Human Capital and Economic Development

The Far Reaching Role of Human Capital in the Economy

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Introduction

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What is Human Capital

- Human Capital" (HC) is an intangible asset, best thought of as a stock of embodied and disembodied knowledge, comprising education, information, physical and mental health, entrepreneurship, and productive and innovative skills, that are formed through investments in schooling, job training, and health, as well as through research and development projects and informal knowledge transfers (Ehrlich and Murphy, 2007)

- It is called "capital" because of its *enduring impact* – like physical capita (PC). Both are also subject to depreciation and obsolescence. And, like PC, HC can also be augmented through investment

- But there are important differences between the two. I will mention 5 major ones:

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Differences between Human Capital (HC) and Physical Capital (PC)

- Human capital (HC) is embodied in people. So unlike physical capital (PC), it is controlled by people w/ heterogeneous abilities & preferences. They choose where to employ it - in different occupations; different states, or countries (i.e., whether to migrate).
- Being embodied in *people*, human capital formation cannot be separated from population formation, by which I mean decisions about marriage, fertility, health and longevity.
- Unlike PC, HC cannot serve as a collateral, which affects financing opp. espec. for higher education.
- Unlike PC, HC has both embodied and disembodied dimensions. It can be transferred to others via schooling and training, but also via books, articles, computational algorithms, and *informal* means of communication, or spillover effects. HC can thus be productive in creating new HC: knowledge and health capital, as well as social capital.
- This is why I believe that John Maurice Clark (1923) was correct claiming that "HC is the only instrument of production that is not subject to diminishing returns". This feature leads to its crucial role in economic development and endogenous economic growth.

- These distinct features of HC also explain its wide applicability to practically all areas of economics, as indicated by the red-colored items. I have had the privilege of exploring many of them, and this is what I'll attempt to address in this lecture.

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Human Capital as Engine of Growth*

** Lucas (1988), BMT, (1990), Romer (1990), Ehrlich and Lui, 1991, Ehrlich, (2007 –NBER), Ehrlich Cook and Yin. (2018-The Morrill Act)*

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From Economic Development to Economic Growth

- The story of Growth, defined in terms of growth in per-capita income exists about 150-200 years following the first industrial revolution, after being more or less stagnant during the Middle Ages. The transition from stagnation to growth is one way to think about the problem: what can trigger such shift? And what is the underlying engine of growth that could guarantee a perpetual growth not just in an economy's total output, but in output or income per-capita as well?

- The Neo-classical growth model solved the Malthusian population explosion threat by showing how it could be balanced by a commensurate growth in physical capital that can produce a constant level of p/c income. But the model cannot assure growth in p/c income under an exogenously given technology.

- The answer has been given by the endogenous growth literature, where human capital is the "engine of growth" that assures continuous technological advancement and productivity growth. There are alternative stories to explain endogenous technological advancement, but an important reason to consider the human capital story is that it can also explain the "demographic transition" − increased longevity and declining fertility, which seems to be an inseparable part of the endogenous growth story.

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The Human Capital Formation Process

- **Here is the story**. In discreet time the human capital production process can be described as follows:

Human Capital of Children, H_{t+1}	=	Transmission Technology, **A**	×	Human Capital of Parents, H_t	×	Share of Resources Parents Are Willing to Invest in Children Education, h_t

$$(1)\quad H_{t+1} = AH_t h_t$$

Equation (1) formalizes the assumption that HC is not subject to diminishing returns since under any given transmission technology and investment level there is a linear relation between parents' accumulated knowledge and what is transmitted to children due to **parental spillover effects!** If human capital is the only instrument of production in the economy, the growth rate of children's potential income becomes as follows: →

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The Human Capital Formation Process – cont'd

The growth rate of income per-capita, **g**	=	The economy's transmission technology, **A**	×	Share of resources parents' generation is willing to invest in children's generation, **h**

$$(2)\quad (H_{t+1} / H_t) \equiv (1+g_t) = Ah^*$$

Therefore, the growth rate g can be positive if, and only if, the product of A & h* is greater than 1. If it is less than 1, the economy will be in stagnation., i.e. a low level of development.

Implication: for an economy to move from a state of "development" to a state of "endogenous growth", by which is meant, self-sustaining and persisting growth, it is necessary for the economy to invest a *sufficiently high* proportion of its production capacity in *human capital formation*.

The critical investment rate must exceed 1/A. Note that this requires a *larger share* in the *least developed countries,* where A is rel' low, than in economies in more advanced stage of development!

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Endogenous Growth and the Demographic Transition

- By this approach, whether the economy is in a stagnant or growth regime depends on the principal objectives motivating parents (or their representative government) to invest in their kids, as well as on external shocks that can bring about a significant change in these incentives.

