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

Autor, Dorn, and Hanson (2013) provide the most compelling evidence about the distributional consequences. . . 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, Ricardian 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 has access to tariffs and a log-linear labor-income tax/transfer scheme Benabou (2002), Heathcote, Storesletten, and Violante (2014).

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 does a progressive tax system compare to import tariffs?

How We Connect with the Literature

A couple of comments. . .

- Our parallel work in Lyon and Waugh (2018); Focused on estimation and welfare evaluation of China shock (including transition dynamics).
- Rodrik (1997, 1998): More open countries have larger governments. Why? Governments provide social insurance against the ills of globalization.
- Antràs, De Gortari, and Itskhoki (2016). We have a different redistribution motive: social insurance for uninsurable shocks, not inequality per se.
- Trade and labor market dynamics: Fast growing literature. 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 and allocative efficiency.

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 follows an exogenous, stochastic process.

Government: Levies tariffs and 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

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

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

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: Overview

What does the government do...

1. Levies taxes and transfers to finance G.

2. Levies tariffs.

3. Government spending is not valued by households.

Government: Tax and Transfer

What does the government do... tax and transfer. 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)

Model Properties

Island-Level Trade

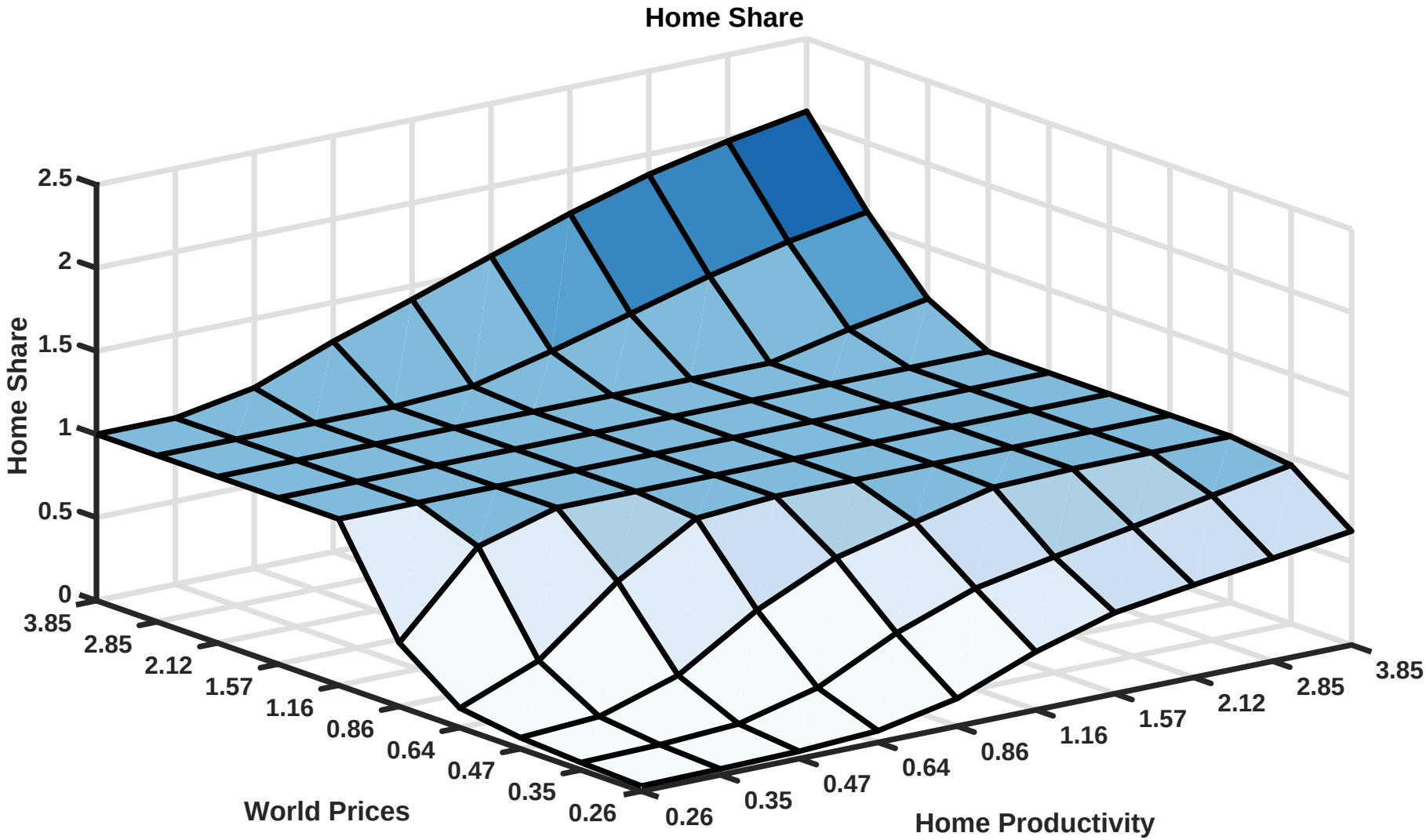
To understand the pattern of trade across islands define the following statistic:

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

which is the "home share" at the island level.

Essentially, this is the micro-level analog of the summary statistic emphasized in Arkolakis, Costinot, and Rodríguez-Clare (2012).

