Immigration

(See Borjas Ch. 2 and 3)

Trevor Gallen

Introduction

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- Is immigration good or bad?
  - What is "good" and "bad"?
  - For whom?
  - Over what time horizon?
  - Who is immigrating? Why?

Framework

- We'll think in two frameworks
  - Growth model w/inelastic labor supply: broad labor market, examine very short, very long run
  - Labor markets with incentives
  - Sorting
- Then we'll look at the facts

Framework I: Growth Theory

- Recall the Solow Growth model:

$$k^* = \left(\frac{s\delta + n}{sA}\right)^{\frac{1}{\alpha-1}}$$

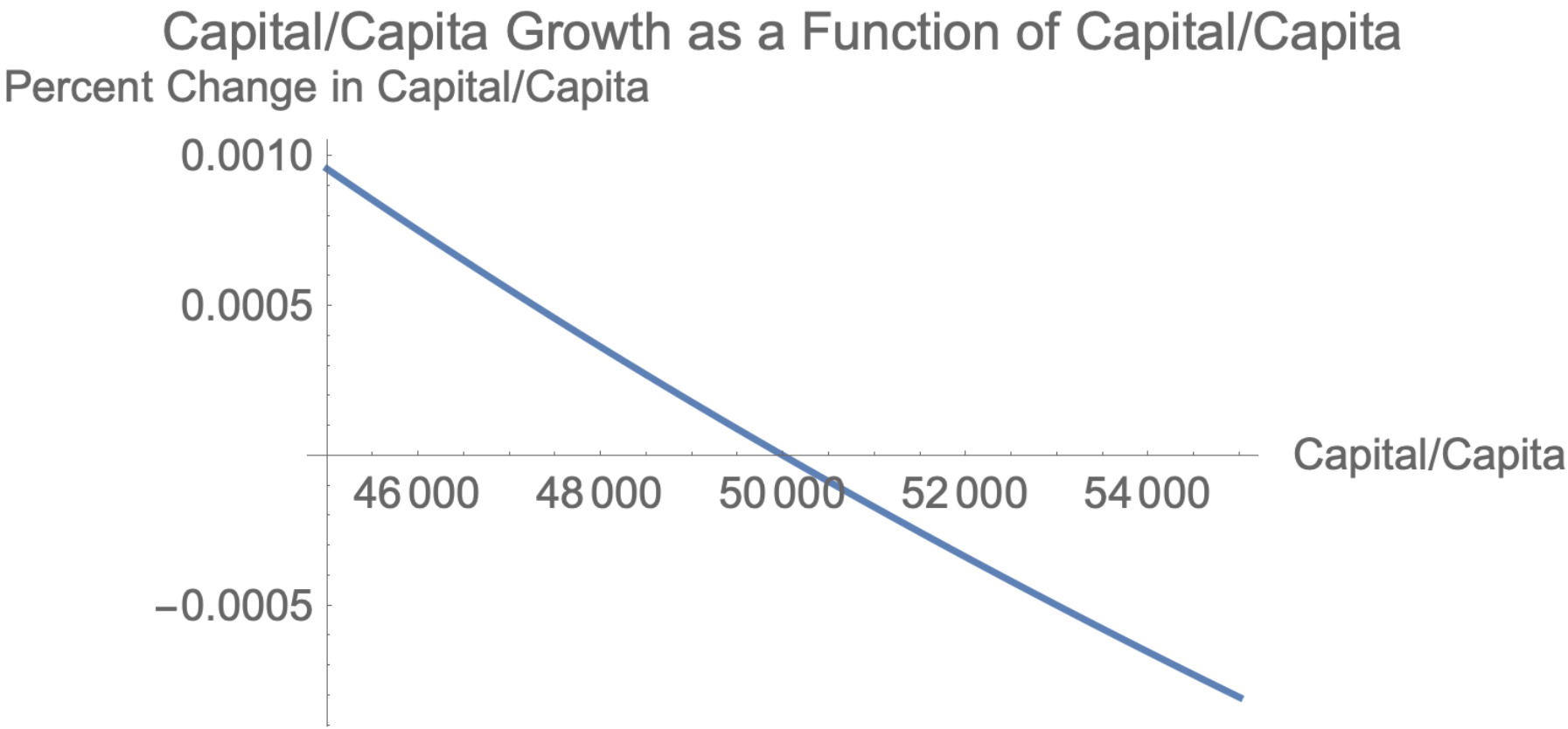
$$\Delta^* k = sAk^{\alpha-1} - s\delta - n$$

$$y = Ak^{\alpha}$$

$$c = (1-s)(Ak^{\alpha} - \delta k)$$

- What happens when n increases briefly (or as $k = \frac{K}{L}$ falls?)?

Framework I: Growth Theory



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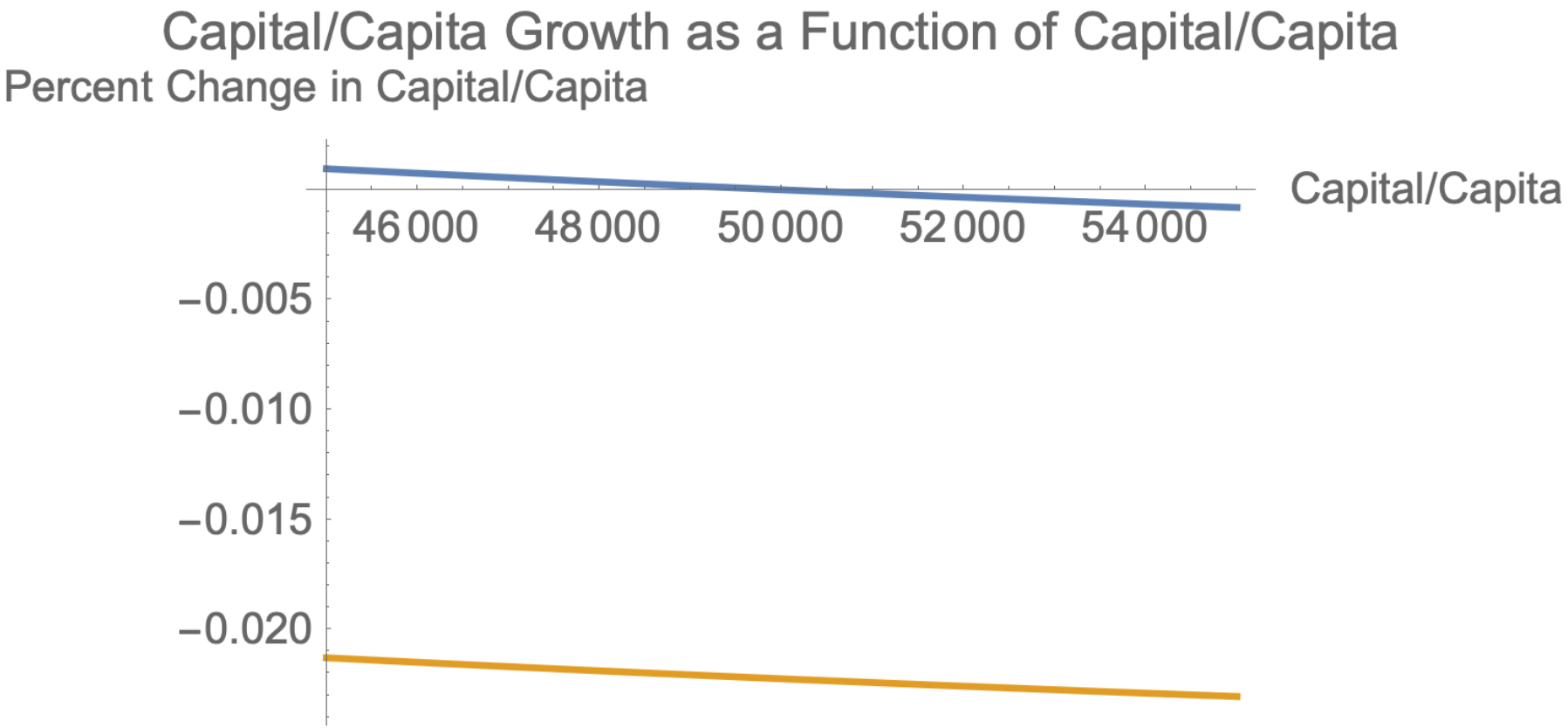

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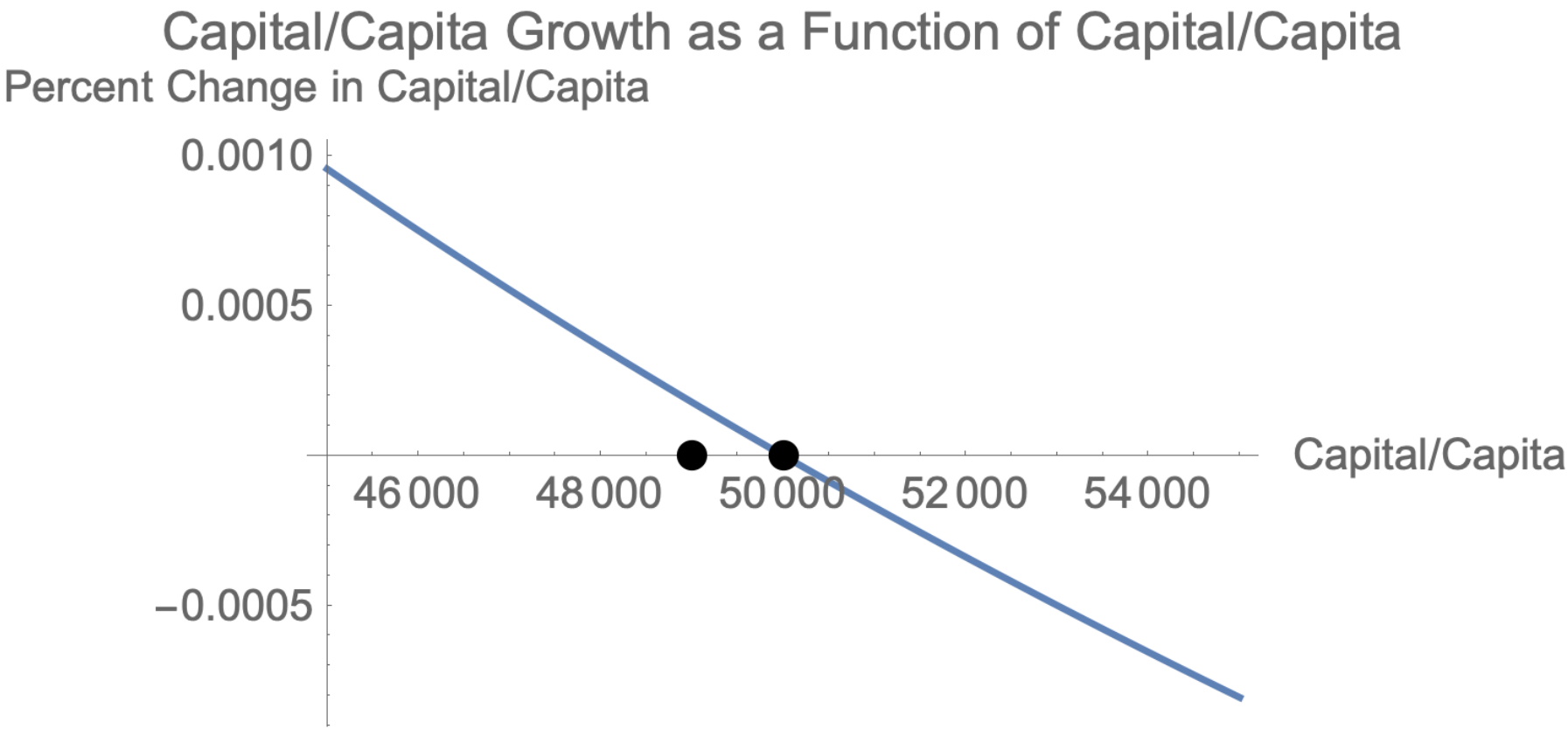

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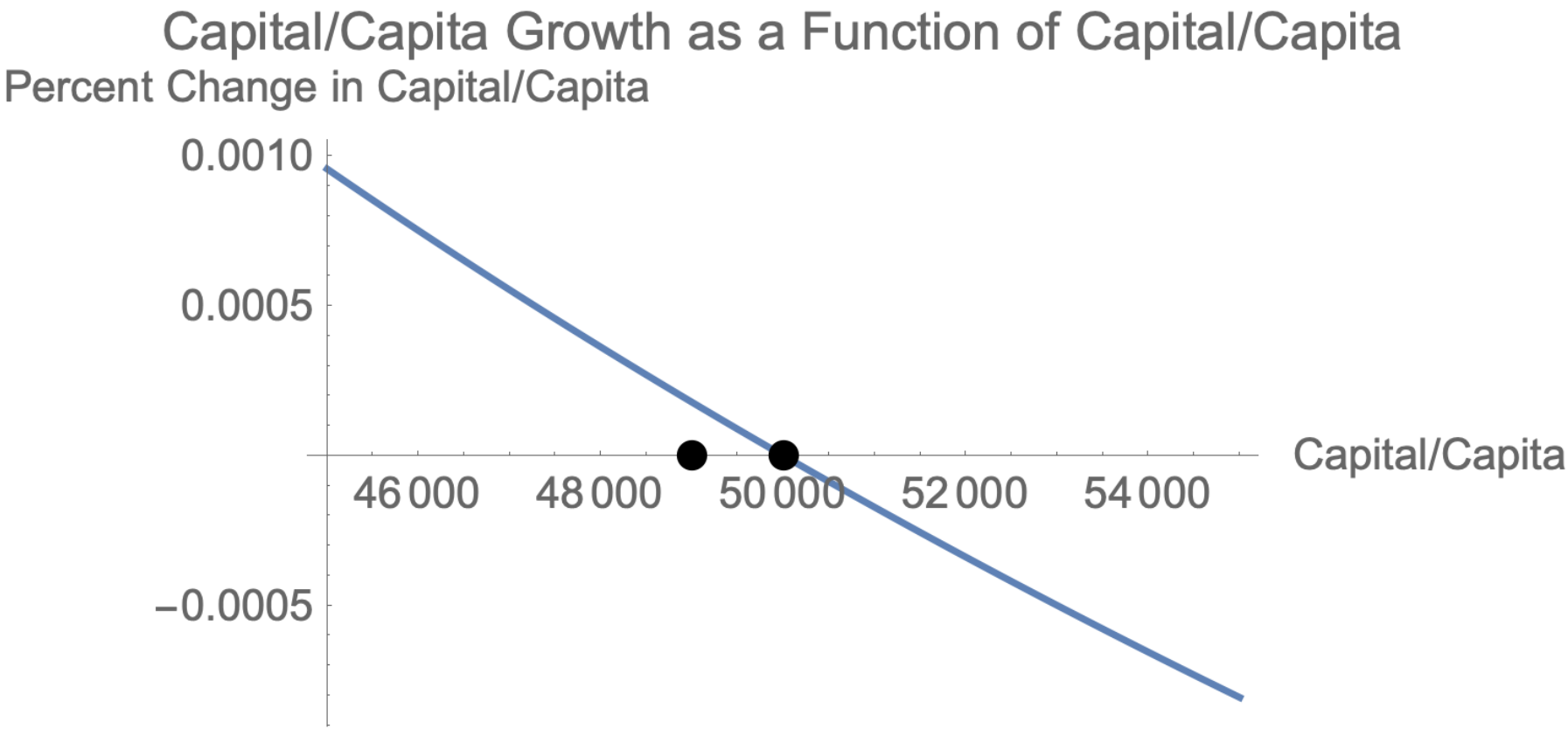