- My study with F. Lui (JPE 1991), e.g., recognized two major motivating forces benefitting parents:
  - Old age support, also summarized as family insurance or intergenerational trade
  - Altruism: parents enjoy vicariously both the **number** of children they have as well as the **quality** of the children – the human capital or potential income - they generate in their offspring.
  - These motives increase the demand for both the number and quality of children. Whether parents can receive the expected benefits from either motive depends on the children's probability of survival, or life expectancy.

- Another important feature of the human-capital-based endogenous growth paradigm is that it can explain the "demographic transition", which invariably accompanies a transition from "development" to self-sustaining "growth".

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Endogenous Growth and the Demographic Transition

- By integrating all of these elements of an endogenous growth model and solving the dynamic maximization problem, the study shows that an upward shock in the life expectancy of children as a result of technological breakthroughs in health science, like sanitation or pasteurization of milk, can trigger a **takeoff** from a stagnant to a growth equilibrium because a higher life expectancy raises the return on investment in HC. Initially both investment in children's human capital and fertility go up because of the wealth effect generated by the shock. But as incomes go up, the opp. costs of having a larger number of children rise sharply relative to that of having less children, but more educated ones – this is where substitution between "quantity" & quality" of children may kick in dramatically to the point where a "corner solution" may arise even below reproduction. Today we have 80 countries out of 200 of the world's oldest countries where TFR is below 2 – many are in Asia (S. Korea, Singapore, Hong Kong) → see charts.
- .

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Take-off from Stagnation to Growth and the Demographic Transition

- The figures below show the simulated paths of human capital and fertility in response to an upward shock in the life expectancy of children (reproduced from Ehrlich & Lui JPE 1991). The shock lifts Human Capital formation from a stagnant to an endogenous growth regime, while first increasing fertility then lowering it sharply as actually seen in empirical data from different countries in the following slides →

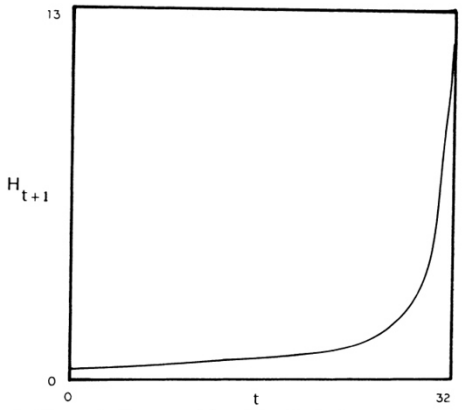

FIG. 3.—Time path of human capital stock in a simulated example of the demographic transition.

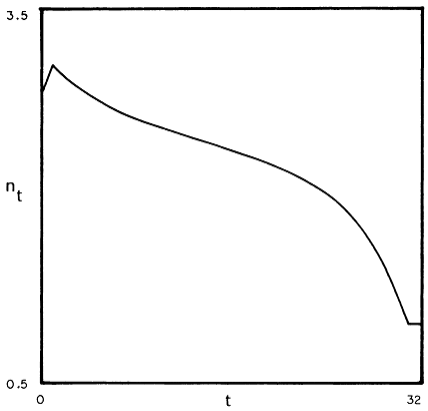

FIG. 4.—Time path of the fertility rate in a simulated example of the demographic transition.

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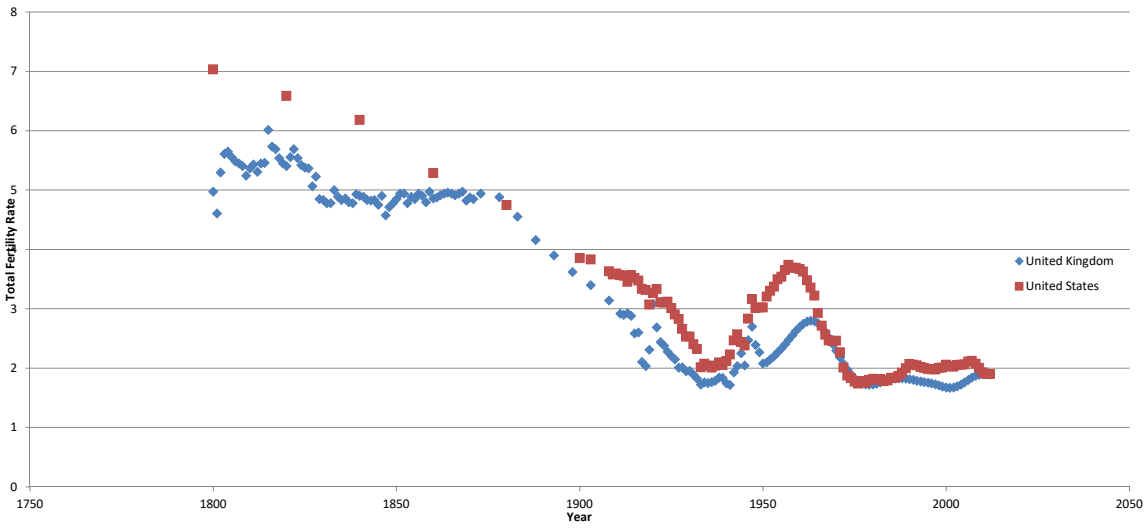
TFR over time (UK and US)