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



Island-Level Trade and Wages

Trade exposure and wages: Real wages on an island with state **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

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

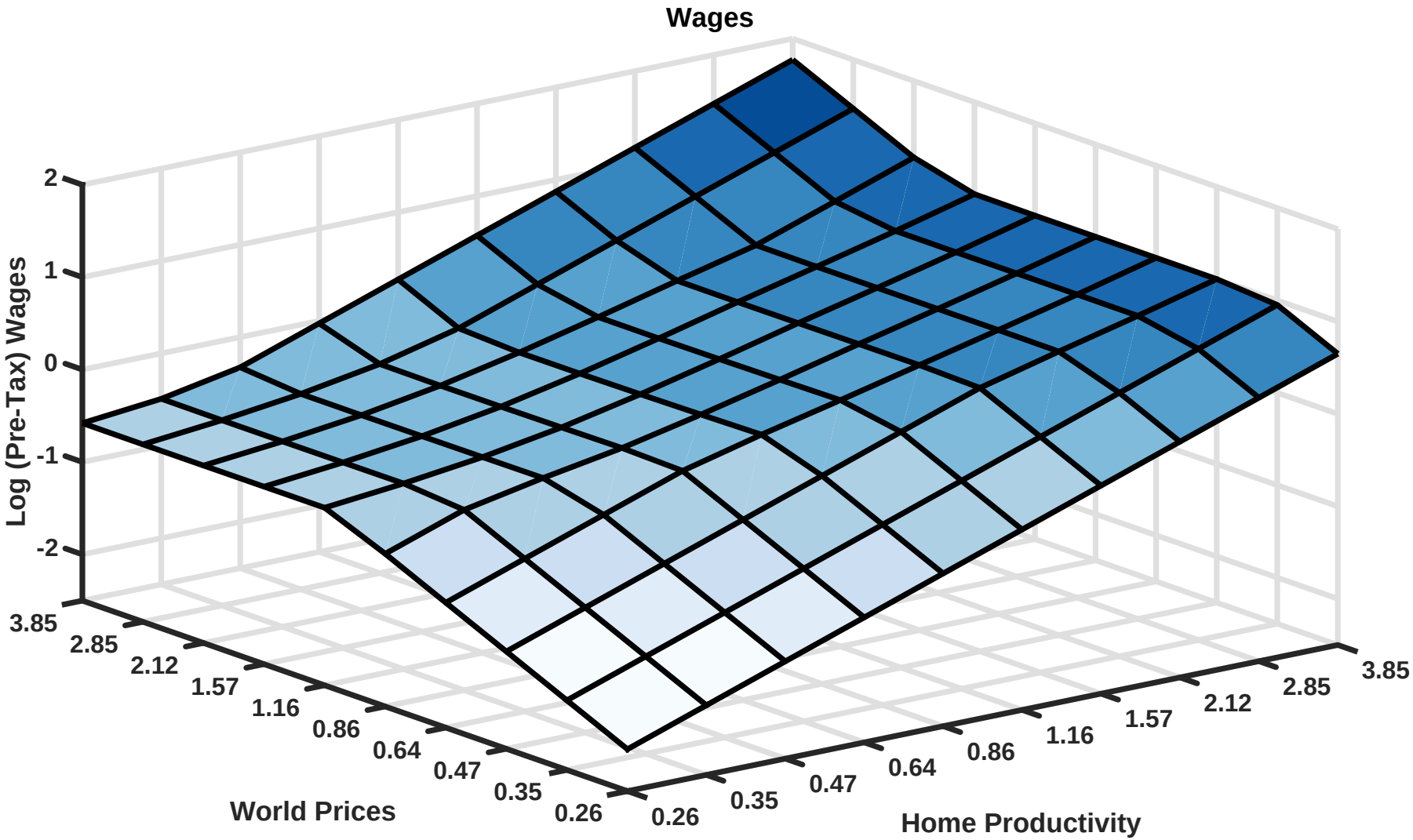
which is the "home share" and $\hat{\mu}(\mathbf{s}) = \frac{\mu_h(\mathbf{s})\bar{h}}{\pi(\mathbf{s})}$ is workers per market.

Important observation...

A smaller home share (**larger import exposure**) 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.

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?
- How does a progressive tax system compare to tariffs?

Calibration: Parameters, Values, and Moments

Calibration

Parameter	Value	Target Moment/Notes
Discount Factor, β	0.95	—
Persistence of z and p_w process	0.95	—
Std. Dev. of innovations to z and p_w	0.17	—
World Interest Rate, R	1.02	—
Demand Elasticity	4.00	—
Tax Progressivity	0.18	HSV
Disutility of work, B	1.51	Aggregate participation rate, 66 %
Migration Cost, m	0.85	Cross CMZ. migration rate, 3%
Borrowing Limit, $-\bar{a}$	0.45	40 % households with $\leq$ 0 net worth
Trade Cost	2.32	Imports to GDP ratio 10%

Social Welfare Function

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

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

- $V(a,\ \mathbf{s})$ is 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:

