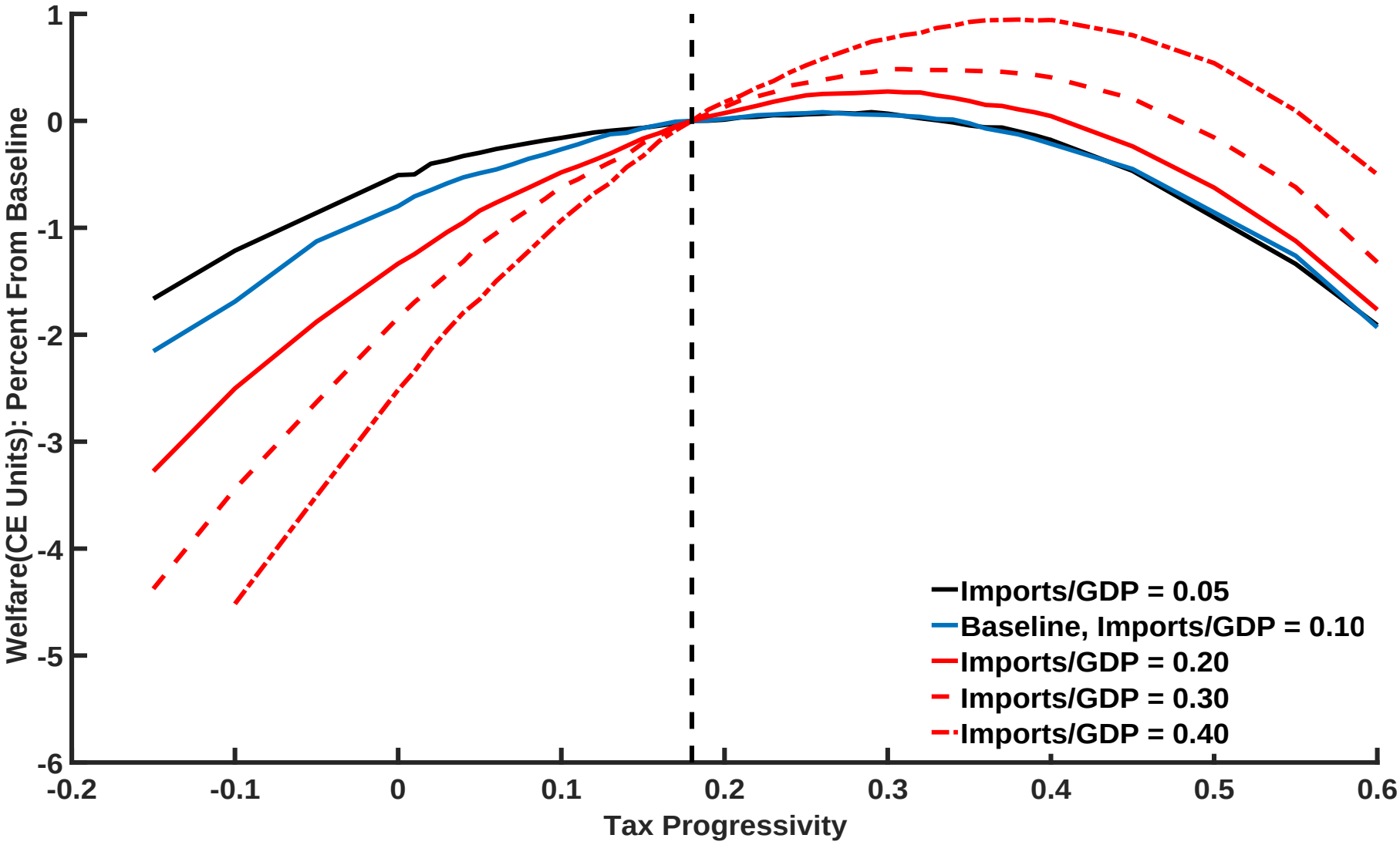
Social Welfare Curves Shift Right with Openness



Optimal Progressivity Increases with Openness

Openness and Optimal Progressivity

			Average Tax Rate	
Imports/GDP	τ_p^*	Gains from τ_p^*	90th Prct.	10th Prct.
0.05	0.29	0.08	45.1	7.11
0.10	0.26	0.08	44.7	7.0
0.20	0.30	0.27	50.0	1.3
0.30	0.33	0.48	56.8	-3.9
0.40	0.37	0.95	62.9	-9.0

Note: 90th Prct is the 90th percentile of the labor income distribution; 10th is the 10th percentile. Gains are consumption equivalent values between living in the baseline economy and an economy with an alternative progressivity parameter τ_p.