Source: Princeton European Fertility Project, http://www.gapminder.com

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TFR for Developing Countries in East Asia & Pacific - 1960-1917

Source: https://fred.stlouisfed.org/series/SPDYNTFRTINEAP updated May 3 2019. Ave. TFR=1.8489 in 2017

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From mild to higher growth – the US ascendency as economic superpower

- Another example of a shock that started a takeoff from growth to a higher sustainable growth is the **Morrill Act of 1862** in the US that established, for the first time, *public higher education* – **the Land Grant university system,** which including all the famous public universities in the US (Berkeley, UCLA, Penn & Michigan State). In a 2018 JHC paper referenced in the cover page to this section, my co-athors and I showed that this act catapulted the US to overtake the UK as the economic superpower in the 20th century. The UK lagged 50 years behind the US in launching a system of public universities.

- I could talk more about the Morrill Act later, but right now I need to shift to my second topic.

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Immigration, Human Capital and Physical Capital*

Work in progress by Isaac Ehrlich and Yun Pei

* This study builds on and greatly extends an earlier study by Ehrlich and Kim (JHC 2007, 2015)

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Is human capital relevant for immigration?

- The relevance harkens back to my point that HC cannot be separated from people. People invest in HC in order to guarantee a larger earning capacity *for both themselves & offspring*. They also have the choice to do that in the place where they were born, or seek a higher return on investment for themselves and offspring by moving to other places, where they have more opportunities to better their lives.

- So migration, whether *within or across countries*, is itself a kind of investment in human capital that has potential returns but also significant costs, financial & emotional, to individuals who choose to migrate.

- There is one implication that immediately arises from this feature of immigration: Those who choose to migrate are expected to benefit from migrating – their own rate of return is expected to be positive. But this may not always be the case for the **natives** of affected destination (D) or source (S) countries. So understanding the "equilibrium" properties of immigration is an economic challenge which also has important policy implications. This is the topic of my current study with my colleague Yun Pei.

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International migration- common features

1. International immigration has been a persisting phenomenon historically

2. **Net** migration is typically from source **(S)** countries w/ high fertility and low HC formation to destination **(D)** countries with low fertility and persistent and high HC formation.

3. While immigration has been growing in recent decades, trends may shift. Immigration may also come in waves – there were 30 million asylum seekers in 2016!

The following facts illustrate these features:

- World wide migration grew about 50% from 173 million in 2000 to 258 million in 2017.
- Largest destination countries are: US (50 M), Saudi Arabia, Germany, & Russia (12) UK & N. Ireland (9)
- Asia is the largest region where immigrants live (80M), followed by Europe (78), N. America (58).
- But Asia as a region is still a net emigration region. (source of 106 M; destination of 80 M immigrants)
- Many Asian countries send more migrants than they receive, except for Russia. See graph →
- Trends may fluctuate. In the US, the population share of immigrants reached a high in the 19th cent. through 1910, then fell steadily until 1970, but has been growing steadily since then (this is the case for **all** major D countries). See graph of US migration flows See chart →

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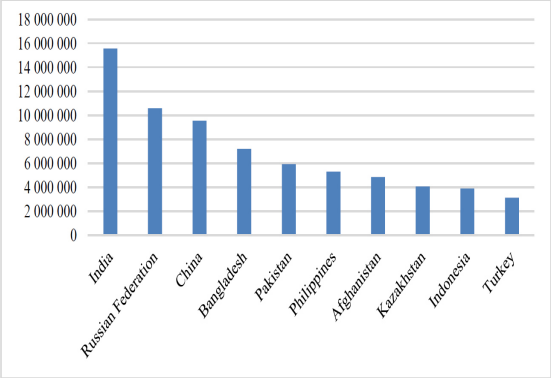
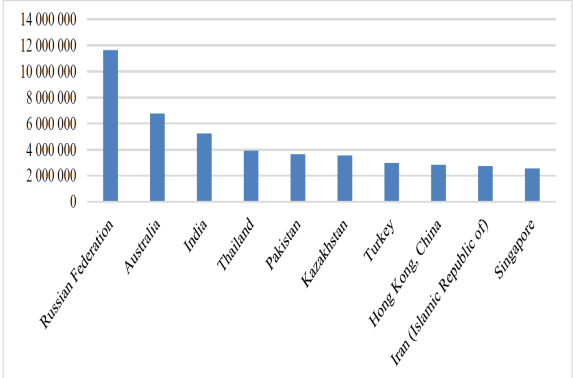
Net Emigrant Stocks in Many Asian Countries are all positive, except for the Russian Federation