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

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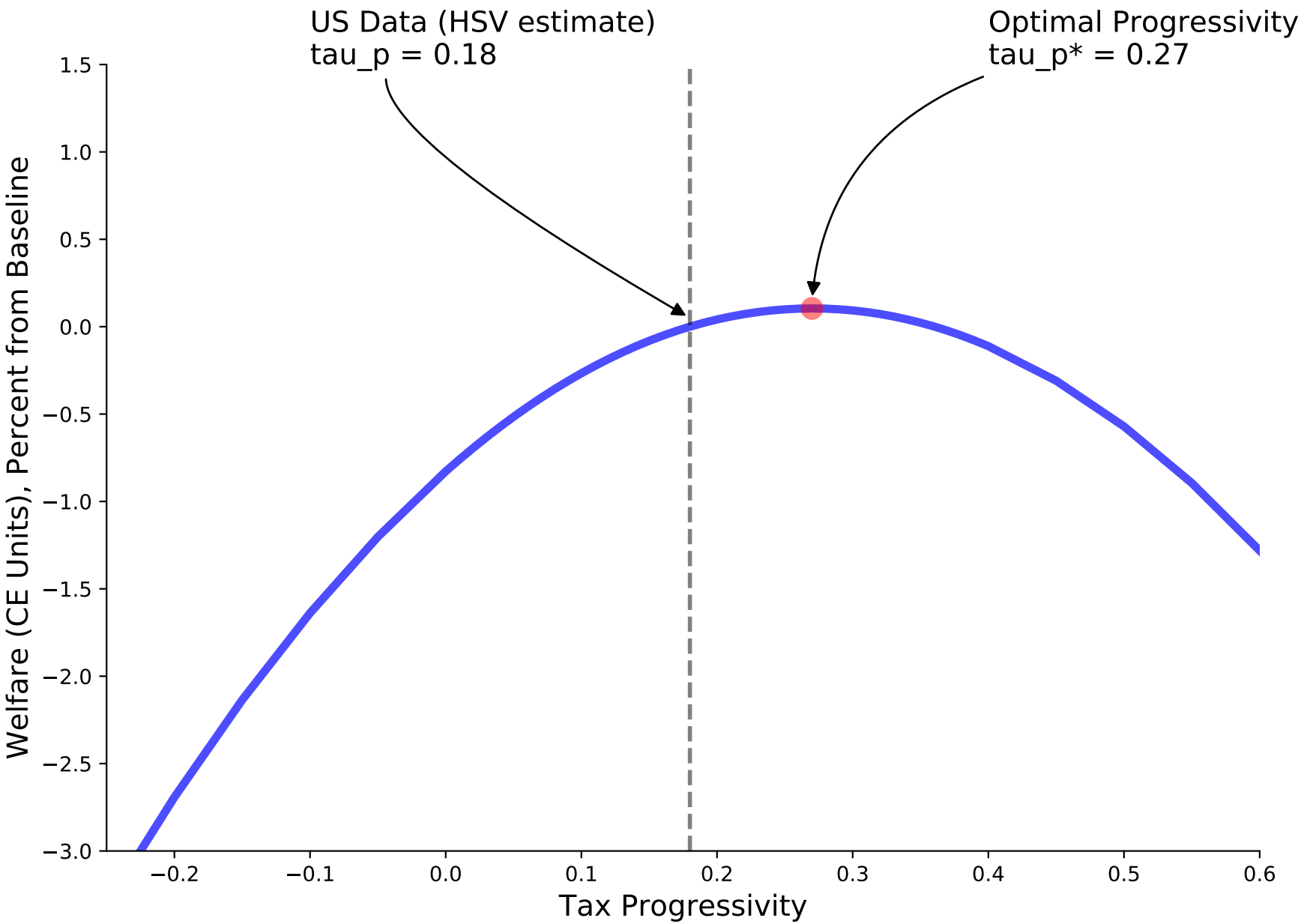
