The Role of Human Capital in Shaping Immigrant Earnings

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Introduction

- Joint work with Yongs Shin.
- Immigrants do not "look" like natives or non-migrants in terms of income.
- Controlling for observables (mostly education and age):
  - Migrants earn initially less than natives (estimates range from 40% to 90%))
  - Migrants have steeper age earnings profiles than natives (except for more recent cohorts in the U.S.)
  - The gap in initial earnings is negatively related to the level of GDP per capita in the country of origin (of the migrant).
  - Pre-migration experience has a negative (small?) effect on post-migration earnings.
  - immigrants earn more than stayers and their income also grows faster.

Introduction

- Objective (immediate): Develop a framework that provides insight about the mechanism underlying the differences in age-earnings profiles.
- Objective (long term): Use the model to evaluate alternative immigration policies.
- This project (we are not there yet): develop a model of the joint decision to migrate and to invest in human capital.
  - Role of incentives.
  - Human capital accumulation.
- This talk: Discussion of preliminary theoretical results and some quantitative results.

This Research (so far)

- Simple model of human capital accumulation so that we can:
  - Analyze the effects of migration upon earnings of migrants.
  - Offer some insights on the nature of migration costs that result in positive or negative selection.
  - Model explicitly how "age" influences migration decisions and migration-related investments in human capital.
  - Study patterns of income differentials for temporary migrants.
  - Analyze how the "option to migrate" might affect human capital investments in the sending location. [Not this talk]

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  - “In certain cases a less accurate scientific theory can still be treated as a theory if it is useful (due to its sheer simplicity) as an approximation under specific conditions.”
- This talk is (at best) a "Wikipedia type of talk."

Model

- Basic model:
  - Individuals maximize the present discounted value of income.
  - They have finite lifetimes.
  - They (or their parents) can invest in "human capital" during three distinct phases:
    - Early childhood.
    - Schooling.
    - On-the-job training (includes all activities that account for the pattern of lifetime earnings).
- Investment in human capital is rival. This excludes learning-by-doing (essentially non-rival as it implies joint production)

Model

- Income maximization (at age six)

$$\underbrace{-p_E x_E}_{\text{Early Childhood}} - \underbrace{\int_6^{6+s} e^{-r(a-6)} p_s x_s(a)\,da}_{\text{Private Exp Schooling}} +$$

$$\int_{6+s}^{R} e^{-r(a-6)} \underbrace{[wh(a)(1-n(a)) - p_w x_w(a)]}_{\text{Net Income}} da.$$

- Constraints:
  - Schooling and on the job training technology (Ben-Porath)

$$\dot{h}(a) = z_h [n(a)h(a)]^{\gamma_1} x(a)^{\gamma_2} - \delta_h h(a), \qquad a \in [6, R),$$

  - Early childhood technology:

$$h(6) = h_E = h_B x_E^{v}$$

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- Endogenous: (s, x_E, x_s, x_w, n)
- Identification: Schooling $=$ measure of time such that $n(a) = 1$.
- Alternative: Choice is $n(a) \in \{1\} \cup [0, \bar{n}]$ and $1 - \bar{n}$ is the minimum number of hours of actual work.
- R is the retirement age (exogenous for now).

Unexpected Migration: Migrants and Stayers:

- Compare two individuals that grow up in the home country (w) and have identical levels of human capital.
- At age a_m, unexpectedly one migrates to the (w^*, p_w^*) country while the other stays in (w, p_w).
- Assume that the retirement age is the same.

Migrants and Stayers: Human Capital Differences

- At age a the **difference** in their human capital is:
  - Increasing in a for $a = a_m$ and decreasing for $a = R$. It is maximal at $\hat{a} < R$ (independent of (w^*, p_w^*))
  - Concave in a whenever it is increasing (and at $\hat{a}$) and possibly convex for $a = R$.
  - Decreasing in a_m.
  - Increasing in ability, z_h, and in the difference between $\left(w^*/p_w^*\right)^{\frac{\gamma_2}{1-\gamma}} w^*$ and $\left(w/p_w\right)^{\frac{\gamma_2}{1-\gamma}} w$.
- Depending both on the level of the wage rate and the cost of training, the differences need not be proportional to the TFP of the origin and destination countries.