Top 10 Countries of Origin in Asia and the Pacific, 2015 (Number of Migrants)



Top 10 Countries of Destination in Asia and the Pacific, 2015 (Number of Migrants)



Source: United Nations, "Trends in International Migrant Stock"

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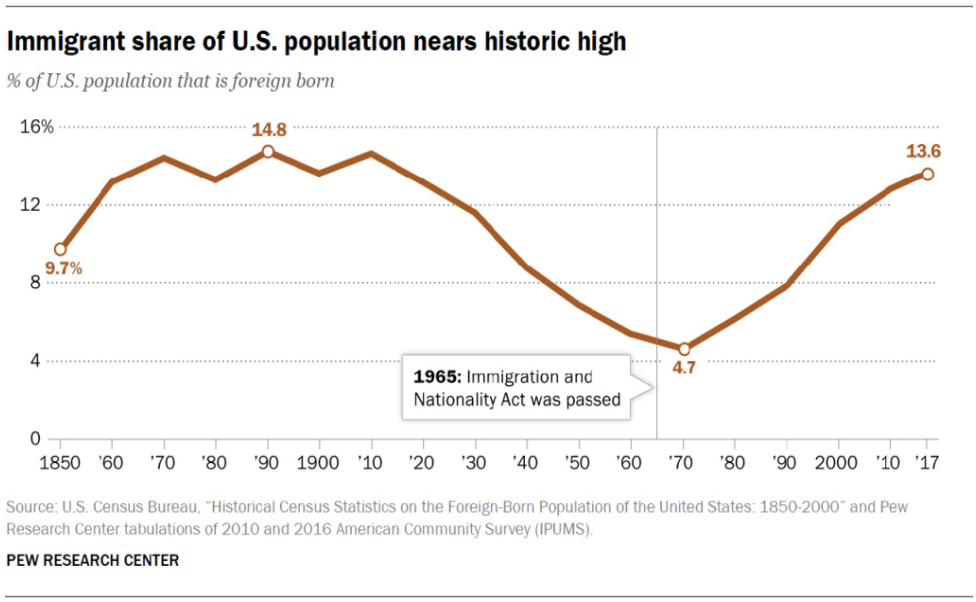

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The Approach we take to explain and assess these features

- There is a vast literature on immigration, most of which treats it as an *exogenous* variable, focusing on its short-term effects. This includes even the bulk of the recent study by an NAS panel on the economic and fiscal consequences of immigration, in which I have also participated.
- The basic innovation of the study is treating migration as an *endogenous variable – coming from individual and family choices* that are subject to external triggers. We study the economic effects of such triggers not just in the *short term*, but especially in the *long-term.*
- We model immigration in an open-economy setting that explores its consequences on income growth, income distribution within and across countries, and on the net benefit to the **native population** in both countries – a term known as *"the immigration surplus"* (**IS***)* – for both source (**S**) & destination (**D**) countries, & thus for the global economy.
- The following supply & demand analysis illustrates how to figure out the IS for the destination and source countries:

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Why the IS can be positive in country D in the short term

- In the short term D's economy has a fixed quantity of technology and physical capital, so its labor demand curve is downward sloping. Any rise in labor supply due to migration lowers wages. Natives' labor income falls.
- But total output rises: more labor yields more output. So where does the surplus income from more output go while wages are down?
- It goes partly to the new migrants who earn wages in D. The rest of the income gain goes to the natives who are the owners of physical capital. This gain to natives **exceeds** the loss to the natives' labor income b/c of the larger output.
- The net effect is what the literature calls the "immigration surplus" = **IS.** This is the area **E** in the following chart.

By the reverse logic, however, the IS must be negative in the short term.