Framework IIa: Labor Markets

- Let's think about the production function (labor demand)

$$\pi = AK^{\alpha}L^{1-\alpha} - wL - rK$$

Maximizing profits:

$$\frac{\partial \pi}{\partial L} = 0 \Rightarrow (1-\alpha)AK^{\alpha}L^{-\alpha} = w$$

$$L^{D} = \left(\frac{(1-\alpha)AK^{\alpha}}{w}\right)^{\frac{1}{\alpha}}$$

- Let's say L^{S} is inelastic in the long run, so that:

$$L^{S} = N$$

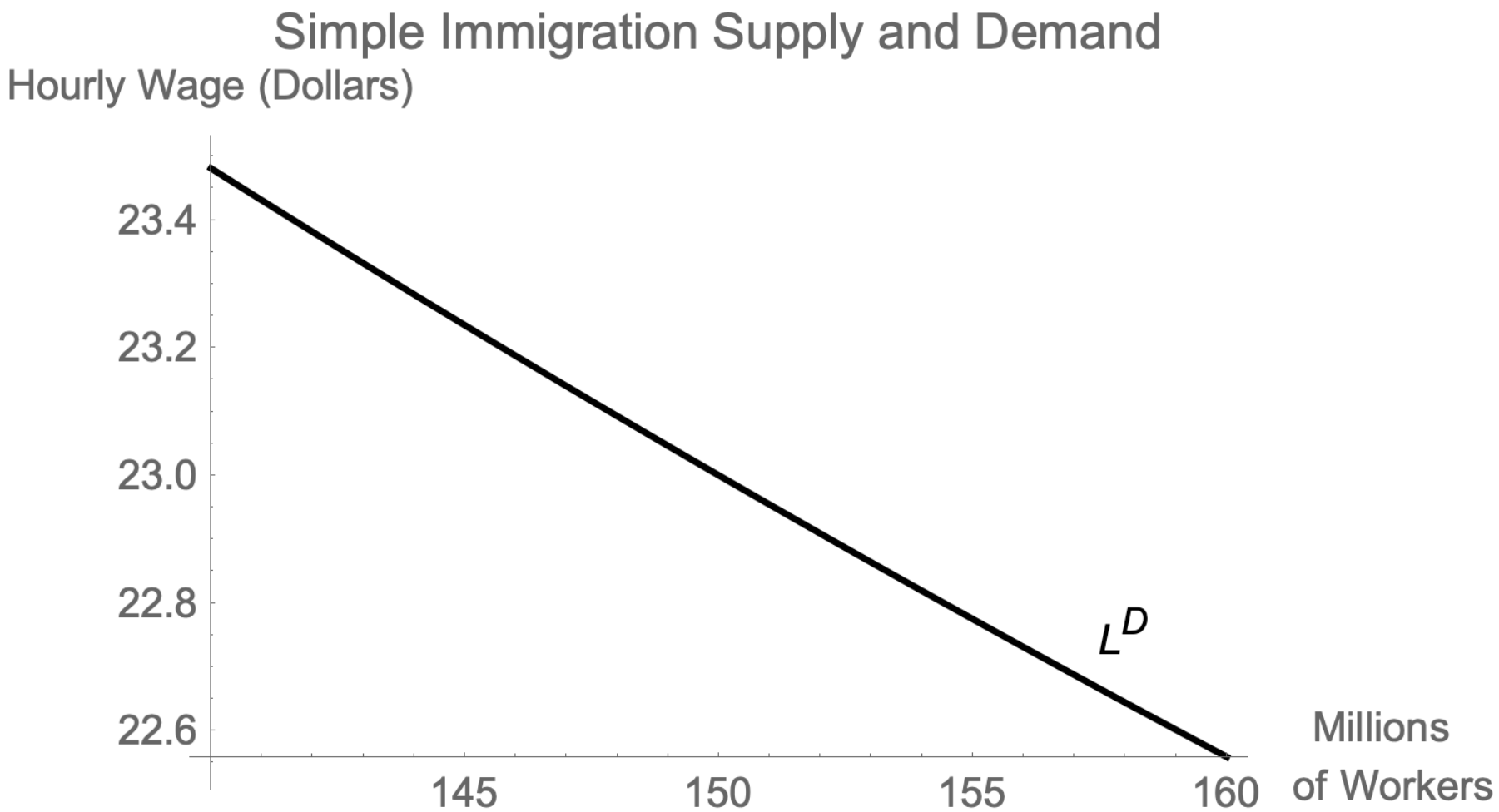
Framework IIa: Labor Markets

- For fun, let's calibrate this (casually)
  - US capital stock/worker is \$50,000 (it's really more). Gives K
  - Capital's share is 30% of national product. Gives α
  - Average hours per working-age person is about 1300. Gives L^*
  - Average wage is around \$23/hour. Gives w^*.
  - Can use all those at equilibrium to uncover A:

$$A = \frac{w}{1-\alpha}\left(\frac{L^*}{K}\right)^{\alpha}$$

  - Now we have all parameters, can plot out our initial equilibrium

Framework IIa: Labor Markets



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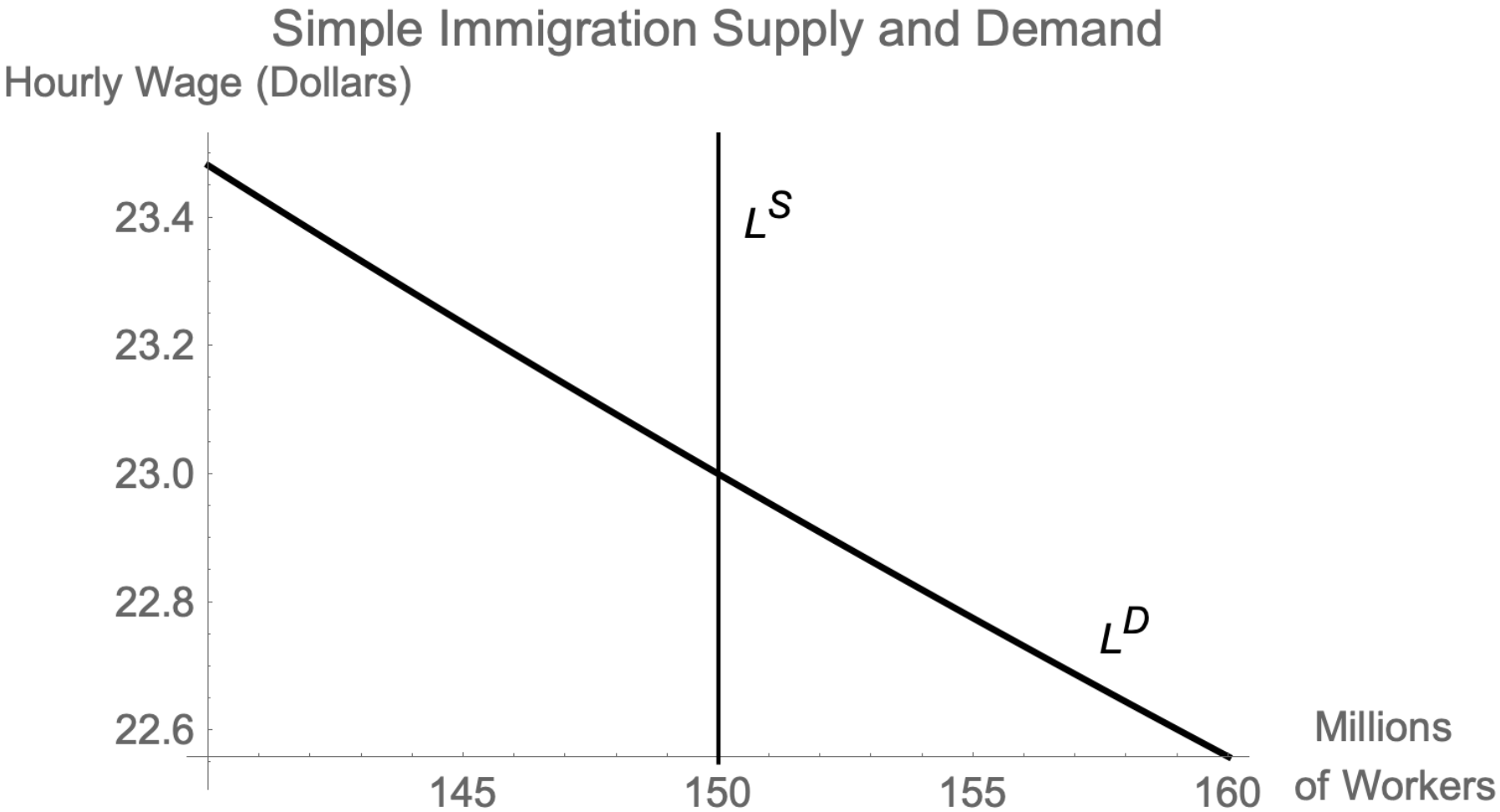

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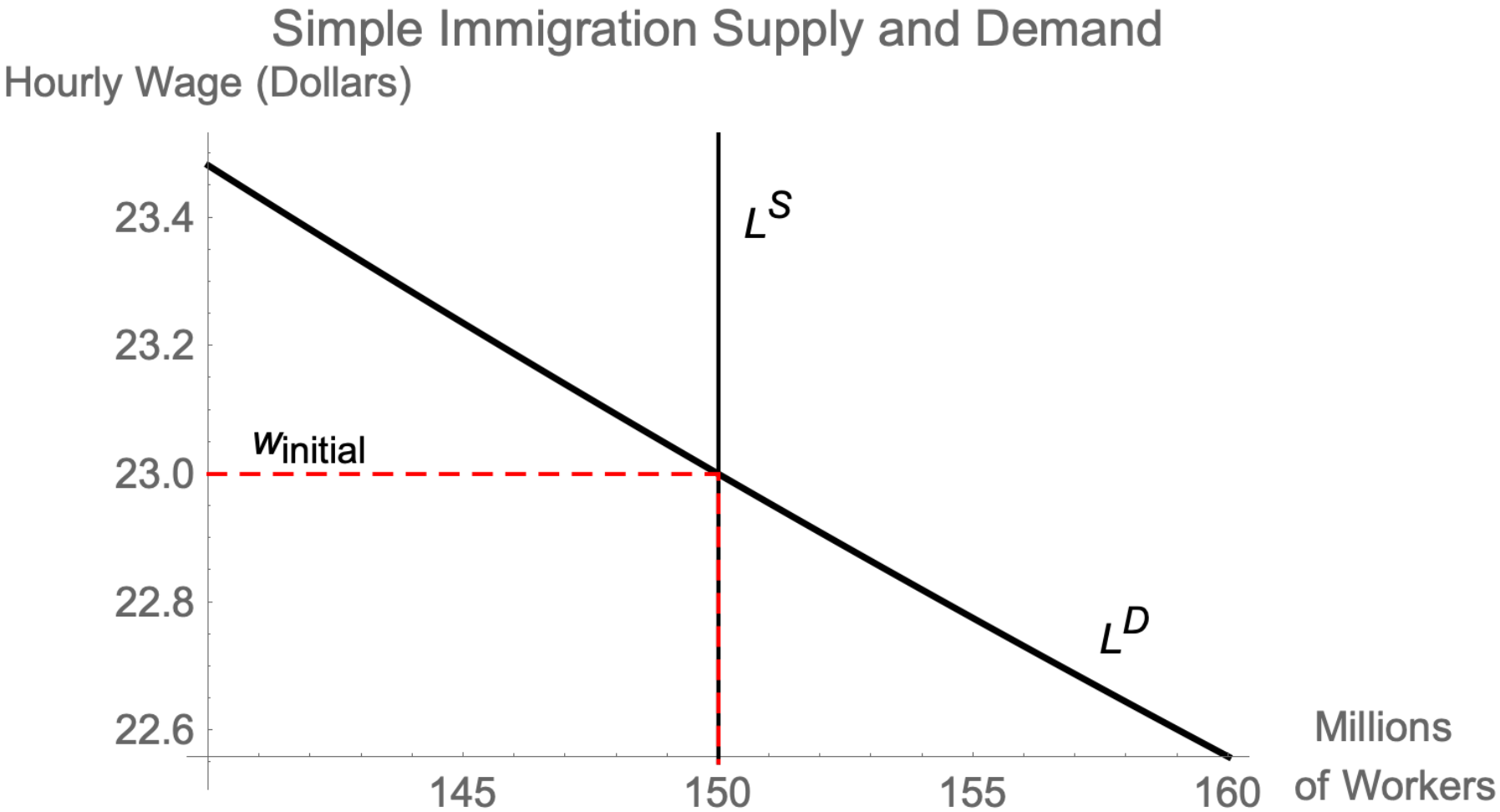