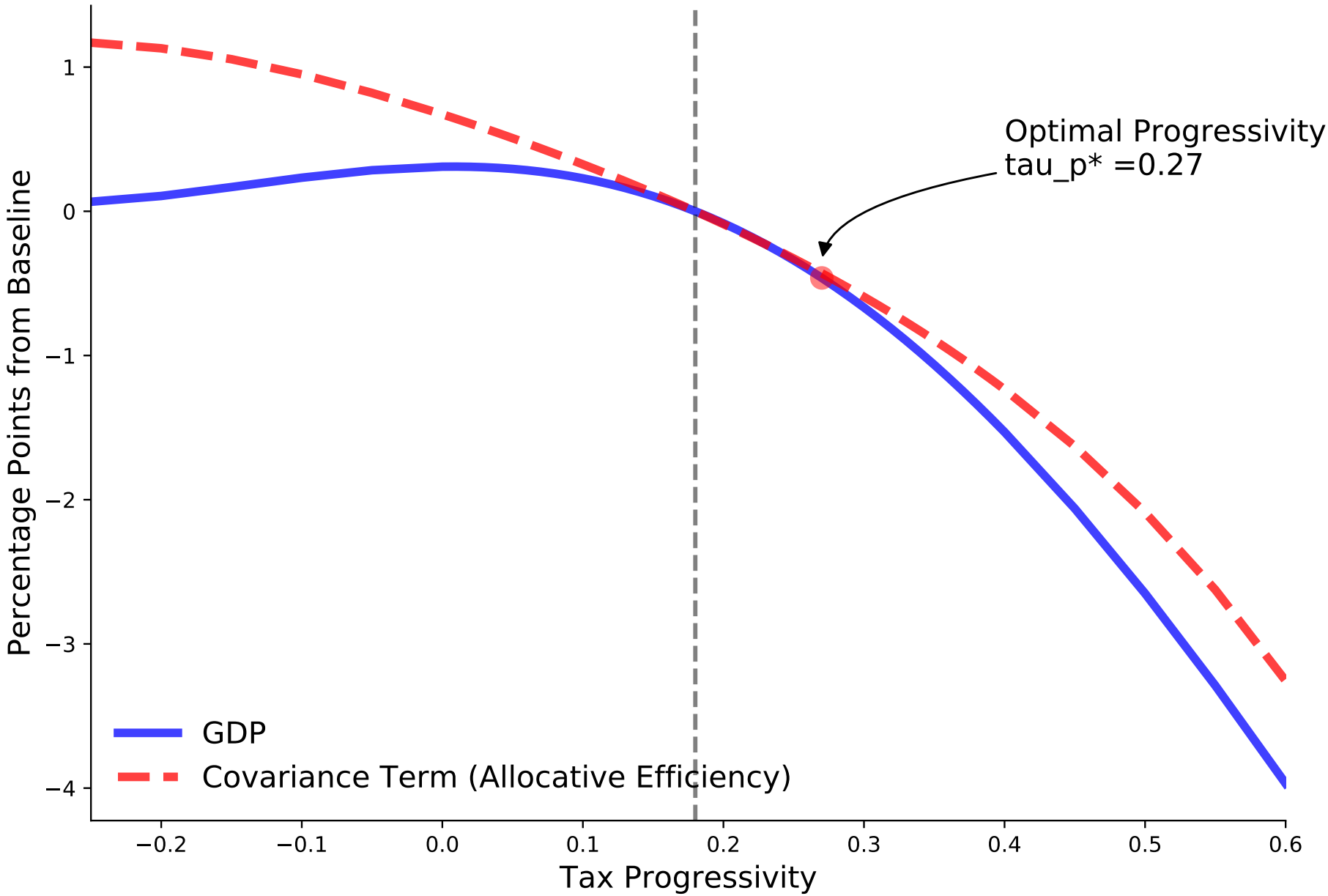
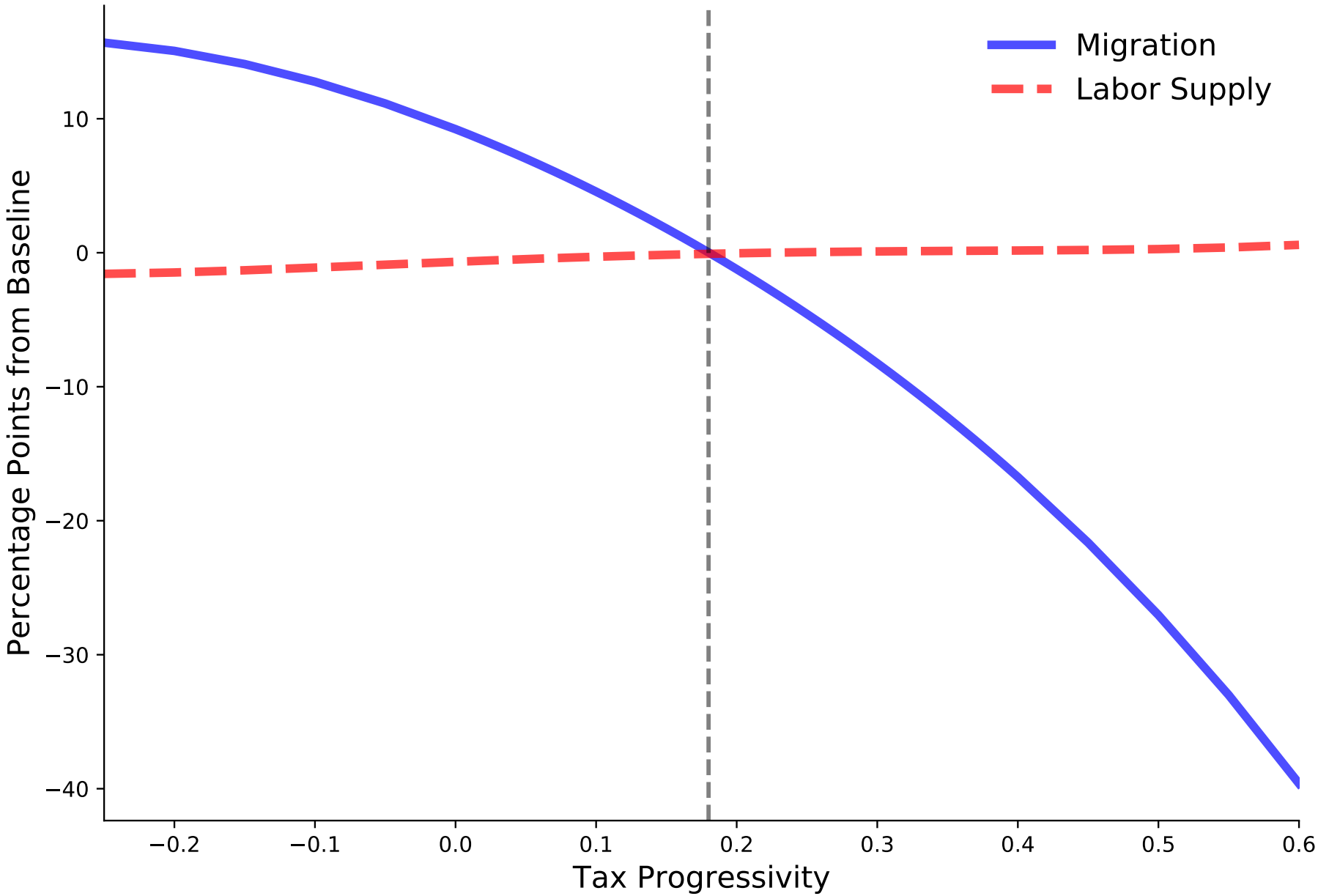
Social Welfare and Progressivity