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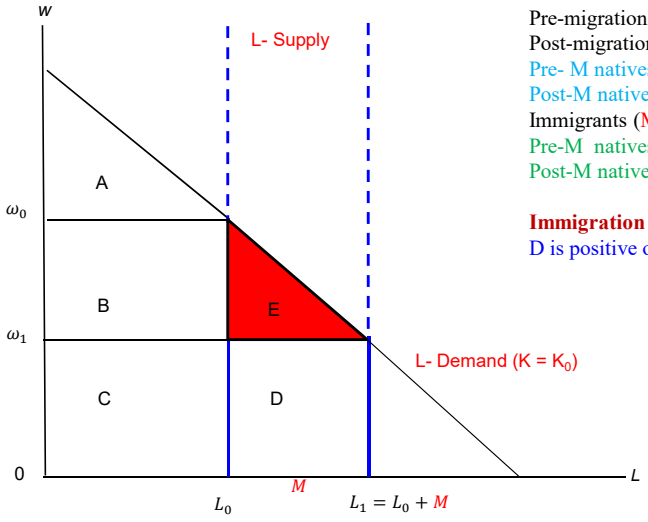
The Short-Term Immigration Surplus (IS) to Natives



Pre-migration GDP :	A+B+C
Post-migration GDP :	A+B+C+D+E
Pre- M natives' labor income :	B+C
Post-M natives' labor income :	C+E
Immigrants (M) labor income :	D
Pre-M natives' return on capital:	A
Post-M natives' return on capital:	A+B+E
Immigration Surplus	**E**

D is positive only if labor wages fall

The 2017 NAS Report on the economic and fiscal consequences of immigration has estimated the IS at 0.3 % of GDP, which amounts to $54.2 Billion today

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Limitations of static, short-term IS measure

- But the short term IS has some properties that need to be highlighted. First, it considers only the net income benefits to the natives, not to the immigrants. This is the way it is assessed in both D and S.
- Second, as the picture shows, IS in D can be positive **only if wages fall**. Immigration yields a net gain just to capital owners but a loss to workers who don't own capital. IS ignores distributional effects.
- Third, a major limitation of IS highlighted by our analysis is that it treats immigration as an exogenous variable under static conditions and ignores **what has triggered it,** as well as its **dynamic, long-term** consequences. We show that the long-term economic consequences of immigration can be different from its short-term effects because of its implications for **human capital formation** in both **D and S**!
- We also compute the IS after extending the analysis to account for interaction effects between natives and immigrants as a result of complementarities in knowledge formation ("diversity effects"), which enhance human capital formation.

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Elements of the Benchmark Model

- Our story involves two countries - destination (*D*) & source (*S*) - which are in a growth regime. (True even for Guatemala, Honduras & El Slavador). D is more developed than S (in the sense that the productivity of human capital investment and the fertility cost are both higher in D than in S). As a result, D has a higher investment in, thus a higher level of, human capital, but a lower fertility rate than S
- *As a point of reference* we allow for free int'l mobility of labor. We also restrict the model to allow for a balanced growth equilibrium, where both D & S always co-exist (so S doesn't run out of people..).
- We allow for **2** periods of life – childhood and parenthood; **2** skill groups - **high** and **low**, to recognize that workers are heterogeneous, and **2** segmented production sectors: high tech and low tech, which employ high skill and low skill workers, resp. In country D, these include **immigrants** as well. Immigrants' **children**, however, are treated as **natives**! (The global econ. has **6 distinct groups of people**)
- Parents are altruistic. They want better life for their children. So they make consumption, bequest, fertility, and HC investment decisions, as well as migration decisions.. Children thus benefit from both parental human capital investment & any bequests they receive in adulthood.
- **Optimal immigration** is determined at the point where the net utility benefits to those who choose to migrate from S to D are equal on the margin to those who choose to stay in S - an **arbitrage condition**.

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Human capital and equilibrium migration

- To allow for a balanced growth equilibrium we expand the human capital formation process to allow for transferability, or **spillover effects**, of human capital not just between parents and children, but also between skill groups within each country (including the immigrant groups in D), as well as across countries**.** Int'l spillover effects include ***remittances.*** But we stress ***knowledge transfers,*** which can be **one-sided** (in our **benchmark** model**) or two-sided** (in our **extended** model).

- **The one-sided** spillover effects are ***hierarchical***: they flow from the high-skill sector to the low-skill sector w/i countries, & from each sector in D to the corresponding one in S due to the superior technologies of producing both human capital & industrial products in D relative to S. *The* **magnitudes** of these spillover effects are proportional to the weighted ave. of HC in D relative to S, where the weights are the size of the relative populations of the relevant skill. In particular, the larger the size of each skill group –including immigrants –in D, the bigger the spillover effects on the corr. groups in S.

- **The one-sided** spillovers are also ***gravitational***: they pull all skill groups w/i & across countries together into equilibrium growth paths that grow at the same rate over time. This assures the existence of **balanced growth global equilibrium** that avoids "corner solutions" (disappearance of S).