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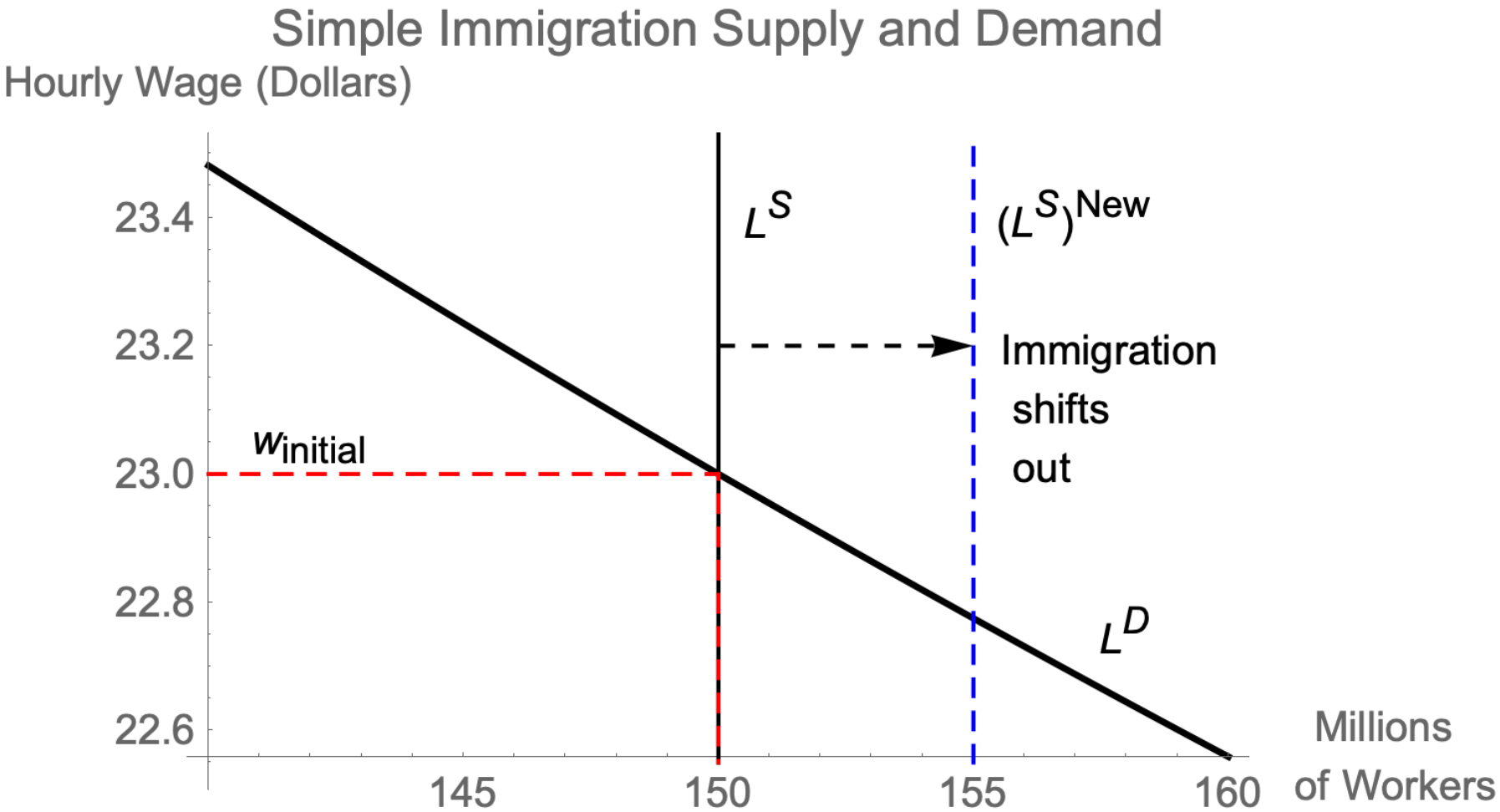

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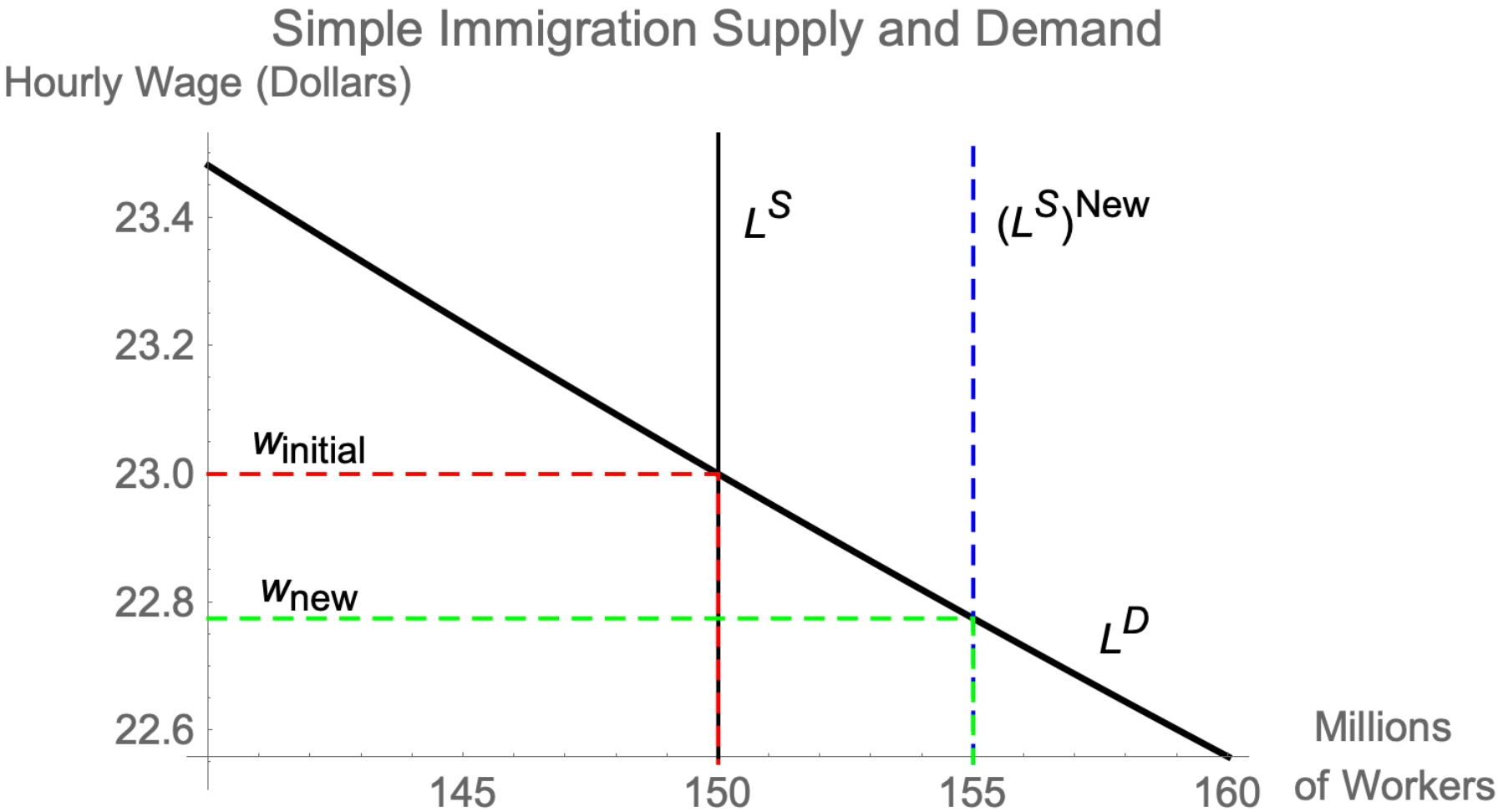


Framework IIb: Labor Markets

- But this seems pretty dumb, right? What's wrong with it?

Framework IIb: Labor Markets

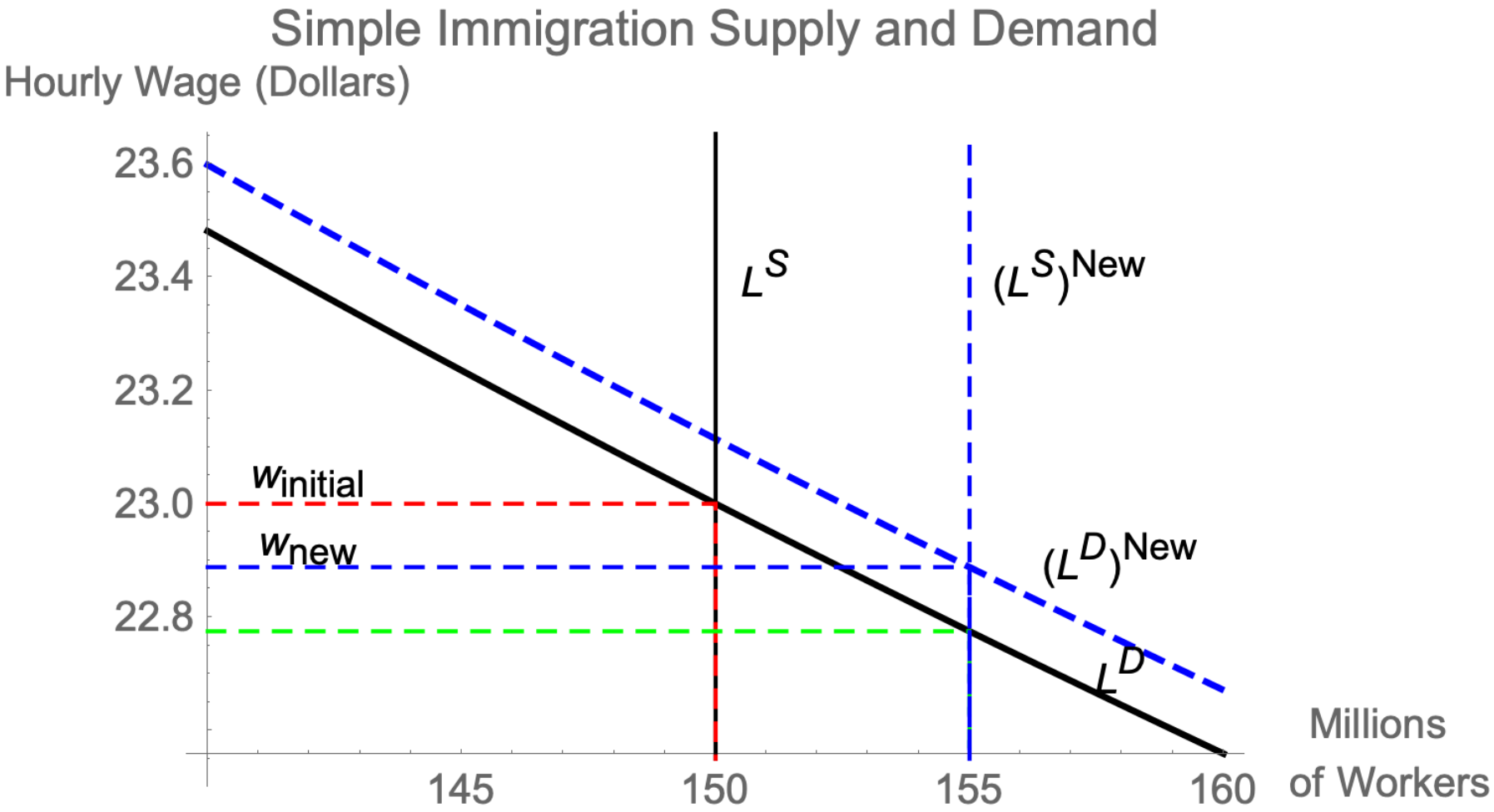
- But this seems pretty dumb, right? What's wrong with it?
  - No frictions (does this matter?)
  - No transfers (no interesting supply)
  - No heterogeneity
  - Immigrants bring no capital with them
  - No spillovers
- Many other things...how affect?

Framework IIb: Labor Markets

- What if immigrants brought a little capital with them...half as much as natives?

$$L^D = \left(\frac{(1-\alpha) A K^{\alpha}}{w} \right)^{\frac{1}{\alpha}}$$

Framework IIa: Labor Markets



Wage loss is mitigated

Framework IIb: Labor Markets

- Let's introduce the slightest bit of heterogeneity:

$$Y = AK^{\alpha}L^{1-\alpha}$$

$$L = \phi\left(a_l L_l^{\frac{\sigma-1}{\sigma}} + a_h L_h^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}$$

- The idea: L_l and L_h are not *perfectly* substitutable.
  - σ controls how substitutable
  - P-substitutes ("substitutes") if $\sigma > 1$ and P-complements if $0 < \sigma < 1$
  - i.e. if $\sigma = 10$, then when I decrease price of P_l by 10% relative to P_h, then ratio of L_l to L_h falls by 100%.
  - But **always** Q-complements when $\sigma < \infty$, so that they each positively affect one another's productivity positively
- This is important! When you hear "substitute" you think that one is always being replaced/being made redundant. That's not *necessarily* the case.
- Let's see how

Framework IIb: Labor Markets

- Firm maximization problem:

$$\pi = \phi \left(a_l L_l^{\frac{\sigma-1}{\sigma}} + a_h L_h^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} - w_l L_l - w_h L_h - rK$$

Taking FOC's:

$$\phi a_l \frac{1}{L_l^{\frac{1}{\sigma}}} \left(a_h L_h^{\frac{\sigma-1}{\sigma}} + a_l L_l^{\frac{\sigma-1}{\sigma}} \right)^{\frac{1}{\sigma-1}} = w_l$$

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We'll look at two things: price substitution and effects of each on the other's demand function.

Framework IIb: Labor Markets

- FOC's:

$$\phi a_l \frac{1}{L_l^{\frac{1}{\sigma}}} \left(a_h L_h^{\frac{\sigma-1}{\sigma}} + a_l L_l^{\frac{\sigma-1}{\sigma}} \right)^{\frac{1}{\sigma-1}} = w_l$$

$$\phi a_h \frac{1}{L_h^{\frac{1}{\sigma}}} \left(a_h L_h^{\frac{\sigma-1}{\sigma}} + a_l L_l^{\frac{\sigma-1}{\sigma}} \right)^{\frac{1}{\sigma-1}} = w_h$$

- For substitution, take ratio of two FOC's, and for clarity write w_l/w_h and L_l/L_h as w_{rat} and L_{rat}:

$$a_{rat} = L_{rat}^{\frac{1}{\sigma}} w_{rat}$$

- Taking logs:

$$\log(L_{rat}) = \sigma \log(a_{rat}) - \sigma log(w_{rat})$$

If $\sigma = 10$, when $w_{rat} \uparrow 1\% \Rightarrow L_{rat} \uparrow 10\%$. LS labor 1% cheaper relative to high-skilled labor, use 10 times more low-skilled labor!

- Seems primed to find immigrants affect wages downward...