Tax Progressivity ⇒ Lower Y ⇒ Misallocation



Why? Tax Progressivity ⇒Huge Decline in Migration...



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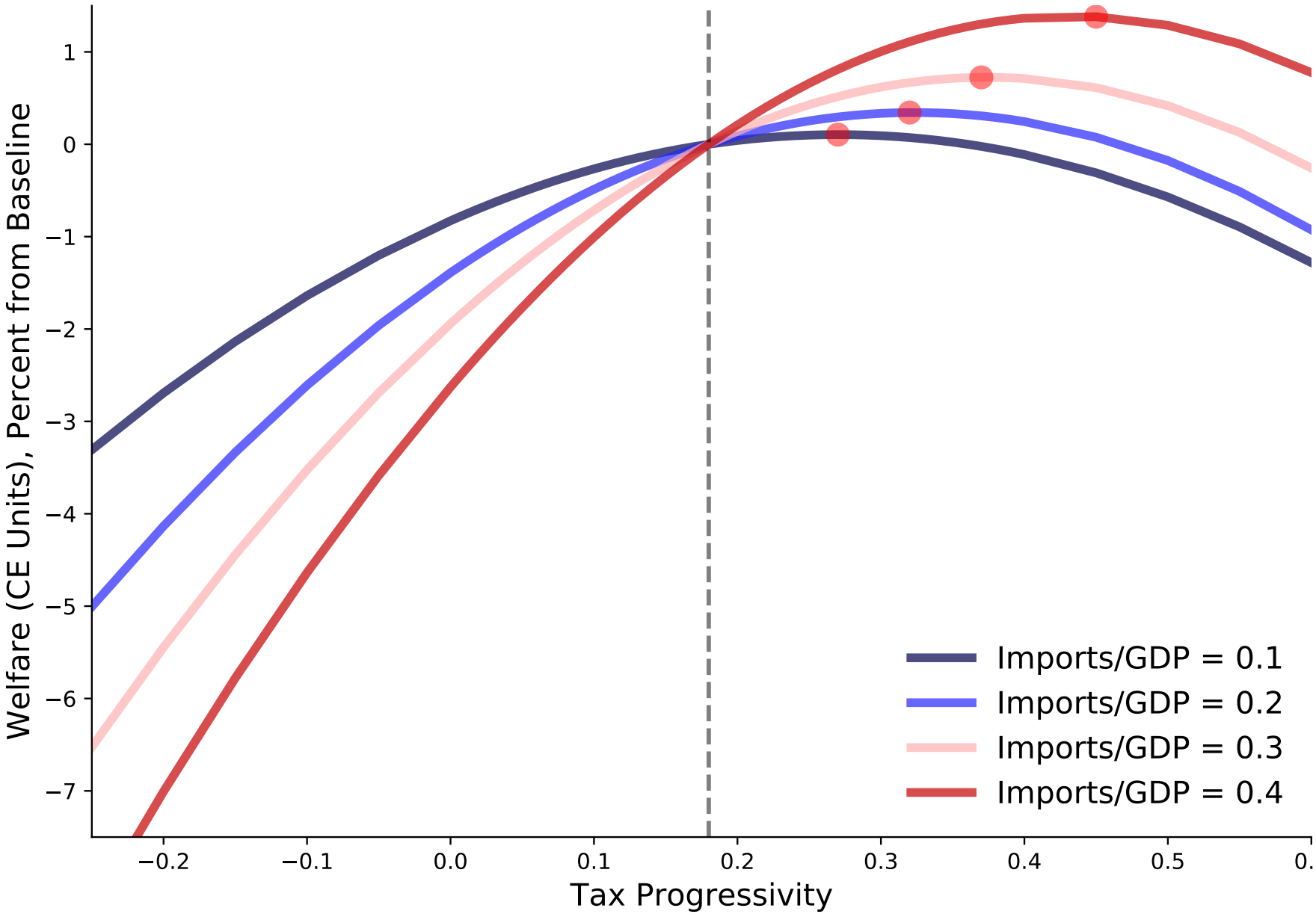
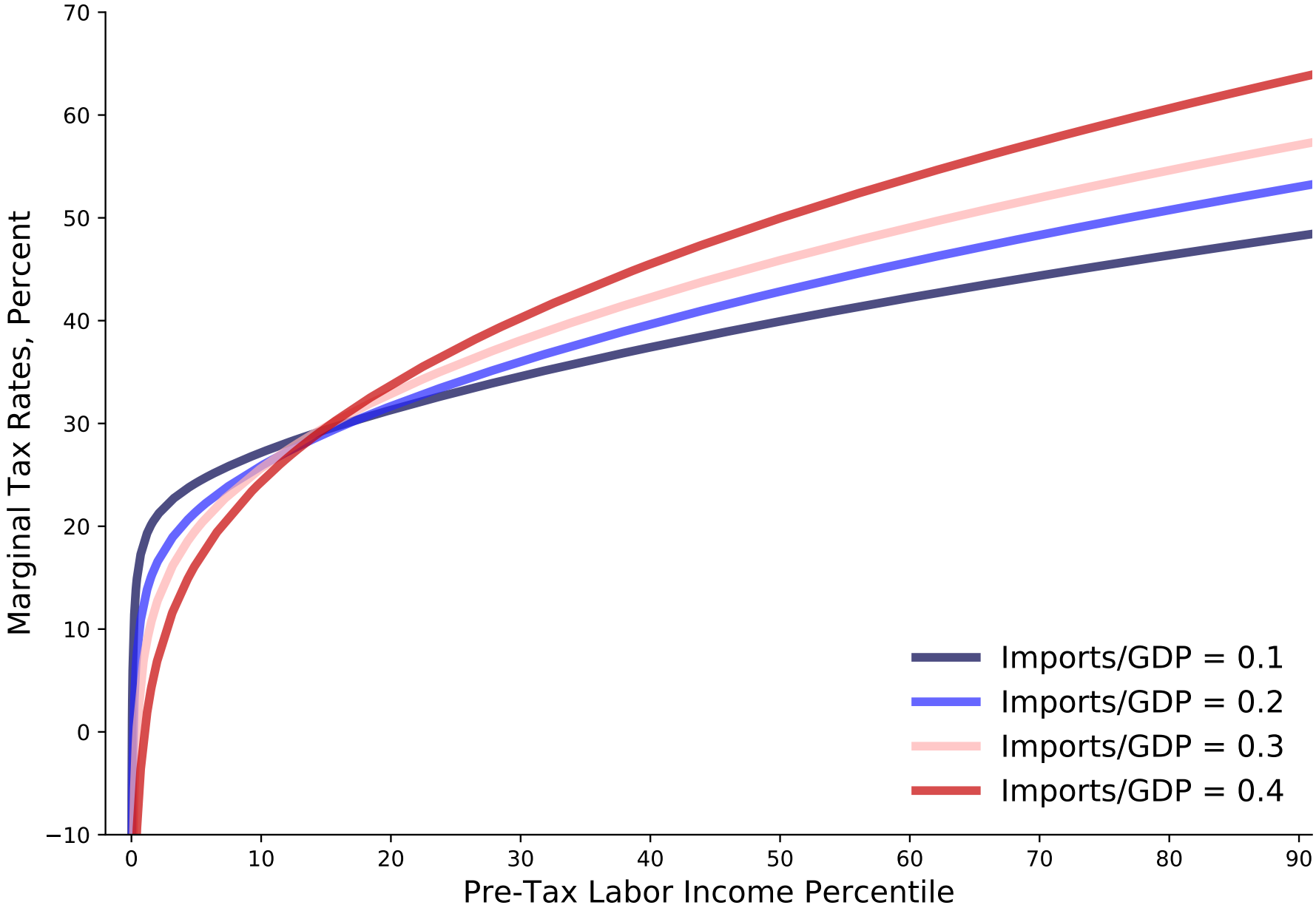
Social Welfare and Progressivity for Different Levels of Openness