See the "box diagram" →

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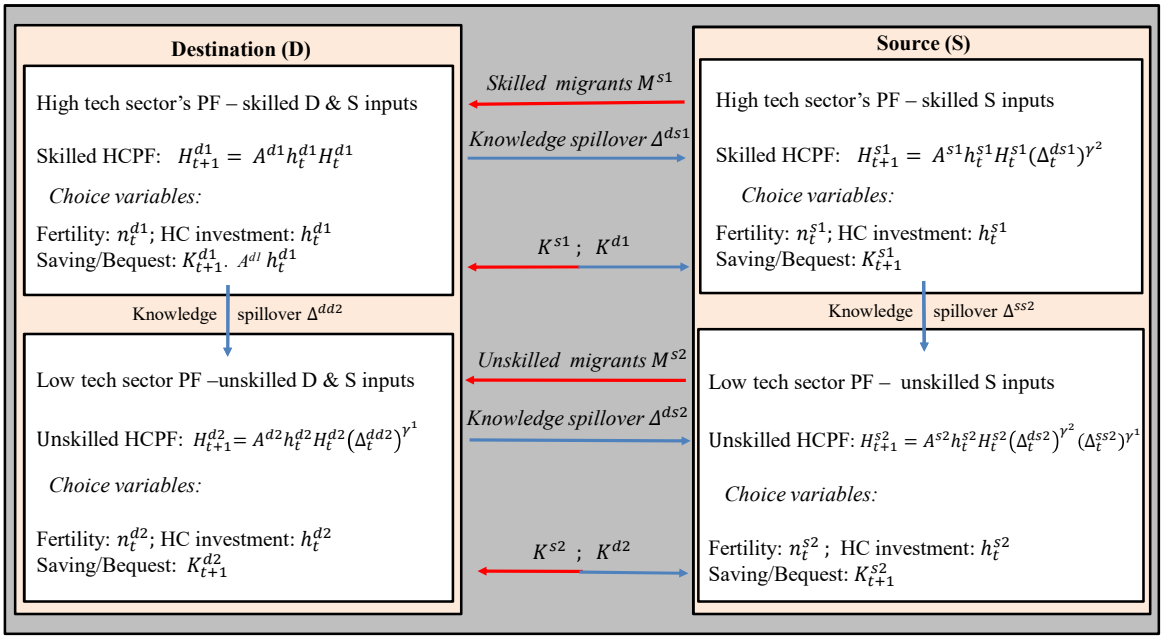
Equilib. migration w/ hierarchical & gravitational spillover effects: a global view



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Interactional spillover effects from diversity – an extended Model

- But spillover effects can also be **two-sided**, or **interactional,** as well as **hierarchical.** The interaction of knowledge between immigrants and natives can produce more human capital because of ***knowledge complementarities*** that come from the **diversity** of the interacting groups.

- While diverse workers may raise communication costs due to differences in language and culture, the interaction between natives and immigrants of the same skill level raises the productivity of knowledge generation especially across workers of the same skill level who acquired their knowledge and skill in independent environments (the classical example being the Manhattan project). We consider these diversity effects in our extended model,* when estimating the IS in that model.

*Some evidence on productivity effects of diversity is provided in Alesina et. al. (2016).

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Immigration triggers: Pull and Push forces

➢ The "box diagram" shows how we can generate a global equilibrium with steady migration flows from S to D. But **changes** in their volume, trend, and composition cannot be understood, without reference to the external forces that produced them. We call these "external shocks" or "triggers". We consider three types of triggers in our study:

➢Pull Factors emanating from destination countries. For example:

- ❑ Skill-biased technological shocks (SBTS) - the digital/internet revolution
- ❑ Demographic shocks - sharp fertility declines in Europe

➢Push Factors emanating from source countries. For example:

- ❑Adverse productivity shocks due to war, famine or political instability

➢Combined Factors

- ❑ Immigration policies

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The total vs. induced (marginal) effects of each trigger

- This is a major insight offered by the study: since immigration is an endogenous choice variable, we need to distinguish the total effect of an immigration trigger from the pure effect of the immigration flows that it induces. It is only the latter effect that determines the immigration surplus!

- To estimate these effects, we first simulate a balanced growth equilibrium solution for the global economy (cf. our "box diagram") under free migration. Second, we apply the shocks produced by each of the 3 triggers w/o any restriction on the migration changes they induce. We then re-estimate the effect of the shock after restricting the skill composition, and shares of migrants in the population to remain the same as they were before the shock.