Framework IIb: Labor Markets

- We were just looking at the relative quantities. What happens to labor demand?
- Need $\frac{\partial Y}{\partial L_l \partial L_h}$, i.e. what happens to marginal product of low-skilled labor

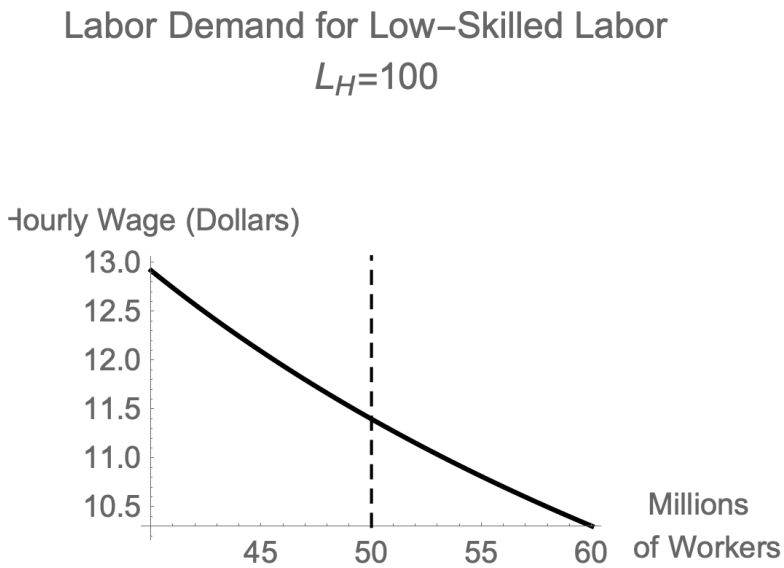
$$\frac{\partial Y}{\partial L_l \partial L_h} = \frac{a_h a_l \phi L_h^{\frac{1}{\sigma}} L_l^{\frac{1}{\sigma}} \left(a_h L_h^{\frac{\sigma-1}{\sigma}} + a_l L_l^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}}{\sigma \left(a_h L_h L_l^{\frac{1}{\sigma}} + a_l L_l L_h^{\frac{1}{\sigma}} \right)^2}$$

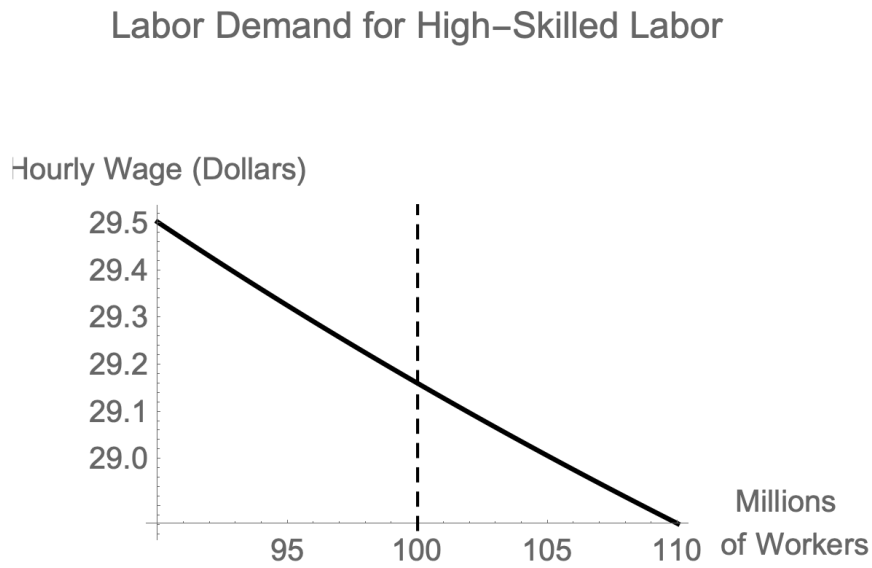
- Note that everything in that expression is positive, so $\frac{\partial Y}{\partial L_l \partial L_h} > 0$!
- If we use more low-skilled labor, our demand for high-skilled labor increases.
- Let's get a feel quantitatively (casually calibrated again)

Framework IIb: Labor Markets

- We think that $\sigma = 1.5$ for high-skilled/low-skilled labor (substitutable)
- Let's say that $L_h^* = 100$ million, $L_l^* = 50$ million, $w_h = 30$, $w_l = 11.4$, so we're pretty comparable to what we had before (avg wage 23, labor market of 150 million)
- With these assumptions and defining $a_h = 1 - a_l$ (pulling common components into ϕ) we get $a_l = 0.2$, $\phi = 39.5$, $a_h = 0.8$
- From here we can make predictions like we did before: what happens to wages if we have 5 million low-skilled immigrants?

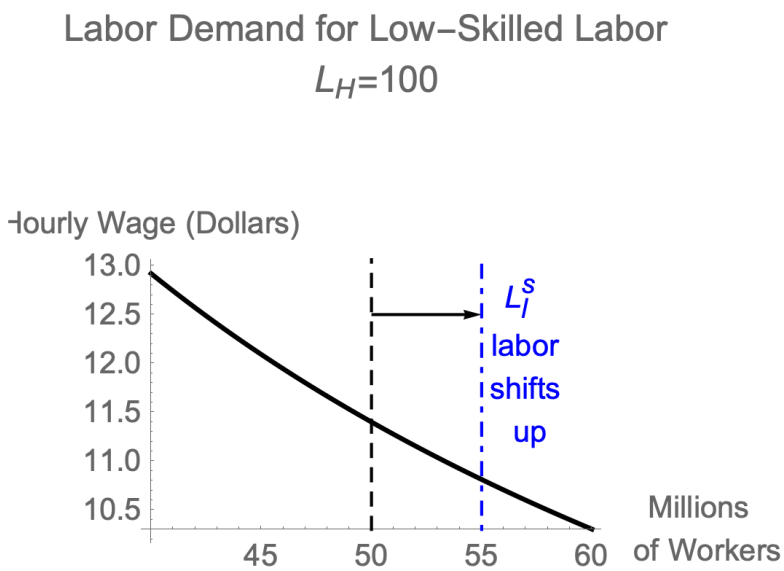
Framework IIa: Labor Markets

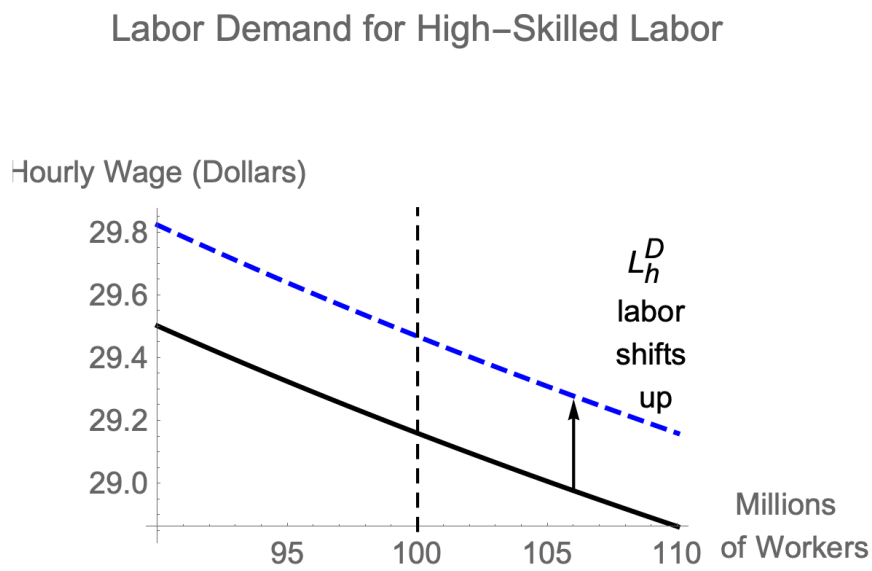




We start from some baseline

Framework IIa: Labor Markets





Wages increase for the high-skilled group, even though they're "substitutes"!

A few lessons

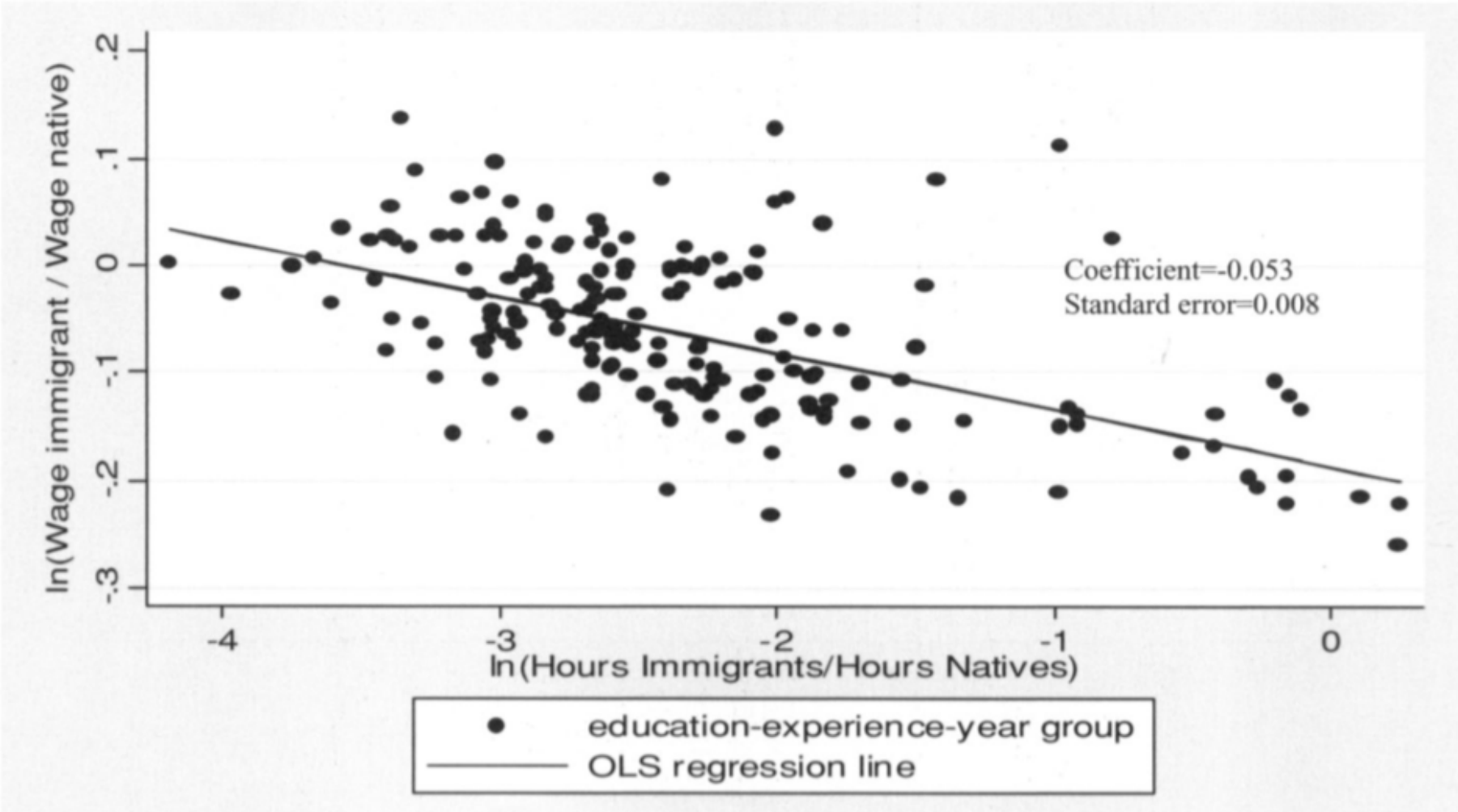
- We took something that was "substitutable" to high-skilled labor and added more of it
- And high-skilled labor demand went up!
- Wages went from 11.40 $\rightarrow$ 10.81, and 29.16 $\rightarrow$ 29.47
- This might be confusing. But note that the ratio of wages w_l/w_h fell by 6%.
- And ratio of L_l/L_h increased by 1.5 times that (10%), from 50/100 to 55/100.
- If $\sigma = 10$ instead, then high-skilled wages would only have increased by 0.1%, not 1%.
- Always remember that economists use "substitute" to mean **p-substitutes**, not **q-substitutes**. The first tells you what happens to the ratio of quantities when you change the ratio of prices, while the second tells you what the cross-derivative of production with respect to the input is (relevant for affects on wages)

Empirics

- What happens if we take the basic model we have above and apply it to a more detailed version of the economy?

- Ottaviano and Peri (2012) do this:
  - Top level: high-skilled and low-skilled labor
  - Next level: {No degree, HS Degree} for low skilled, {Some College, College} for high-skilled
  - Competing within each educational category are eight experience levels: {1-5, 6-10, 11-15, 16-20, 21-25, 26-31, 31-35, 36-40}
  - Competing within each educational/experience bin are US vs foreign born
- The key is that even if you fear competition from workers that are perfect substitutes, you are benefitted from workers that are q-complements

Empirics



Within education-experience-year group, $\sigma \approx 20$!

Empirics

Gains to Natives

Education Group	% change in hours worked due to immigrants 1990-2006	% Change in weekly wages due to immigration
No HS	23.6%	+0.6%
HS	10.0%	+0.3%
Some	6.0%	+1.3%
College	14.6%	+0.3%

Gains to Natives: Alternative model

Education Group	% change in hours worked due to immigrants 1990-2006	% Change in weekly wages due to immigration
No HS	23.6%	-3.1%
HS	10.0%	+0.7%
Some	6.0%	+1.6%
College	14.6%	-1.1%

Gains to Immigrants

Education Group	% change in hours worked due to immigrants 1990-2006	% Change in weekly wages due to immigration
No HS	23.6%	-4.8%
HS	10.0%	-7.1%
Some	6.0%	-3.6%
College	14.6%	-8.2%

Empirics

- We know labor demand curves slope downwards (i.e. immigration "should" lower wages)
- But when natives and immigrants aren't perfect substitutes, complementarities can kick in pretty quickly
- All broad natives can potentially gain from immigration (even if current immigrants may lose significantly)
  - This last was pretty surprising to me at first!
- Also note: none of our discussion above had to refer to the opacifying statement "immigrants demand goods as well as produce them". It may be true, doesn't clarify things much. We can see everything through labor supply and firm marginal cost curves.
- Now that we understand immigrants can help natives even when "substitutes," let's get an overview of other empirical results

- Empirically, immigrants have been found to affect:
  - Cause natives to leave public/go to private school (Farre, Ortega and Tanaka 2018)
  - Cause districts to reduce student/teacher ratio (Farre, Ortega and Tanaka 2018)
  - Reduces US-born women's STEM participation in college (Orrenius and Zavodny 2018)
  - Lowers vocational enrollment among natives in construction (Roed and Schone 2016)
  - Reduces cost of household production goods and increases top-quartile women's labor force participation (Cores and Tessada, 2011)
  - Reduce firm capital intensity, investment, and increase returns (Baum-Snow, Freedman, and Pavan, 2018)
  - Increases patents & citations (Draca, Machin, and Witt 2011)
  - Increases probability of firm exporting (Parrotta, Pozzoli, and Sala, 2016)
  - Increases the price of housing (Saiz, 2007)
  - Increases right-wing vote share (Halla, Wagner, and Zweimuller 2017)
  - Among other things

Pivoting: What about the immigrants perspective?