Overview of Quantitative Analysis

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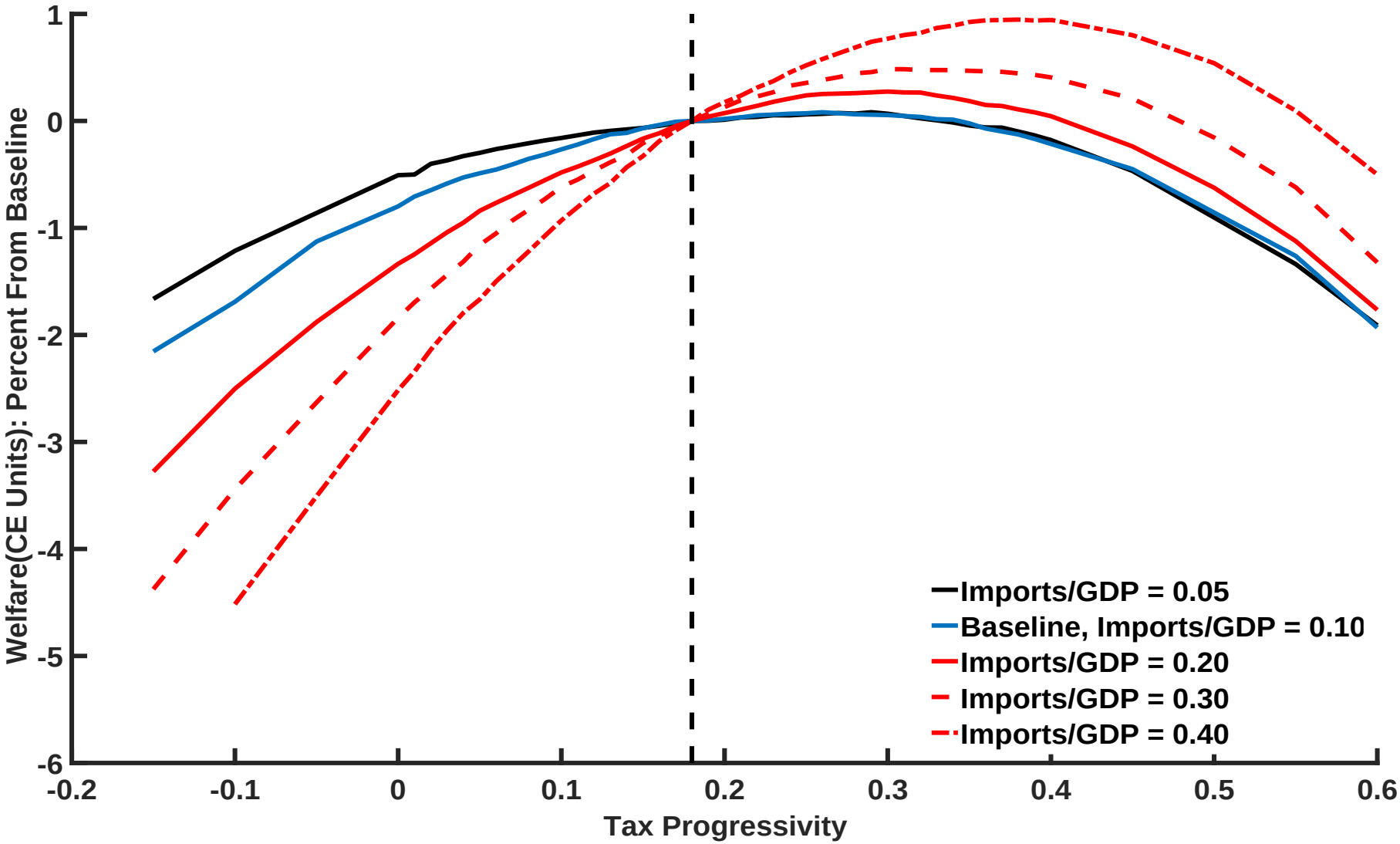
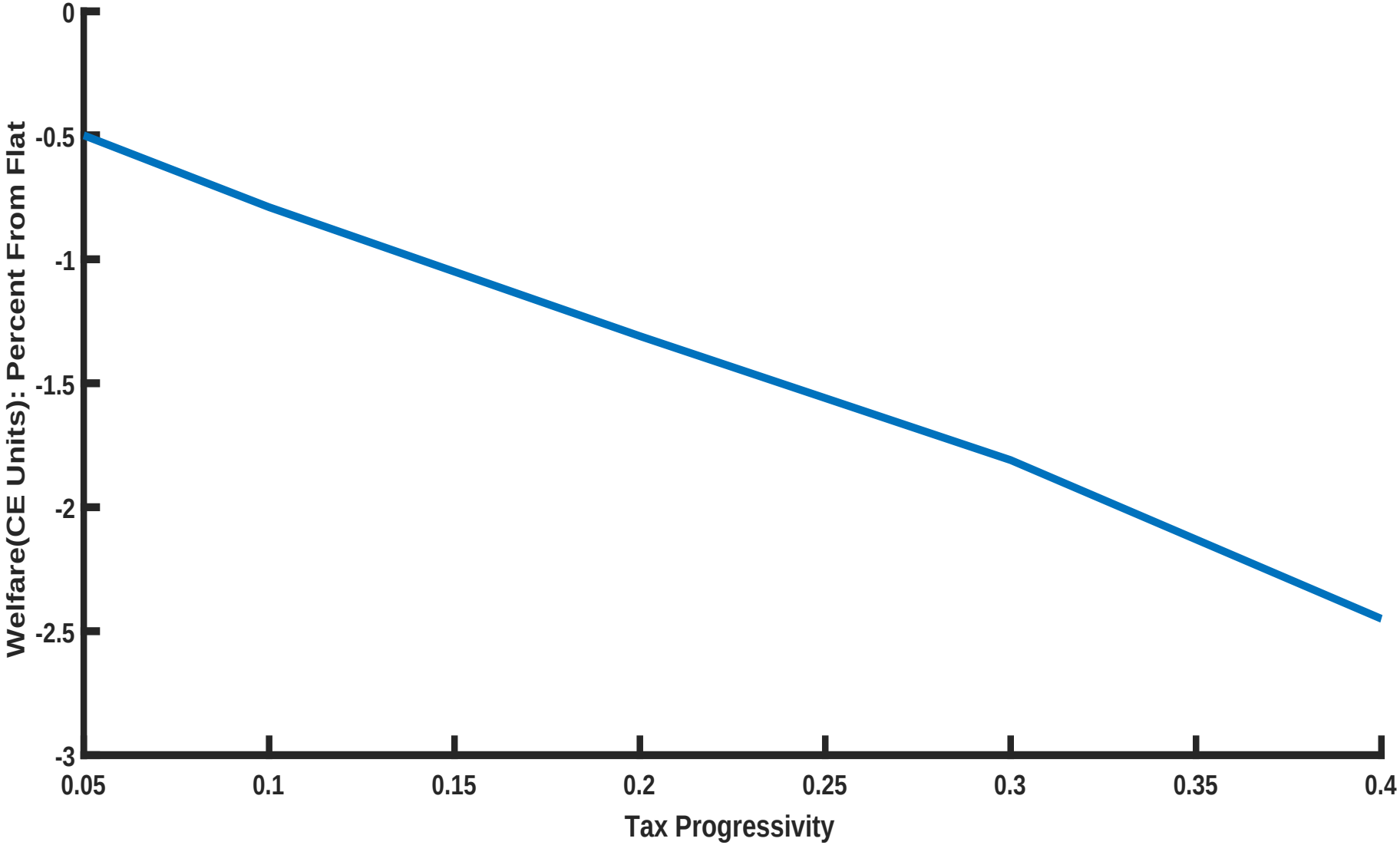
- **How does openness change the benefits of a progressive tax system?**