- The % difference between the unrestricted and the restricted migration gives us the induced (marginal)* **immigration surplus in our dynamic context**. It is quite different from the way we illustrated it in the static model where immigration was treated as an exogenous once-and-for-all event. Here is what we find using **first** our Benchmark model :

* The induced effect is marginal because we start from an equilibrium that included a constant rate of migration

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Simulated total vs. induced IS effects of 3 triggers - pull effects

- **A skilled biased tech shock (SBTS):**

- Raises the growth rates of human (and physical) capital, thus per-capita income in both D and S. We ***predict*** that the shock will raise the **volume and skill distribution** of migration flows to D. This is indeed what we find empirically in all major destination countries. See graph →

- The induced immigration effects, however, are **asymmetric for D and S**. Because the skilled workers' population share in D rises, the human capital and wage levels **rise*** for the ave. native in D. Note that: this result contradicts the conventional IS analysis which claims IS >0 in D only if wages fall. But wages in S fall due to the "brain drain" under SBTS. In the long term (LT), unrestricted immigration yields a larger IS in **D** (1.14% after 10 periods, which amounts to $272 billions based on the US's 2017 GDP), but a bigger % loss in **S** (-16.84% after 10 periods, or -$194 billions using Mexico's 2017 GDP).

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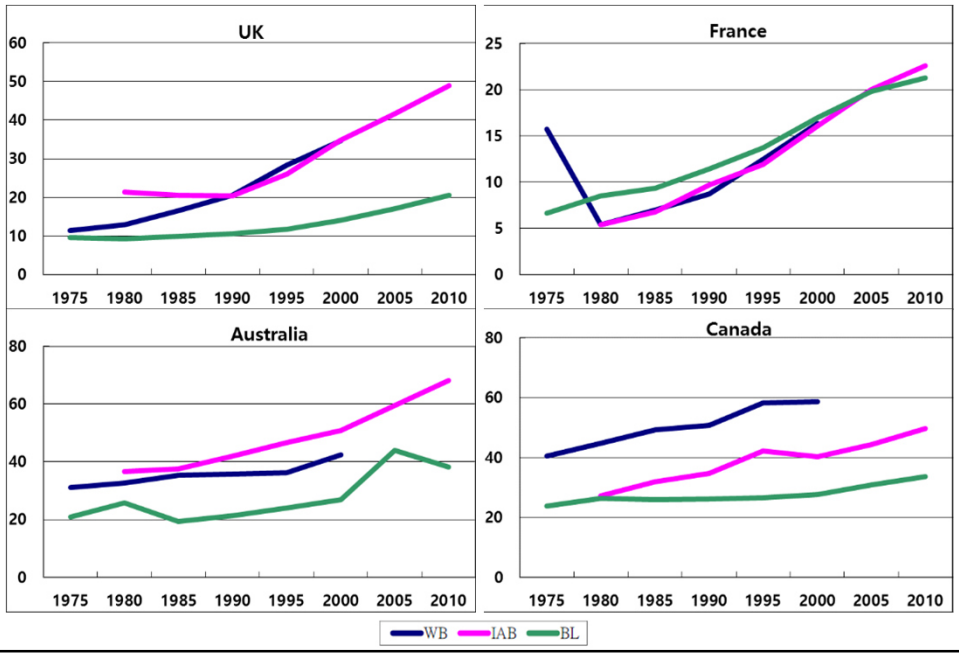
Weighted averages of the skill composition of the migrant population (WB=World Bank; IAB=Institute for Labor Research) vs. total domestic population (BL=Barro Lee) in major destination countries
Population age 25+ with 13+ years of education



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Simulated total vs. induced IS effects of 3 triggers - pull effects

- **A downward fertility shock in D:**

- Causes a fall in fertility and a bias in favor of more investment in the HC of each child. This increases the growth rates of HC and PC and thus in the ave. wage and income in D. Since human capital rises faster in D, S will also benefit due to larger knowledge spillover effects.

- The induced immigration are again **asymmetrical** for D and S. Immigration to D lowers the ave. human capital level in D. Thus, unrestricted immigration yields a **lower IS** in D (-0.95% after 10 periods, which amounts to -$184 billions based on 2017 U.S. GDP). But the higher population in D raises the intensity of the spillover effects favoring workers in S, and thus a **higher IS** in country S (68.44% after 10 periods, or equivalent to $787 billions using 2017 Mexico GDP).

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Simulated total vs. induced IS effects of 3 triggers - push effects

- **An adverse productivity shock in S** that affects both high-tech & low-tech sectors:

- Has ***asymmetric consequences for D and S***. In S it initially lowers significantly wages and income. It pushes workers to migrate to D w/o affecting the skill composition of migration flows. Ave. HC in D, however, and thus the ave. wage level and income in D **decline** as a result of such migration. **IS in D declines**. Over time, the spillover effects of the larger migrant pop. in D **raise the IS in S**.