- Why do people immigrate?
  - Persecution, war
  - Family
  - Opportunity

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Two Countries & Selection

- Two countries, U and M, people maximize earnings given a wage draw from each country and moving costs
- Two wage draws:

$$\log w_{i,U} = \mu_U + \nu_{i,U} \qquad \nu_{i,U} \sim \mathcal{N}\left(0, \sigma_U^2\right)$$

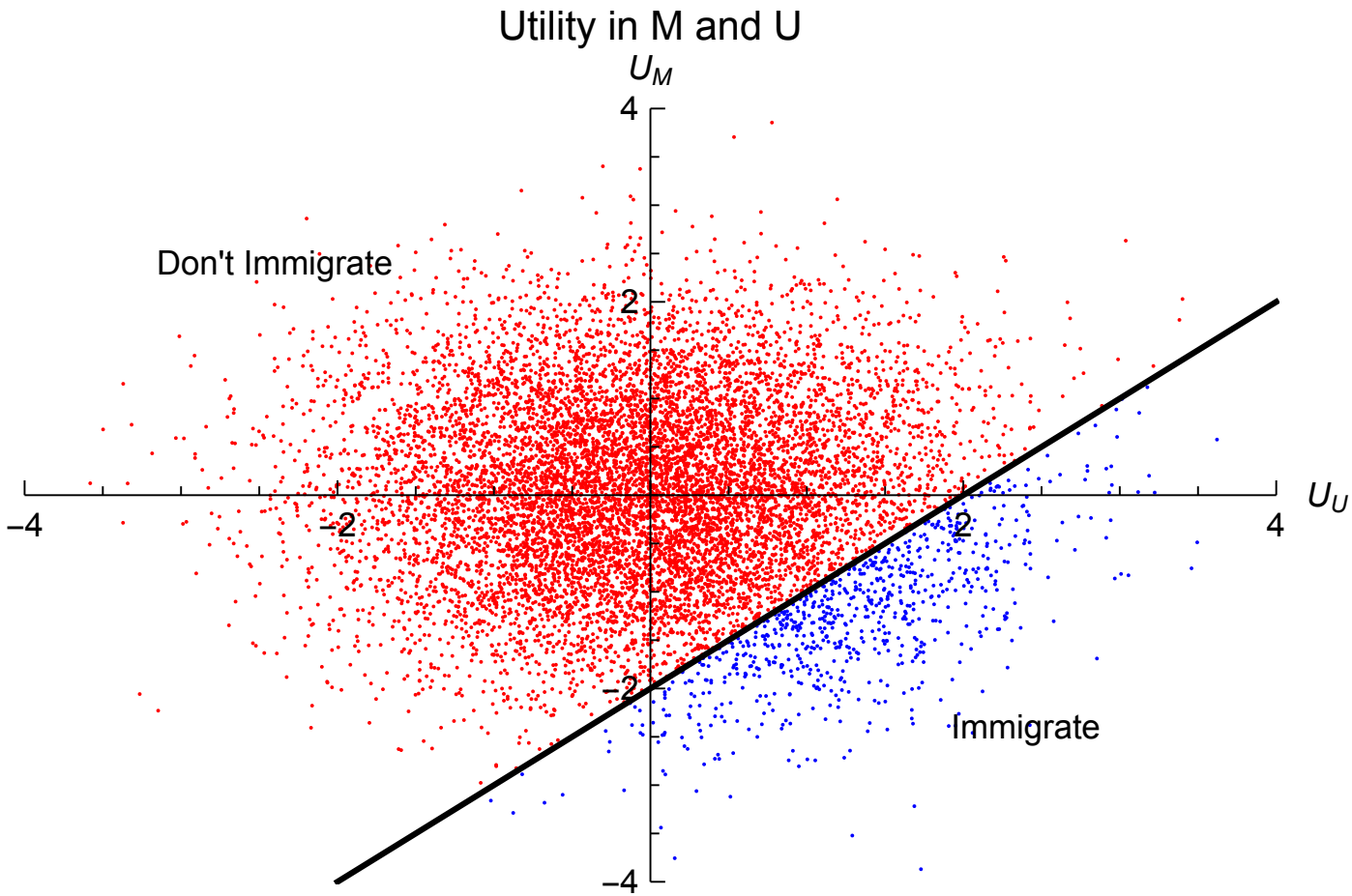
$$\log w_{i,M} = \mu_M + \nu_{i,M} \qquad \nu_{i,M} \sim \mathcal{N}\left(0, \sigma_M^2\right)$$

- Correlation between $\nu_{i,U}$ and $\nu_{i,M}$ is $\rho_{U,M}$.
- Cost of moving from M to U is C.

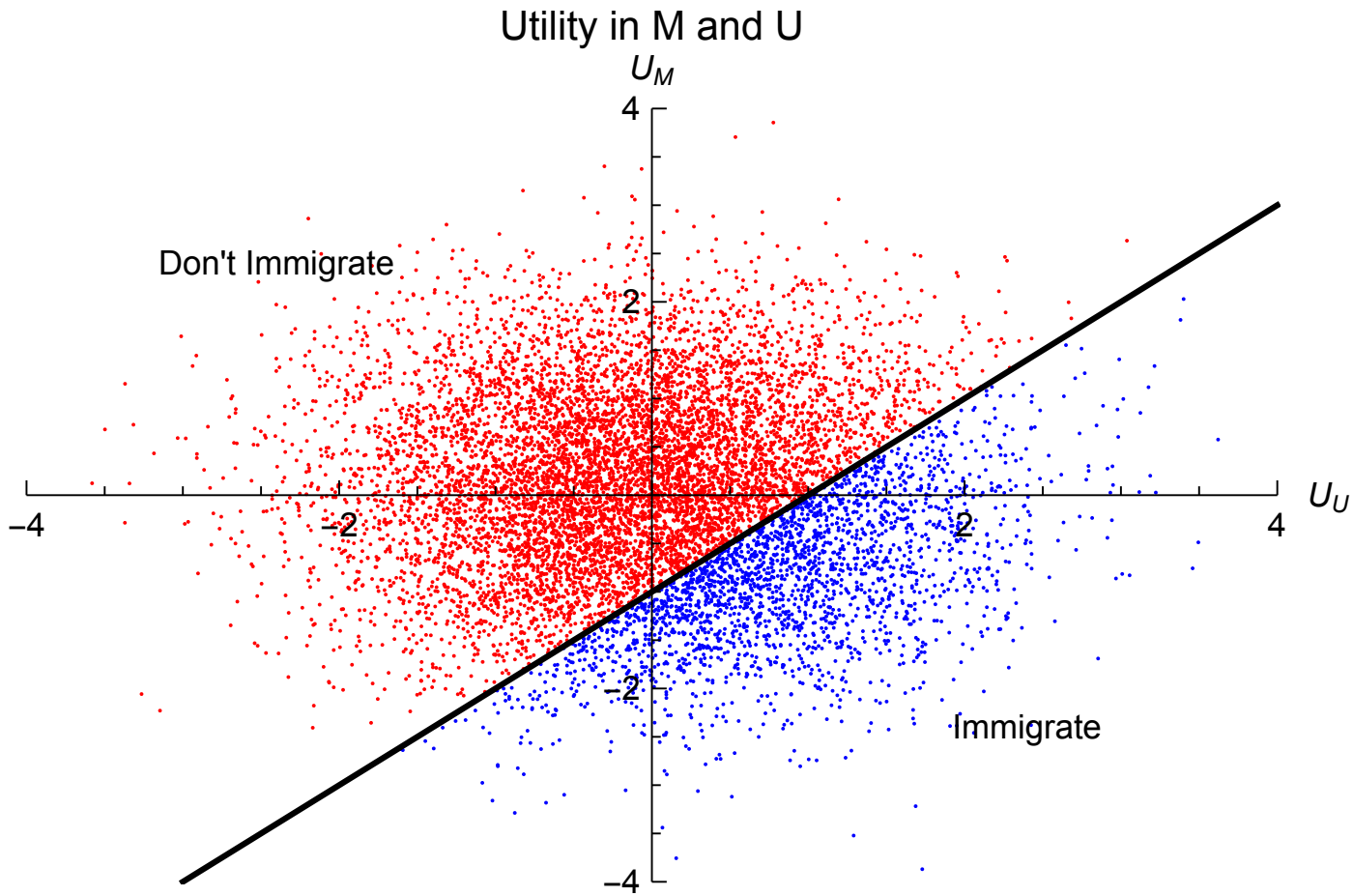
Important Note

- For all discussion below, **you live in M, and are considering moving to U**.