Optimal Marginal Tax Rates for Different Levels of Openness



Optimal Progressivity Increases with Openness

Openness and Optimal Progressivity

		Welfare		Marginal Tax Rate	
Imports/GDP	τ_p^*	Gains from τ_p^*	Losses from Flat	90th Prct.	10th Prct.
0.10	0.27	0.10	-0.83	48.0	27.3
0.20	0.32	0.34	-1.39	52.8	25.9
0.30	0.37	0.72	-1.94	56.8	25.5
0.40	0.45	1.38	-2.62	63.5	24.0

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^*.

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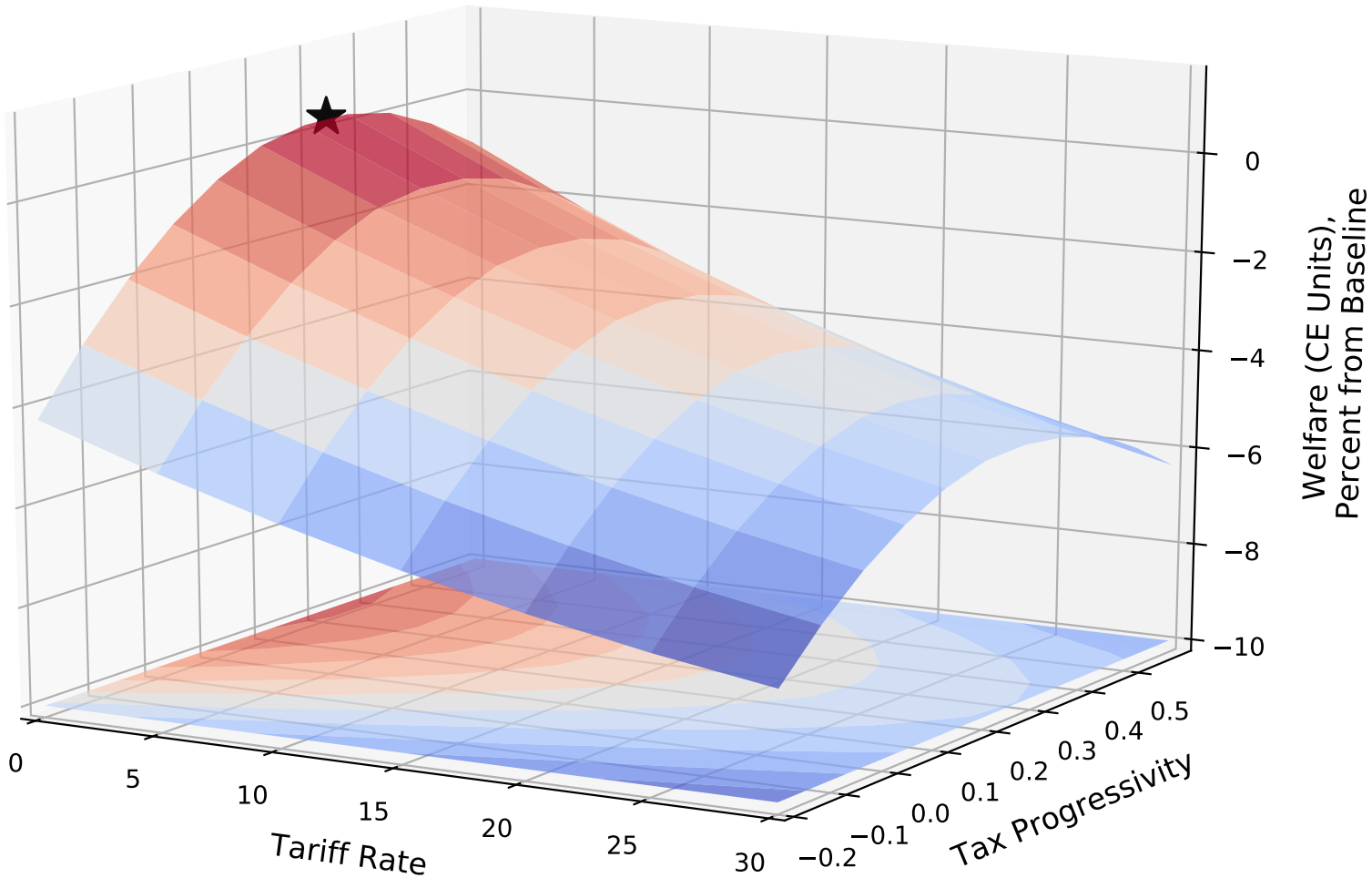
- In choosing tax policy, what trade-offs does the planner face?
- How does openness to trade change optimal tax policy?
- How does openness change the benefits of a progressive tax system?
- **How does a progressive tax system compare to tariffs?**
  - Why is this interesting?
  - It's what we are doing now in the US!
  - Relates to Eaton and Grossman (1985) or Newbery and Stiglitz (1984).