Benefits of **Current** Progressivity Increase with Openness



Benefits of **Current** Progressivity Increase with Openness



Punchlines

In choosing tax policy, what trade-offs does the planner face?

- Insurance vs. incentizing migration and, thus, allocative efficiency.

How does openness to trade change optimal tax policy?

- Optimal progressivity should increase, but welfare gains are modest relative to current system.

How does openness change the benefits of a progressive tax system?

- Current progressivity of the tax system becomes increasingly beneficial as we become open, enhancing the gains from trade.

Final Thoughts

Lots more to do! I'm sure Oleg will point us in the right direction!

Two thoughts about questions to ask, issues to explore...

- What was western Europe's experience with the "China Shock"? Did their social safety net "insure" them?
- Very similar issues in this paper are present in the discussion about automation, its consequences, and UBI as a solution.

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Equilibrium: A Little Bit of Detail... Non-Traded Goods

Non-Traded Case: An islands with state **s** where the good is non traded...

- Because it's non-traded: $\frac{p_w}{\tau} < p_h(\mathbf{s}) < \tau p_w$.
- Real wages on the island are:

$$w_h(\mathbf{s}) = \frac{p_h(\mathbf{s})z}{P}.$$

- Goods market clearing:

$$\pi(\mathbf{s}) \left(\frac{p_h(\mathbf{s})}{P} \right)^{-\theta} C = z\mu(\mathbf{s})\bar{h}.$$

Note: Household decisions matter in two places: (i) labor supply $\mu(\mathbf{s})$ on the island and (ii) aggregate consumption, C.

Equilibrium: A Little Bit of Detail...Imported Goods

Imported Case: An islands with state **s** where the good is **imported**...