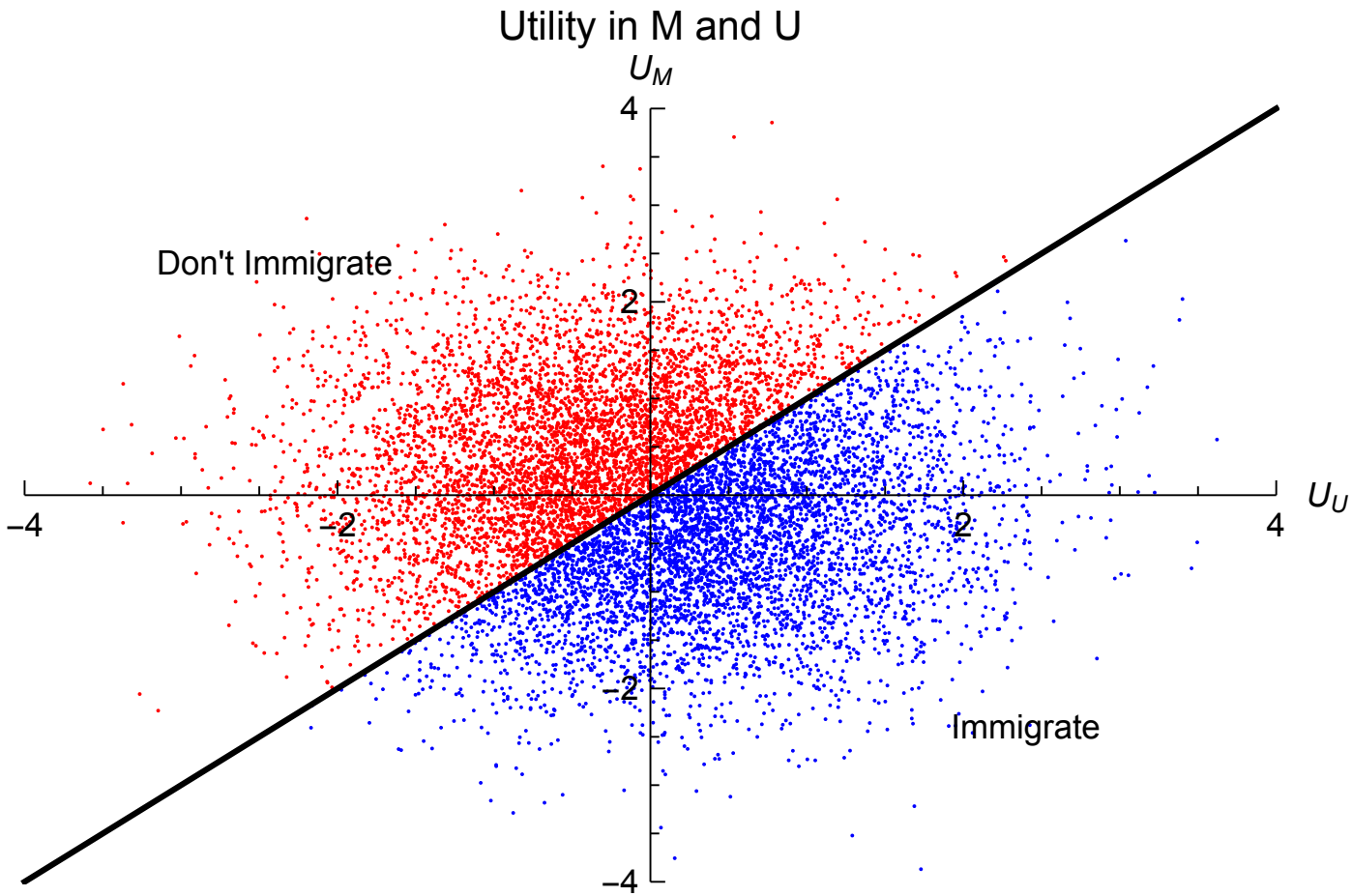
High Cost of Immigration



Low Cost of Immigration



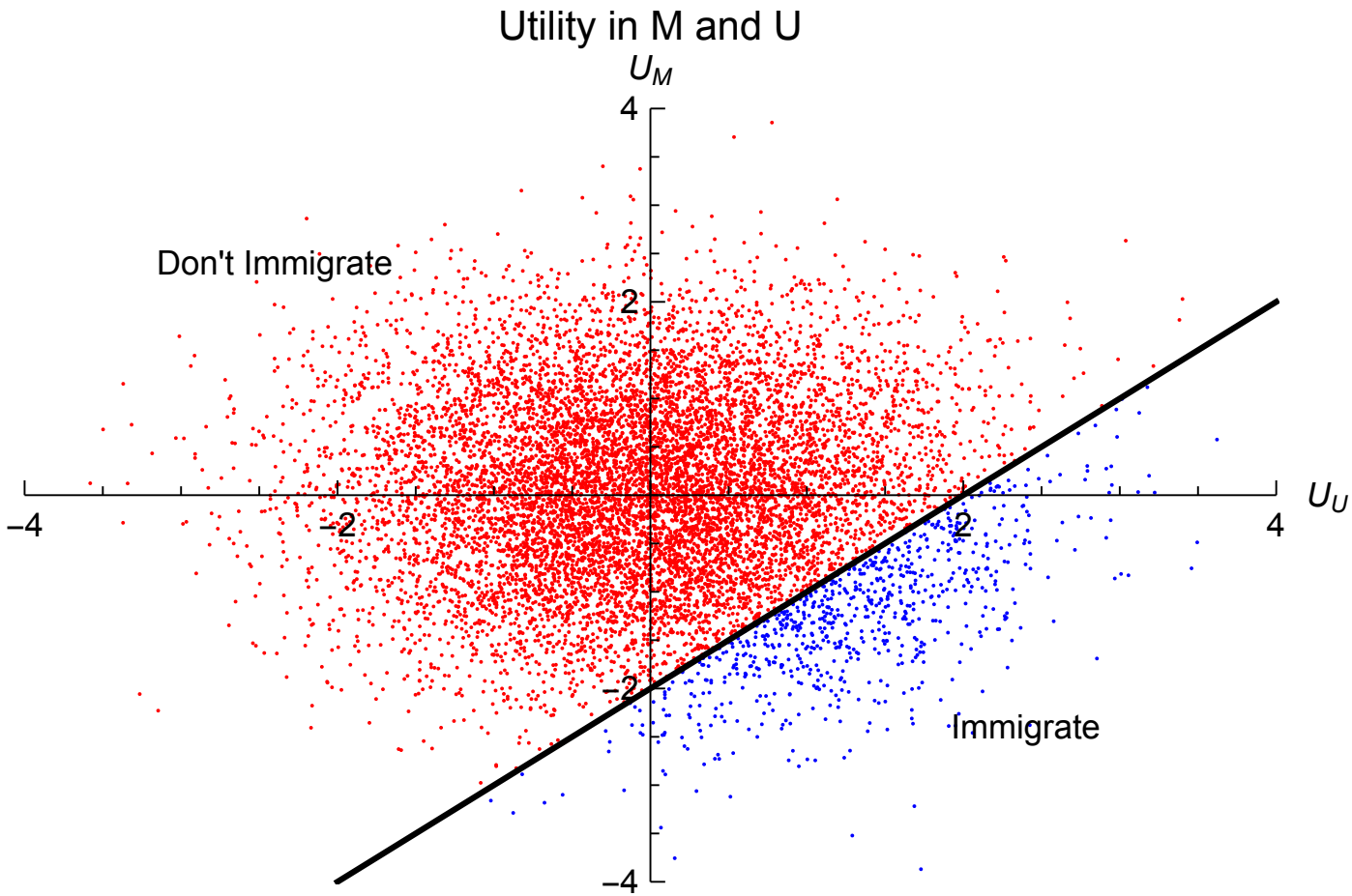
No Cost of Immigration



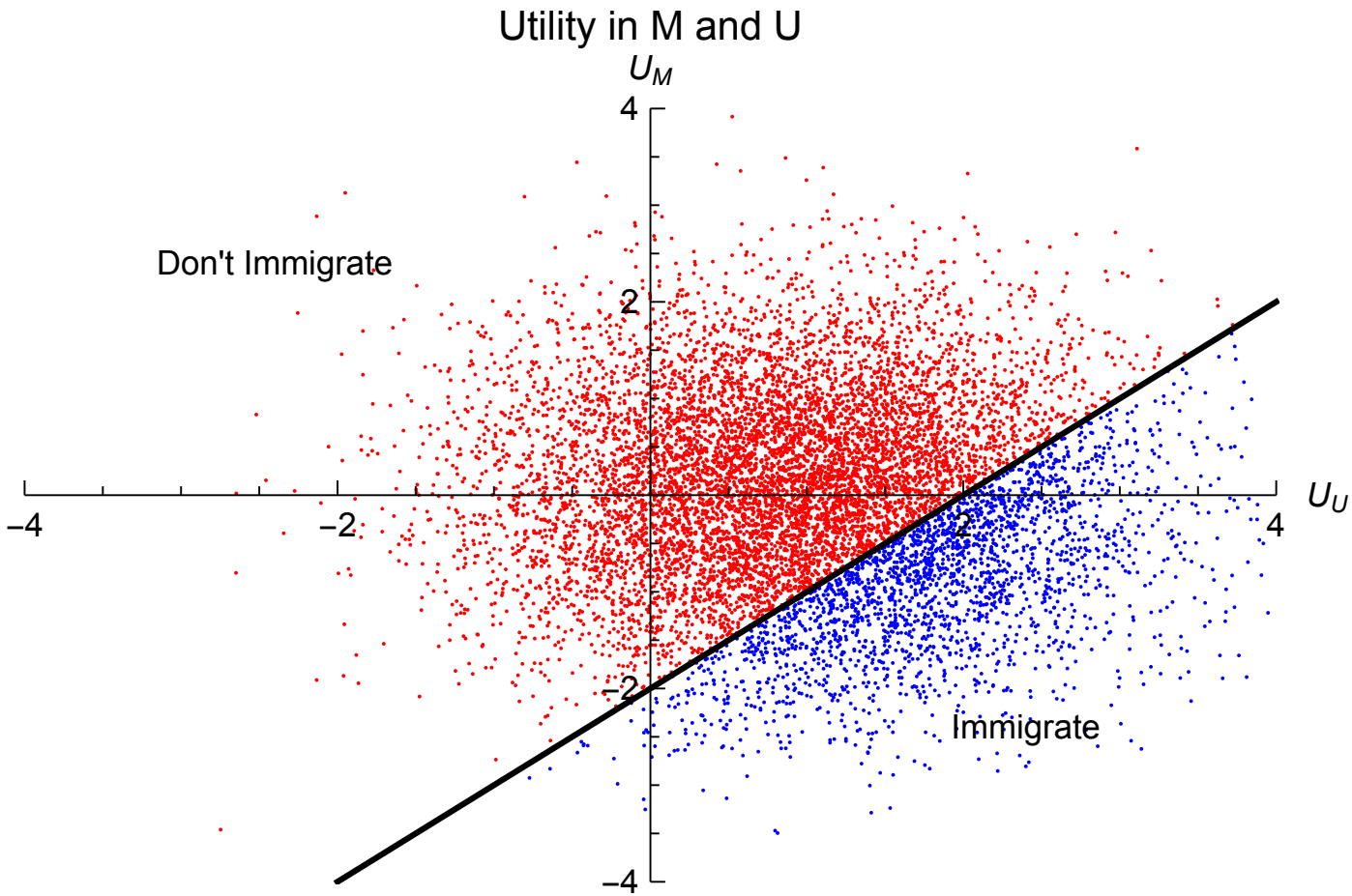
Hicksian Immigration

- As costs of migration fall, more people migrate.
- What about shifts in μ_M or μ_U?

High Cost of Immigration



Lower Cost of Immigration, US better



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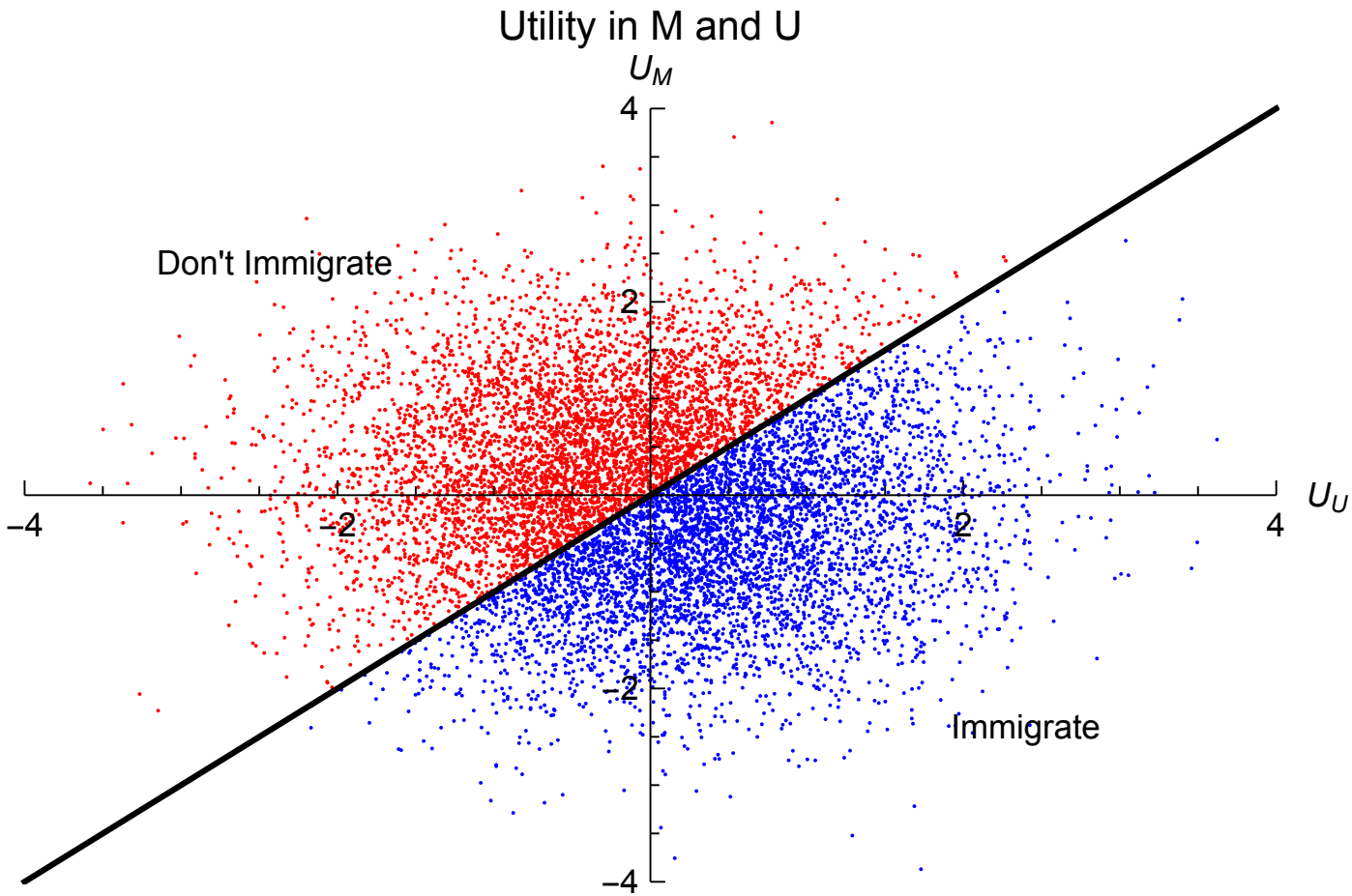

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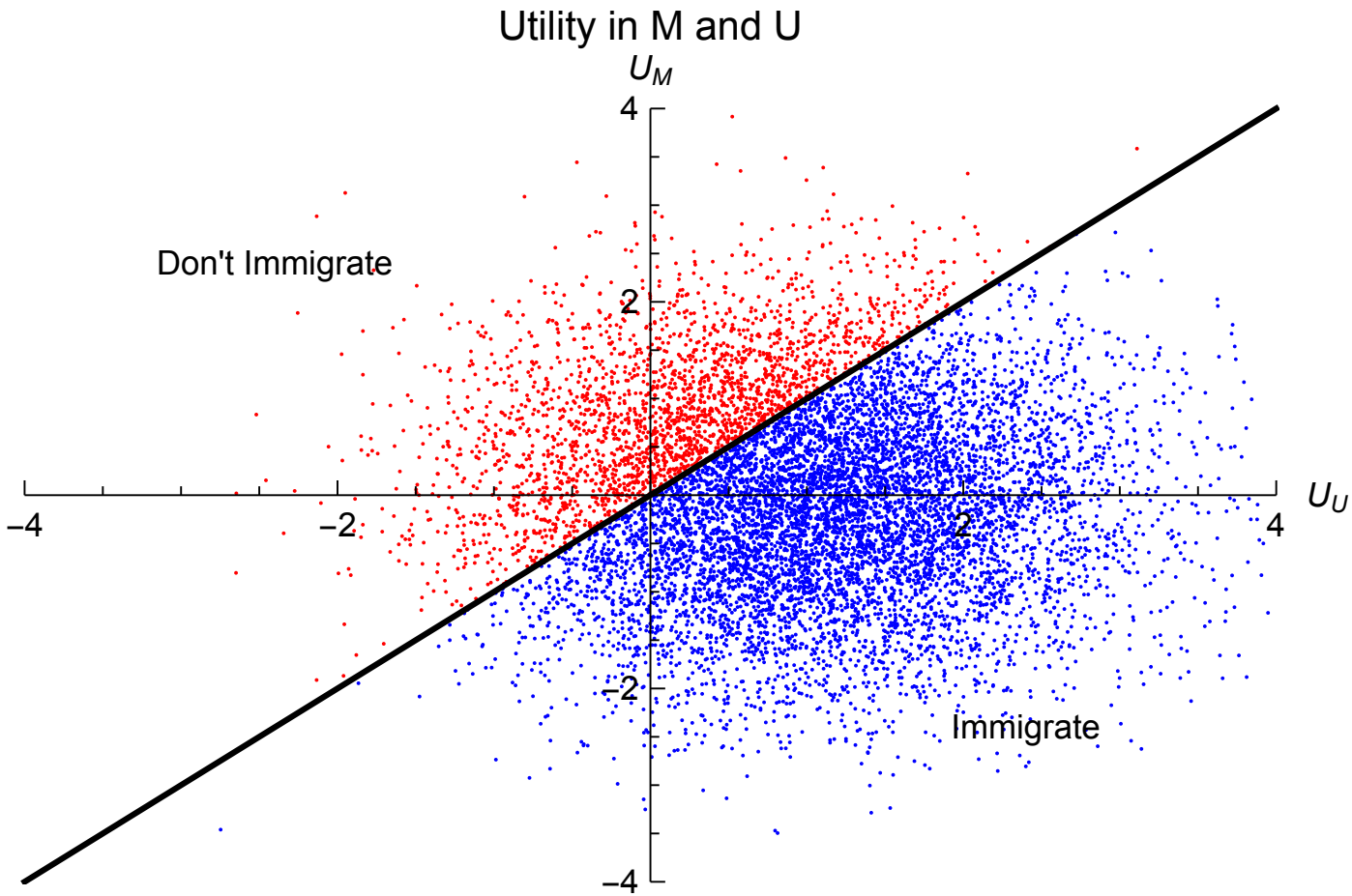


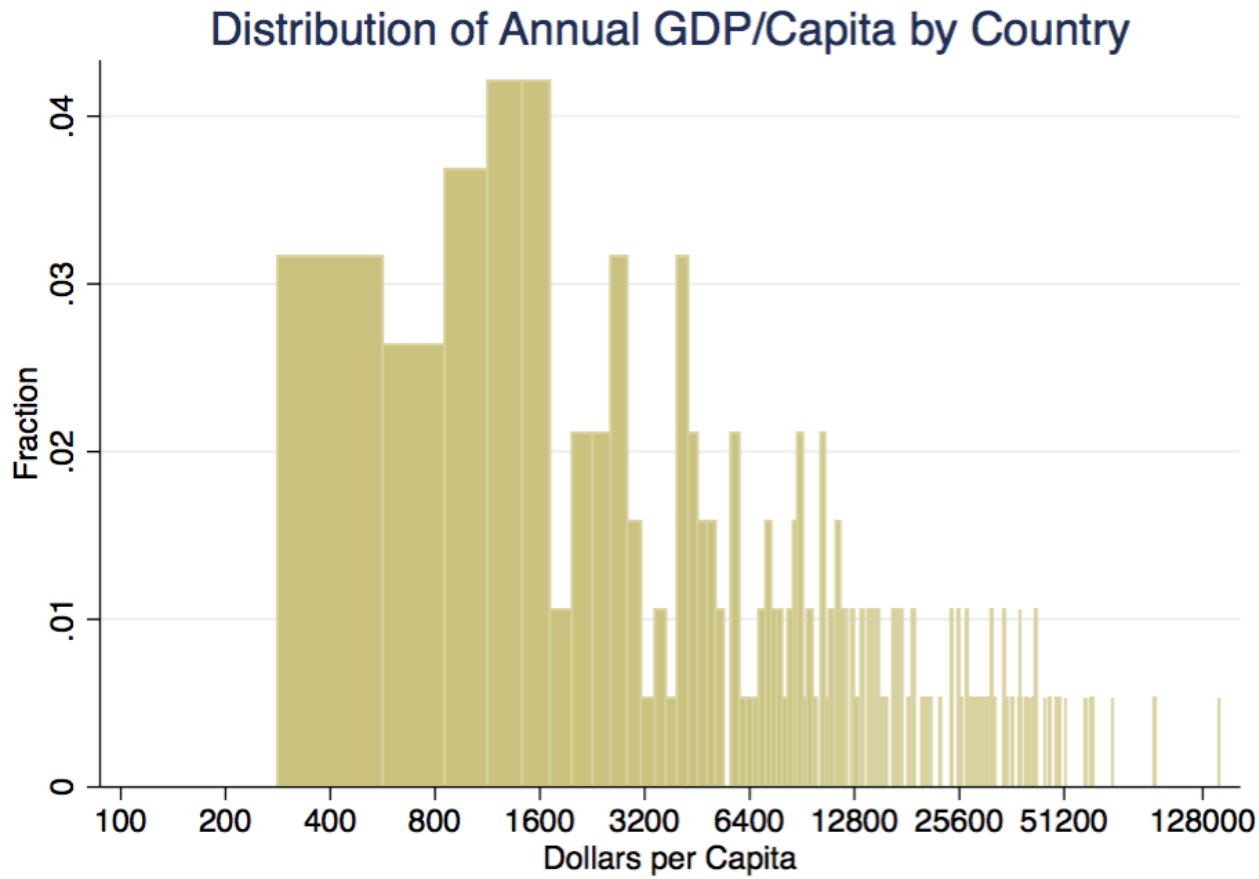
Summarizing Hicksian Immigration

- Let P be the proportion of people moving from M to U.
- Four obvious but important points:
  - $\frac{\partial P}{\partial \mu_M} < 0$: As μ_M (original country wages) increase relative to μ_U (prospective country wages), fewer people immigrate.
  - $\frac{\partial P}{\partial \mu_U} > 0$: As μ_U (prospective country wages) increase relative to μ_M (original country wages), more people immigrate.
  - $\frac{\partial P}{\partial C} < 0$: As the cost of migration increases, fewer people immigrate.
  - The impact on P depends on how many marginal people there are.