Are Tariffs Welfare Improving? No



This Economy, Imports/GDP = 0.40

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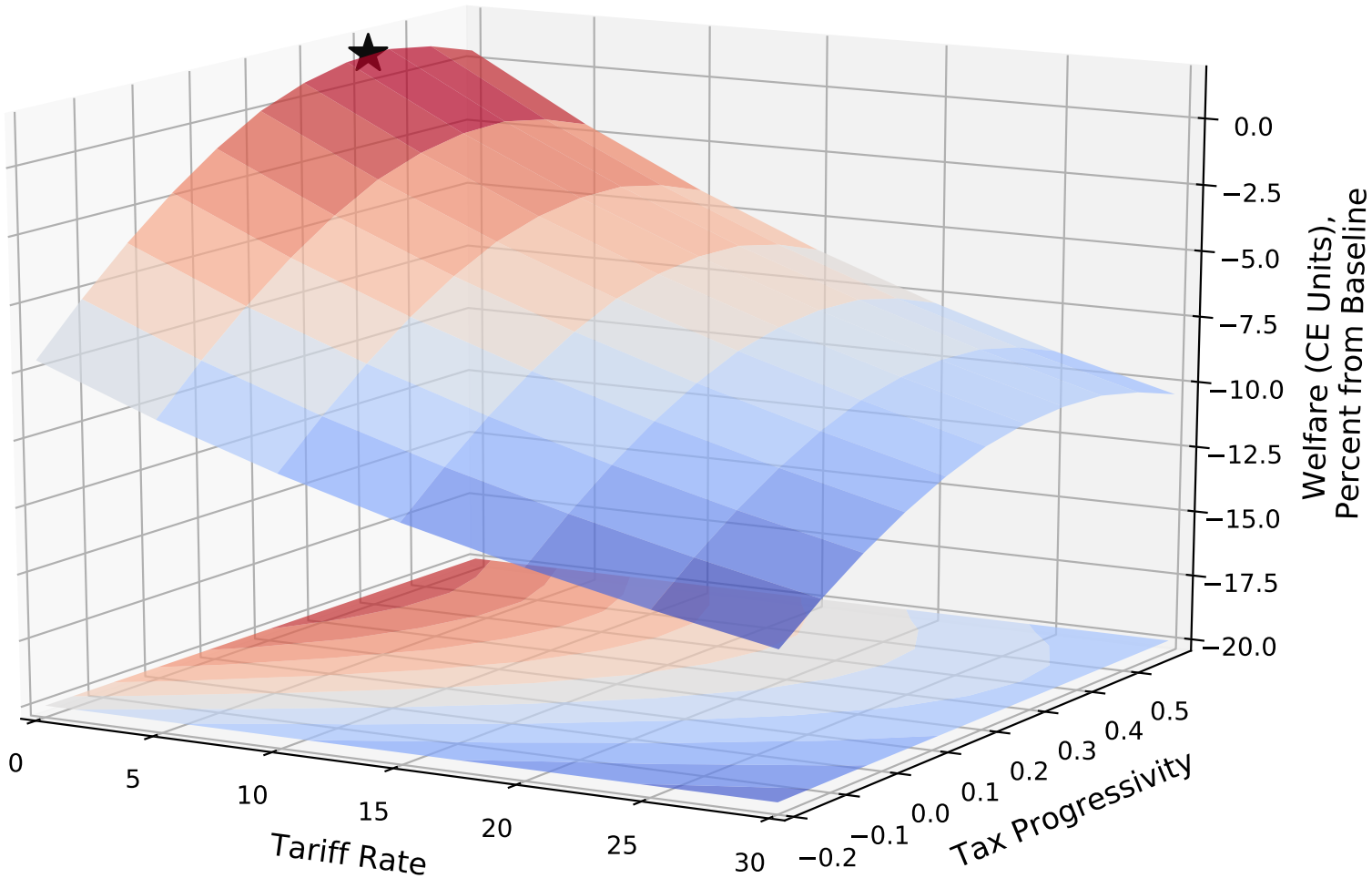

This Economy, Imports/GDP = 0.40

Punchlines

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

- Insurance vs. incentivizing 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.

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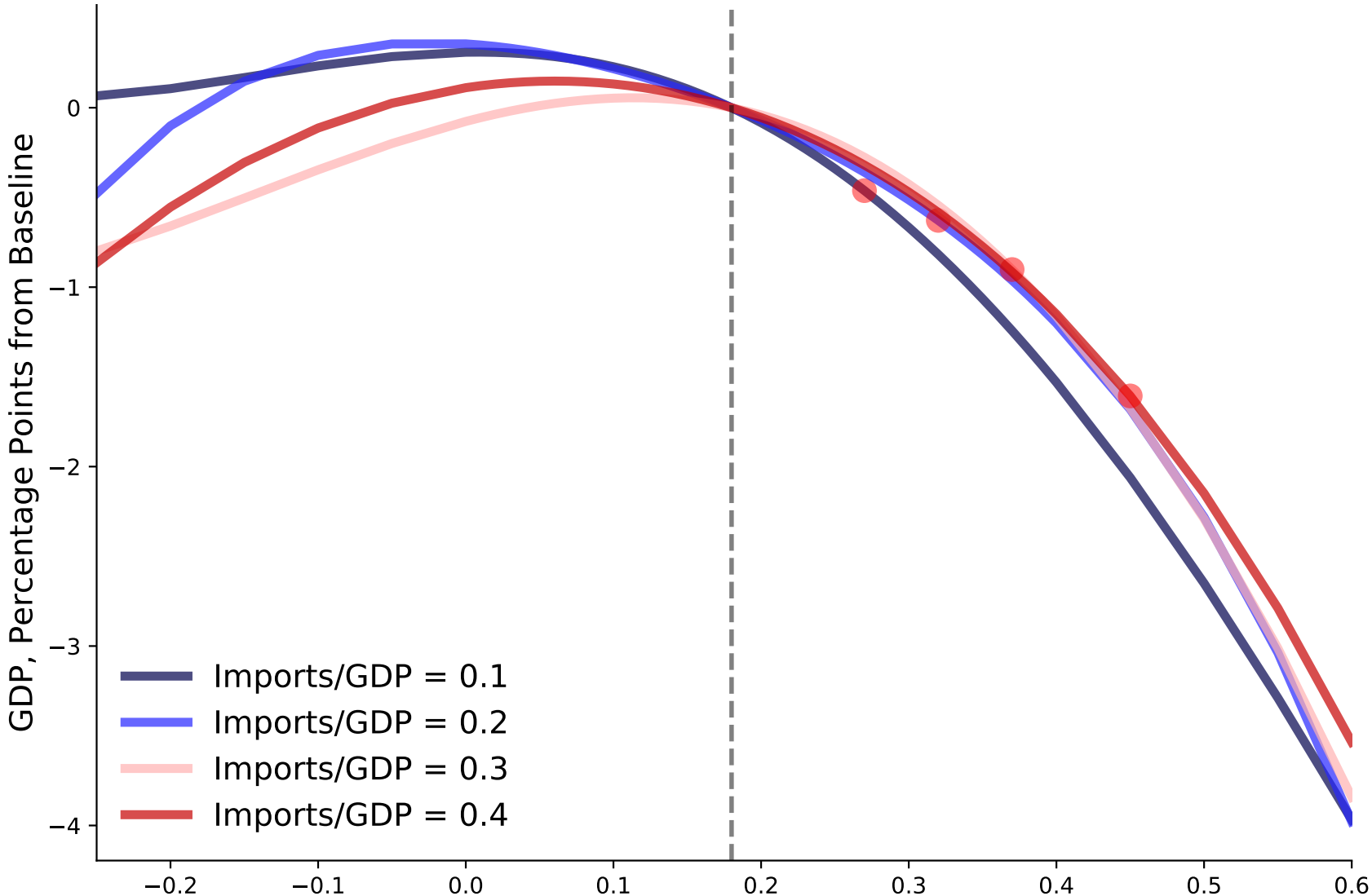
Output Cost of Progressivity