- Because it's imported: $p_h(\mathbf{s}) = \tau p_w$.
- Real wages on the island are:

$$w_h(\mathbf{s}) = \frac{\tau p_w z}{P}.$$

- Goods market clearing:

$$\pi(\mathbf{s}) \left(\frac{p_h(\mathbf{s})}{P} \right)^{-\theta} C \; - \; z\mu(\mathbf{s})\bar{h} \; > \; 0$$

Equilibrium: A Little Bit of Detail...Exported Goods

Exported Case: An islands with state **s** where the good is **exported**...

- Because it's exported: $p_h(\mathbf{s}) = \frac{p_w}{\tau}$.
- Real wages on the island are:

$$w_h(\mathbf{s}) = \frac{p_w z}{\tau P}.$$

- Goods market clearing:

$$\pi(\mathbf{s}) \left(\frac{p_h(\mathbf{s})}{P} \right)^{-\theta} C \; - \; z\mu(\mathbf{s})\bar{h} \; < \; 0$$

Connection with National Accounts. . . Income Side

The value functions for different options

$$V^{s,w}(a,\ \mathbf{s}) = \max_{a' \geq -\bar{a}} \left[u(Ra + \tilde{w}(\mathbf{s})\bar{h} - a') - \bar{h}B + \beta EV(a', \mathbf{s'}) \right],$$

$$V^{s,nw}(a,\ \mathbf{s}) = \max_{a' \geq -\bar{a}} \left[u(Ra + w_n - a') + \beta EV(a', \mathbf{s'}) \right]$$

$$V^{m,w}(a,\ \mathbf{s}) = \max_{a' \geq -\bar{a}} \left[u(Ra + \tilde{w}(\mathbf{s})\bar{h} - a' - m) - \bar{h}B + \beta V^{m}(a') \right]$$

$$V^{m,nw}(a,\ \mathbf{s}) = \max_{a' \geq -\bar{a}} \left[u(Ra + w_n - a' - m) + \beta EV^{m}(a') \right]$$

Putting everything together. . .

$$V(a,\ \mathbf{s}) = \max \left[V^{s,w},\ V^{s,nw},\ V^{m,w},\ V^{m,nw} \right].$$

Connection with National Accounts. . . Income Side

Aggregate income must equal all payments to labor. . .

$$P_h Y_h = \int_{\mathbf{s}} P_h w_h(\mathbf{s}) \mu_h(\mathbf{s}) \tag{1}$$

Combining (1) and aggregating over households budget constraints connects aggregate income with consumption

$$P_h Y_h = P_h C_h + P_h G - P_h R \mathcal{A} + P_h \mathcal{A}' - P_h \int_a \int_{\mathbf{s}} w_n (1 - \iota_n(\mathbf{s}, a)) \lambda_h(\mathbf{s}, a) + P_h \int_a \int_{\mathbf{s}} m \iota_m(\mathbf{s}, a) \lambda_h(\mathbf{s}, a).$$

In words, income equals consumption plus government spending minus (i) returns on assets (ii) new purchases of assets (iii) home production and (iv) plus moving costs.

Connection with National Accounts. . . Production Side

Aggregate production equals the value of all island level output. . .

$$P_h Y = \int_{\mathbf{s}} p_h(\mathbf{s}) z \mu_h(\mathbf{s})$$

which then working with the island level market clearing conditions gives

$$P_h Y = P_h C_h + P_h G + \int_{\mathbf{s}} \text{exports}(\mathbf{s}) - \int_{\mathbf{s}} \text{imports}(\mathbf{s}).$$

Savings, Trade Imbalances, and Capital Flows.

Then combining the previous results allows us to connect savings with trade imbalances...

$$
\begin{aligned}
P_h Y - P_h C_h - P_h G &= \int_{\mathbf{s}} \text{exports}(\mathbf{s}) - \int_{\mathbf{s}} \text{imports}(\mathbf{s}), \\
&= -P_h r \mathcal{A} + P_h(\mathcal{A}' - \mathcal{A}) && \text{net change in asset holdings} \\
&\quad - P_h \int_a \int_{\mathbf{s}} w_n(1 - \iota_n(\mathbf{s}, a))\lambda_h(\mathbf{s}, a) && \text{-home production} \\
&\quad + P_h \int_a \int_{\mathbf{s}} m\iota_m(\mathbf{s}, a)\lambda_h(\mathbf{s}, a), && + \text{ moving costs}
\end{aligned}
$$

Special case with no moving, home production, and in stationary equilibrium:

$$
P_h Y - P_h C_h - P_h G = \int_{\mathbf{s}} \text{exports}(\mathbf{s}) - \int_{\mathbf{s}} \text{imports}(\mathbf{s}) = -P_h r \mathcal{A}
$$