- The induced immigration effects are again ***asymmetrical for D and S***. Unrestricted migration yields a **fall of IS in D** (-0.24% after 10 periods, which is equivalent to -$47 billions using 2017 U.S. GDP), but **a sizeable rise of IS in S** (41.87% after 10 periods, which is equivalent to $482 billions using Mexico's 2017 GDP).

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Simulated diversity effects of 3 triggers in our extended model

- **Allowing for interaction effects** which generate complementarities in knowledge production between migrants and natives **alters** the predicted total and induced immigration effects of the 3 triggers:
  - In all 3 cases, there is a **rise** in the rate of growth of human and physical capital, and thus **income in D**.
  - The faster growth rate in D, in turn, **increases** the rate of growth of human and physical capital, thus income **in S** due to the knowledge spillover from D to S.
  - The interaction effects thus lead to faster growth rates in both D and S, independently of the migration trigger.

- **Under SBTS**, ***asymmetry remains*** between D and S: While the IS gain becomes larger (1.84% after 10 periods, relative to 1.14% in the benchmark model) in D, there is still an IS loss in S, but smaller - 14.56% after 10 periods, relative to -16.84% in the benchmark model.
- **Under a downward fertility shock in D**, **IS** now turns to be **positive in D** from being negative in the benchmark model, while continuing to be **positive in S**. This is a **win-win** situation when we allow for interaction effects.
- **Under an adverse productivity shock in S**, IS turns to be positive in D for about 3 periods, but then slides down in a negative direction. The initial gain is due to the interaction effects, but the later loss is due to the lower ave. HC of migrants outweighing the diversity benefits. IS continues to be positive in S.

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Policy Implications -1

- Our findings indicate that the total effects of triggers generating pull effects (SBTS; Fertility shocks) are positive for both D and S. However, their induced immigration effects are *asymmetrical*: in the long-term, SBTS raises IS in D and lowers it in S, while a fertility shock lowers the IS in D and raises it in S. Triggers generating push effects exert similar *asymmetric* outcomes in D and S: both the total and induced effects of these triggers lower the IS in D and ultimately raise it in S.
- **We do get some win-win outcomes** for both D and S induced by diversity effects and spillover effects. For example, a fertility shock induces positive changes in IS in both D and S, if they generate positive diversity effects. We also find that allowing unrestricted migration of skilled workers is still superior to a policy of disallowing it altogether, despite the concern for a "brain drain", because of the spillover effects generated by skilled migrants for their counterparts in S. Unrestricted immigration of unskilled workers, however, lowers the IS in D and ultimately raises the IS in S.

- Thus, free migration inevitably imposes **externalities** on the natives in either D or S, depending on the immigration trigger, even in the extended model. This means that although there exists a balanced growth equilibrium, it may be **unstable politically**. Note that these externalities stem from the economic consequences of migration. We don't discuss here the fiscal burdens of immigration in D, which **intensifies** the negative externalities on the native population in D.

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Policy Implications- cont'd

- One way to internalize these diseconomies is through regulatory intervention, like restrictive migration policies, or bargaining solutions; e.g., US aid to Central America when the trigger is an adverse prod' shock in S.

- A superior solution, however, would be more investments in human capital in the sending country (S) – especially in higher education, which puts a check on the incentive to emigrate while at the same time allowing higher education to generate higher growth in the sending country But this solution works if the economy allows free markets to provide an adequate rate of return to investment in higher education. The Morrill Act worked in the US because of the strength of its private sector in the 19th century.

- There is, of course, an altruistic solution as well: a special allowance, e.g., for asylum seekers and refugees

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Concluding Remarks and Takeaways

- The study's basic implication is that the long-term net economic consequences of dynamic changes in migration flows cannot be assessed w/o reference to the forces that trigger them. Our simulated dynamic estimates of the IS also differ from the conventional short-term IS by showing that:
  - **a**. The IS varies by its **trigger;**
  - **b.** Its **long-term** dynamic effects may differ from its **short-term** static values;
  - **c.** It accounts for possible **diversity effects** of immigration which affect human capital formation.
- Our simulations reveal that the induced immigration effects and the IS can be asymmetric in response to both pull & push factors due to opposite externalities generated by migration. We find, however, that in most cases, immigration lowers income inequality across D and S b/c of the spillover effects running from skilled groups in D to their counterparts in S.

Our final takeaway is that:

- Human capital plays an essential role in determining the LT, dynamic IS. This is b/c IS can be positive in the long-term only if migration raises the average HC in the economy. Thus, an optimal way to internalize the externalities of migration is to facilitate an optimal HC formation in both D and S!

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Thank You!

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