Government: Tariffs

What does the government do... levies tariffs.

The government imposes a tariff on imported intermediates, τ_f. The total cost to importing one unit of the good is then...

$$\hat{\tau} = \tau(1 + \tau_f).$$

Total tariff revenue is then:

$$\tau_f \int_{\mathbf{s}} p(\mathbf{s}) \text{imports}(\mathbf{s})$$

Equilibrium: Overview

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

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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.

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: $\frac{p_w}{\tau} < p(\mathbf{s}) < \hat{\tau} p_w$.
- Real wages on the island are:

$$w(\mathbf{s}) = \frac{p(\mathbf{s})z}{P_h}.$$

- Goods market clearing:

$$\left(\frac{p(\mathbf{s})}{P_h}\right)^{-\theta} Q = z\left(\mu(\mathbf{s})/\pi(\mathbf{s})\right)$$

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

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

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

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

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

- Goods market clearing:

$$\underbrace{\left(\left(\frac{\hat{\tau} p_w}{P_h}\right)^{-\theta} Q\right) - z\left(\mu(\mathbf{s})/\pi(\mathbf{s})\right)}_{\text{imports}} > 0.$$

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

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

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

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

- Goods market clearing:

$$\underbrace{\left(\frac{p_w/\tau}{P_h}\right)^{-\theta} Q - z\left(\mu(\mathbf{s})/\pi(\mathbf{s})\right)}_{-\text{ exports}} \quad < \quad 0$$

Government: Putting it All Together

Given government policy $\{G, \tau_p, \tau_f\}$, δ is chosen such that government spending equals tax revenue.

$$G = \int_a \int_{\mathbf{s}} T(w(\mathbf{s}))\iota_n(\mathbf{s}, a)\lambda(\mathbf{s}, a)d\mathbf{s}\ da + \tau_f \int_{\mathbf{s}} p(\mathbf{s})\text{imports}(\mathbf{s})d\mathbf{s},$$

Connection with National Accounts. . . Income Side

Aggregate income must equal all payments to labor. . .

$$Y = \int_{\mathbf{s}} w(\mathbf{s})\mu(\mathbf{s})d\mathbf{s} \tag{1}$$

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

$$Y = C + G - R\mathcal{A} + \mathcal{A}' + \int_a \int_{\mathbf{s}} m\iota_m(\mathbf{s}, a)\lambda(\mathbf{s}, a)da \; d\mathbf{s} - \tau_f \int_{\mathbf{s}} p(\mathbf{s})\text{imports}(\mathbf{s})d\mathbf{s}$$

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

Connection with National Accounts. . . Production Side

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

$$Y = \int_{\mathbf{s}} p(\mathbf{s}) z \mu(\mathbf{s}) d\mathbf{s}$$

which then working with the island level market clearing conditions gives

$$Y = C + G + \int_{\mathbf{s}} p(\mathbf{s}) \text{exports}(\mathbf{s}) d\mathbf{s} - \int_{\mathbf{s}} p(\mathbf{s}) \text{imports}(\mathbf{s}) d\mathbf{s}.$$

Savings, Trade Imbalances, and Capital Flows

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

$$
\begin{aligned}
Y - \ C - G &= \int_{\mathbf{s}} p(\mathbf{s})\text{exports}(\mathbf{s})d\mathbf{s} - \int_{\mathbf{s}} p(\mathbf{s})\text{imports}(\mathbf{s})d\mathbf{s}, \\
&= -r\mathcal{A} + (\mathcal{A}' - \mathcal{A}) && \text{net change in asset holdings} \\
&+ \int_a \int_{\mathbf{s}} m\iota_m(\mathbf{s}, a)\lambda(\mathbf{s}, a)da \ d\mathbf{s} && + \text{ moving costs} \\
&- \tau_f \int_{\mathbf{s}} p(\mathbf{s})\text{imports}(\mathbf{s})d\mathbf{s} && \text{- tariff revenue}
\end{aligned}
$$

Special case with no moving, home production:

$$
Y - C - G = \int_{\mathbf{s}} p(\mathbf{s})\text{exports}(\mathbf{s})d\mathbf{s} - \int_{\mathbf{s}} p(\mathbf{s})\text{imports}(\mathbf{s})d\mathbf{s} = -r\mathcal{A} + (\mathcal{A}' - \mathcal{A}).
$$