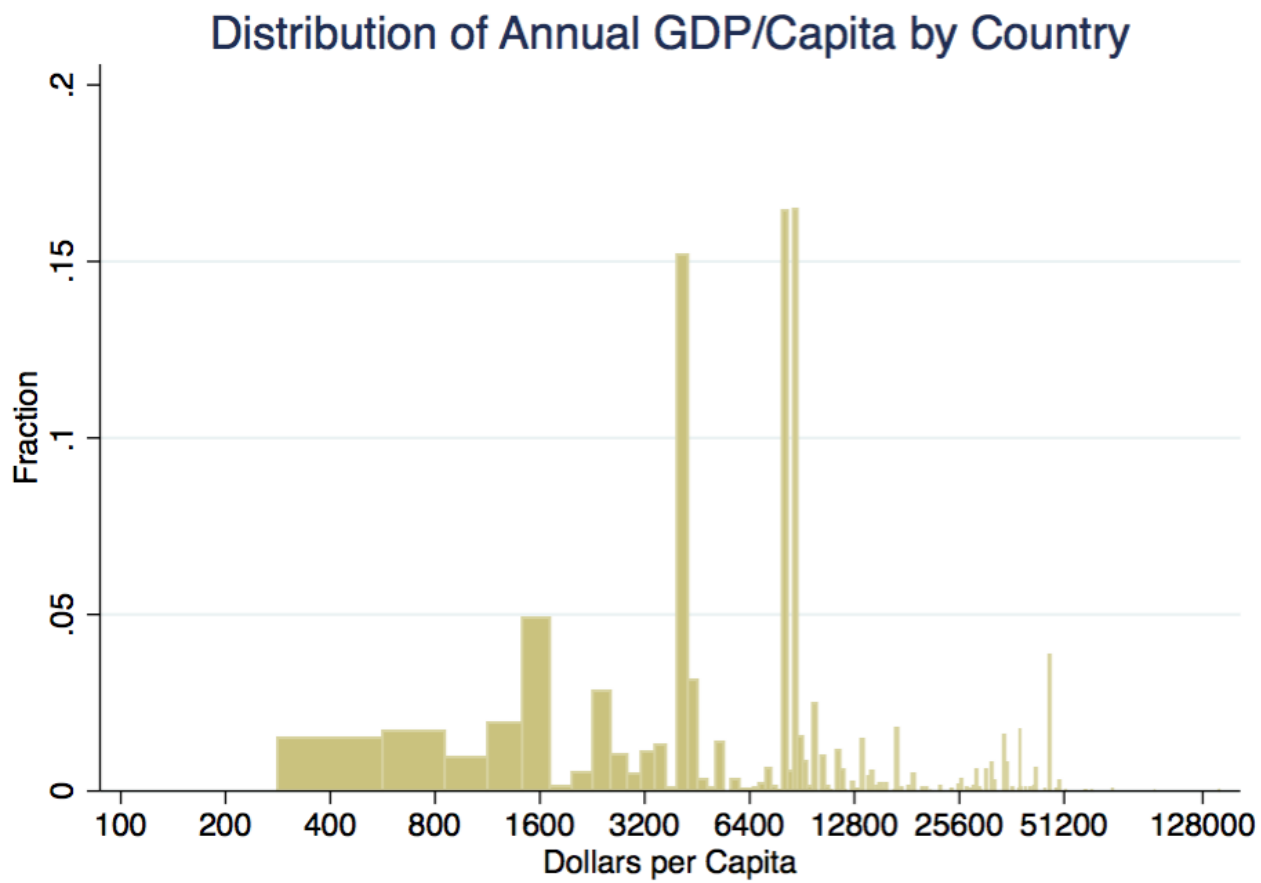
A Puzzle

- There are enormous differences in income across countries!
- Why so little immigration?

Distribution by Country



Distribution by Country, Weighted by Population



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  1. Costs are high
     - $1,000,000 high? Unrealistic.
  2. Immigration restrictions
     - But no immigration restrictions between Puerto Rico and the U.S. (with a mean wage difference in 2012 of $12,000) and still 2/3 of Puerto Ricans have not immigrated since end of WWII

Selection-I

- Q: Do the most skilled immigrants migrate?
- A: Not necessarily
- Consider our model before: who moves will depend a great deal on the correlation between wages in the origin and destination countries, as well as the variance

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Selection-II

- Three types of sorting:

  1. Positive selection: the best immigrate–high $\nu_{i,M}$ migrate to U.S. and have high $\nu_{i,U}$

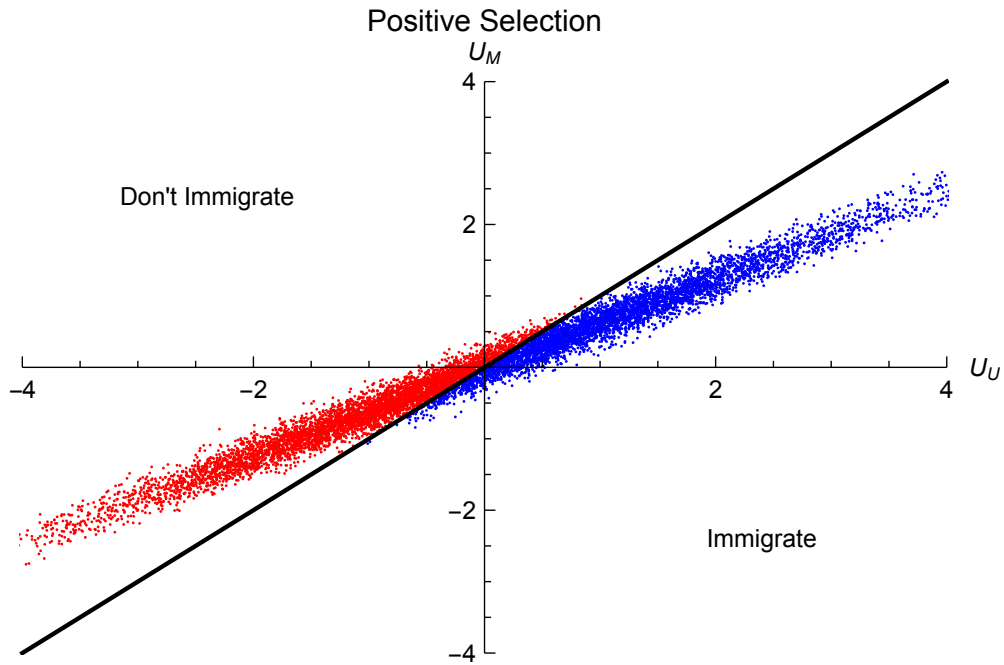
  2. Negative selection: the worst immigrate–low $\nu_{i,M}$ migrate to U.S. and have low $\nu_{i,U}$

  3. Inverse sorting: the misfits immigrate–low $\nu_{i,M}$ migrate to U.S. and have high $\nu_{i,U}$

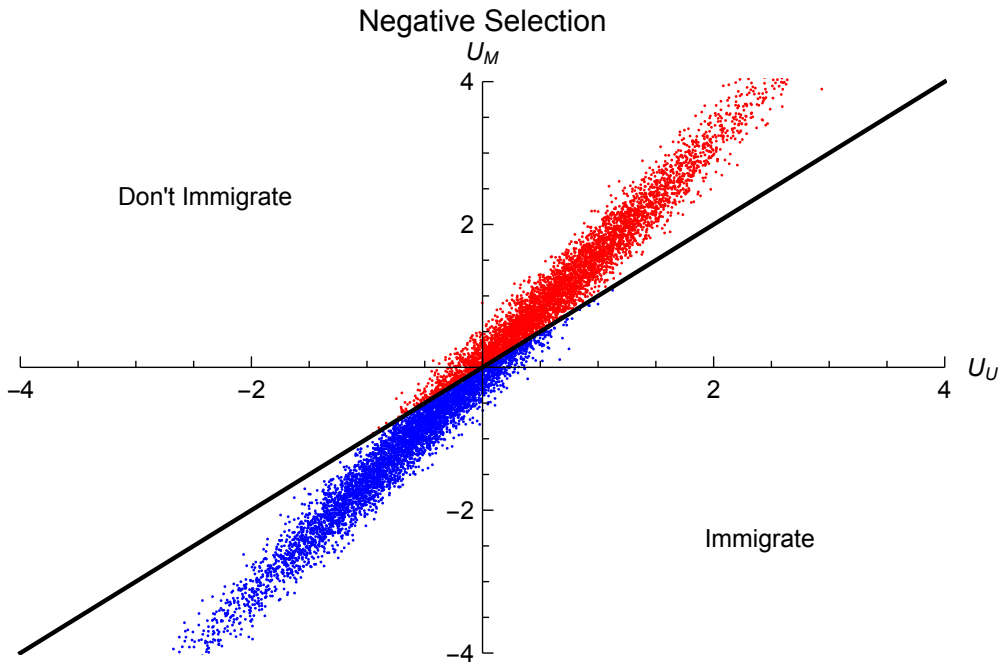
- What makes each more or less likely?

  - When $\rho_{U,M} < 0$ or small, inverse sorting likely
  - When $\rho_{U,M}$ big and $\sigma_M < \sigma_U$, positive selection likely
  - When $\rho_{U,M}$ big and $\sigma_M > \sigma_U$, negative selection likely

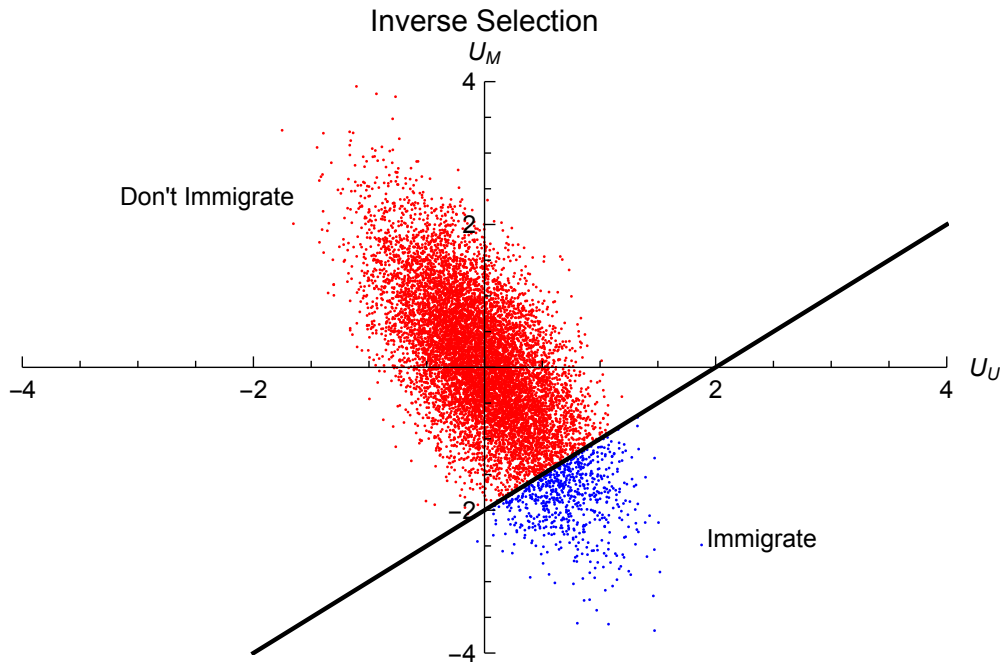
Positive Selection



Negative Selection



Inverse Sorting



Selection-III

- Ways to think about each type of sorting in English
  - Positive selection: highest-skilled doctors (transferable skill, so $\rho_{U,M} > 0$) should go where wages are most unequal (for instance, because of low taxes ($\sigma_U > \sigma_M$)
  - Negative selection: low-skilled workers (transferable skill, so $\rho_{U,M} > 0$) should go where wages are most compressed (for instance, because of high union representation ($\sigma_U < \sigma_M$)
  - Inverse sorting: communist takeover in host country, punitive behavior towards high-skilled ($\rho_{U,M} < 0$) should go to where they are not punished/rewarded for skill.

Note on Selection

- Positive vs. negative selection doesn't depend on correlation between skill draws!
- For instance, both figures we saw had strongly positive correlation
- What matters (conditional on strong positive correlation) is the variance between countries
- This makes sense: with positive correlation between draws, you go to (or stay at) the place where you have highest variance.

Understanding Selection

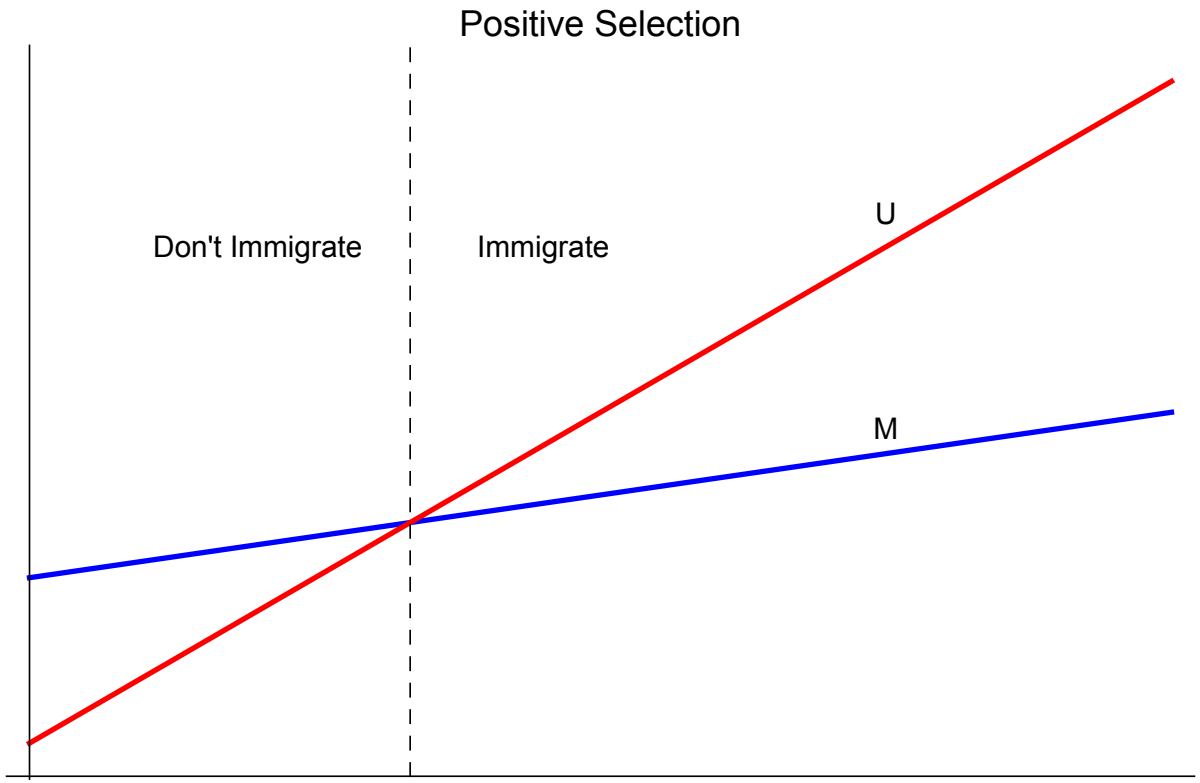
- Now let's take the case where $\rho = 1$, perfect correlation between draws.
- Then the variance in a country is a bit like the wage. Call s the common draw and w the wage:

$$w_M = \alpha_M + r_M s$$

$$w_U = \alpha_U + r_U s$$

- Then, roughly mapping to our previous discussion, α_M maps to μ_M, α_U to μ_U, r_M to σ_M, and r_U to σ_U.
- High-skilled workers move to where reward to skill is largest, low-skilled workers move to where reward to skill is smallest

Positive Selection



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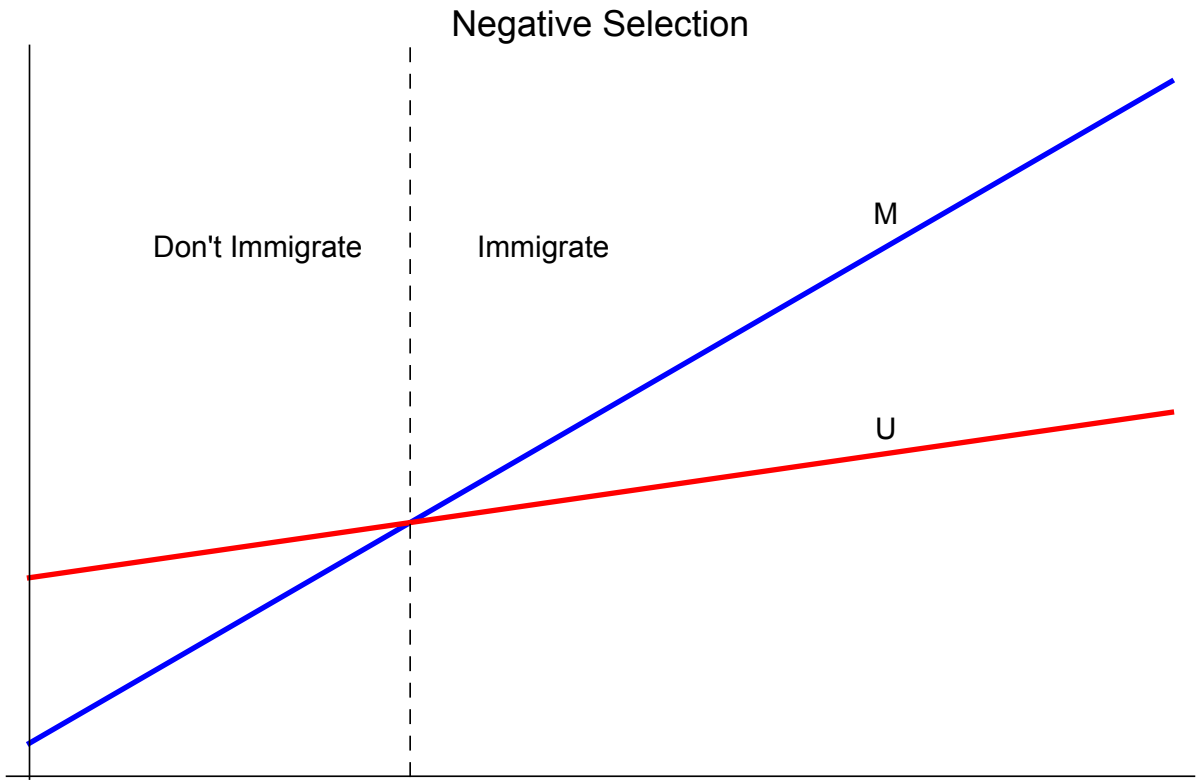


Fun public policy

- Let's say you wanted the high-skilled immigrants from another country, but not their low-skilled immigrants
- One way to do this is to have a highly-regressive tax structure! (Or just less progressive than theirs)
- Highest skilled are taxed differentially more in competing country, assuming their high-skilled have common support with your high-skilled
- Tax-driven migration is real (elasticity estimated to be quite large, above one by more than four high-quality papers)

Tax-Driven Migration

- For star scientists, long-run elasticity of mobility relative to *state* income taxes is 1.8 (Moretti and Wilson 2017)
  - If Indiana lowers its net-of-tax rate by 1% relative to all other states, stock of scientists rises by ≈0.4% per year (continuously)
- Elasticity to net-of-tax rate for domestic superstar inventors is around 0.03, foreign superstar inventors is 1. (Akcigit, Baslandze, Stancheva 2016)
  - If U.S. lowers its net-of-tax rate by 1% relative to all other countries, stock of top inventors increases by 0.1%.
  - If U.S. lowers its net-of-tax rate by 1% relative to all other countries, stock of foreign superstar inventors increases by 2.6%
- In Spain, a 1% increase net-of-tax rate for a region relative to others increases probability of moving there by 1.7 percentage points. (Agrawal and Foremny 2019)
- Denmark flat tax doubled number of highly paid foreigners relative to ineligible foreigners (elasticity of migration greater than one!) (Kleven et al. 2011)

Theory Meets Empirics

- Two clear predictions of the "skill" (strong correlation) model

    1. Conditional on high wages in your original country, you should have high wages in your new country (skill/positive correlation)

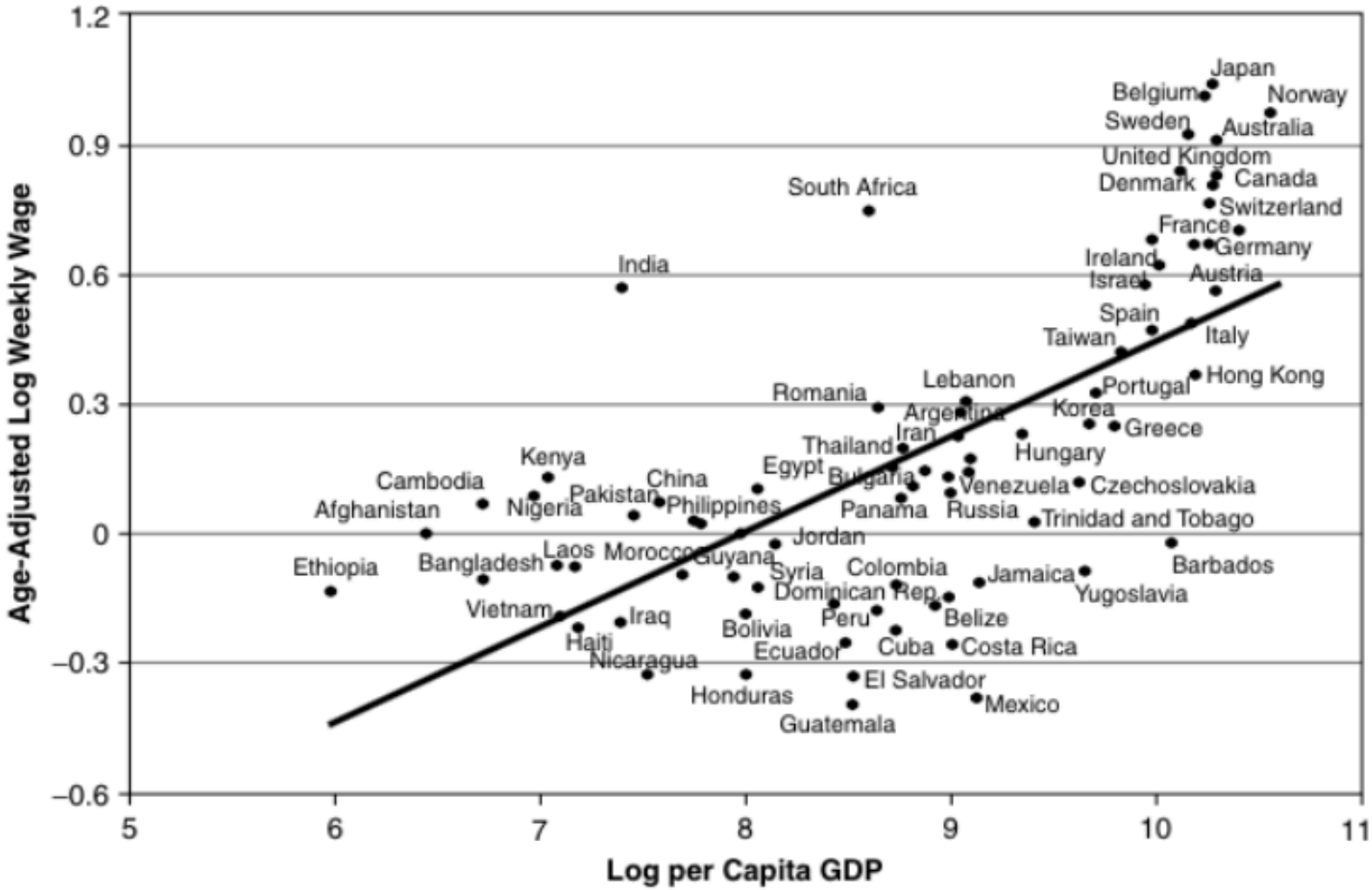
    2. The more unequal your original country, the lower wages in your new country (negative selection). Think of this as taxes: if taxes on rich low (inequality high) then poorer migrate.

- So let's bring it to the data:

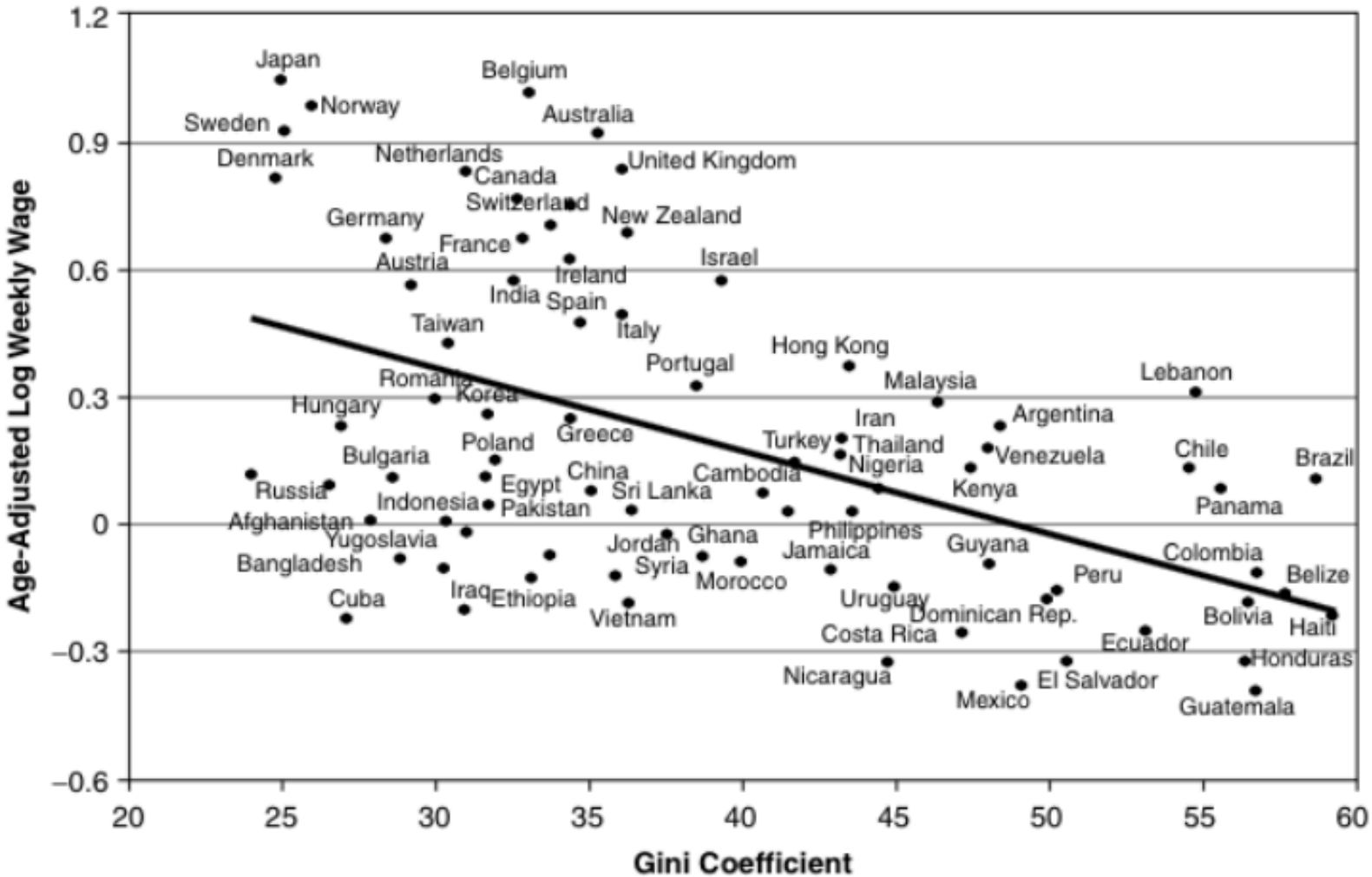
    1. How is original country GDP correlated with new country wages?

    2. How is original country Gini Index (inequality) correlated with new country wages?

Original GDP vs. New Wages



Original Gini vs. New Wages



Theory Meets Empirics: Summary

- Our basic hypotheses are confirmed
- The better you were in your original country the higher your wage is in your new country
- The more unequal your country (the higher reward to skill), the more you get negative selection

One more theory+empirics

- Algeria, Israel, and Japan, along with over one hundred other countries, are sources of migrants to the United States. Try the following thought experiment: Rank those three countries' immigrants, highest to lowest, by educational attainment.

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- When thinking about success of immigrant groups, this is really important!

- Idea: policy filters matter. Big countries with small immigration have higher (on average) education. As immigration grows larger,

Lazear 2018

- Idea: policy filters for immigration matter
  - When you have a small % of pop heading to US, frequently only the best go (positive selection)
  - As you send more, selection by necessity can't be as strong (lower average education)
  - Explains why highly under-represented India has far greater average education while highly over-represented Mexico has far lower
  - Main finding: 73% of variation explained by size of source country, % of immigrants allowed in US, and average education in source country!)
- Conclusion: positive sorting+filters important when thinking about immigrant group success!

Selected Takeaways from Immigration Slides-I

1. Simple models (Solow) suggest that immigrants are short-run loss, long run no change to natives
2. More complex models allow short-run loss and long-run loss (CES production function: immigrants could possibly make some natives less scarce)
3. But more likely that they are short- and long-run benefits (complex CES production function) when immigrants are imperfect substitutes and migrate in scarce labor categories

Selected Takeaways from Immigration Slides-I

1. Can get positive and negative sorting on immigration, depending on costs and correlation *and variance* of skills across countries
2. Puzzling why so few immigrate even when allowed to
3. Broadly: high-skilled people migrate to where work/skill differential/reward is highest, low-skilled to where it's lowest, ceteris paribus
4. Tax-driven migration is very large: see this in papers and raw data
5. Positive sorting + filters important to understanding differential immigrant success in US