Migrants and Stayers: Income Differences

- How do these differences in post-schooling training impact income?
- Can we infer TFP differences measuring income of "similar "migrants and stayers?
  - The "scale" (initial) estimate of income differences overpredicts earnings of the migrant at the time of migration.
  - Over time, the gap between earnings of the migrant and the stayer increase and, at least close to retirement, the differences exceed the differences in wage rates. Thus, the shape of the age earnings profile of migrants and stayers is different, with migrants exhibiting a steeper age-earnings profile. Measurement of differences among older migrants would tend to overestimate actual productivity differentials.
  - Differences in age-earnings profiles are not independent of the age at migration, a_m. In particular, the older the migrant, the flatter his post-migration age-earnings profile.

Migrants and Natives: Same Schooling

- Compare an individual born and raised in w^* (native) with another raised in w (immigrant) that **attain the same level of schooling**.
- We look at migrants who completed their schooling in the sending country and **unexpectedly** migrate at age a_m.
- Assume that $(1-\gamma_1)v < \gamma_2$. [Early childhood human capital technology not too goods intensive.]
- **Result**: At the time of migration,
  - the level of human capital of the native exceeds that of the migrant $[h_n(a_m) > h_m(a_m)]$,
  - and the migrant has higher innate ability $[z_{h,m} > z_{h,n}]$.
- Let the (adjusted) difference in earnings at age a be

$$\Delta_y^n(a, a_m; w^*, p_w^*) = y_m(a; a_m, w^*, p_w^*) - y_n(a, 0; w^*, p_w^*),$$

Migrants and Natives: Same Schooling

- At the time of migration, immigrants earn less than natives, i.e. $\Delta_y^n < 0$ (driven by lower human capital)
- Income gap narrows over time (driven by higher innate ability of the immigrant)

$$\frac{\partial \Delta_y^n}{\partial a} > 0.$$

- Income gap is inversely related to the wage rate (level of development) of the country of origin.

$$\frac{\partial \Delta_y^n}{\partial w} < 0.$$

Migrants and Natives: Same Schooling

- The return to experience in the migrants' home country is negative

$$\frac{\partial y_m}{\partial a_m}(a; a_m, w^*, p_w^*) < 0,$$

and this gap is increasing in innate ability and the difference in wage rates between the sending and receiving locations.

- Return to schooling:

$$\frac{\partial y_m}{\partial s}(a; a_m, w^*, p_w^*) \text{ is increasing in } w,$$

  - Since schooling is endogenous the model "induces" an individual to acquire more schooling only if he has higher innate ability (i.e. higher z_h)

The Migration Decision: Post Schooling

- Two components of the cost of migrating:
  - A fixed (independent of human capital) cost, C
  - An iceberg cost in the form of a fraction of human capital lost, η. [Occupation/country specific?]
- $V(h, a; z_h, w^*)$ gives the present discounted value of income of an a year old individual who has human capital h, lives in a country where the wage is w^*, and has skill level z_h.
- Random utility shocks —independent across individuals— drawn from an extreme value distribution. The difference, ε, has a logistic distribution. The individual will choose to migrate if

$$V((1-\eta)h, a; z_h, w^*) - C + \varepsilon \geq V(h, a; z_h, w).$$

- Fraction who migrate

$$P[\varepsilon \geq -(\underbrace{V((1-\eta)h, a; z_h, w^*) - C - V(h, a; z_h, w)}_{\Lambda(h,a,z_h,\eta,w^*)})]$$

The Migration Decision: The Average Individual

- **Case I**: $w^*(1-\eta) - w > 0$. Optimal rule is migrate if and only if

$$y(a, z_h, w, p_w) \geq y_l^L(a, z_h, \eta, w^*, p_w^*, w, p_w) = \underbrace{D_{l,0}^L(a, \eta, w^*, w)}_{+}$$

$$- (z_h)^{\frac{1}{1-\gamma}} \underbrace{D_{l,1}^L(a, \eta, w^*, p_w^*, w, p_w)}_{+},$$

$$y_l^L(\underset{+}{a}, \underset{-}{z_h}, \underset{+}{\eta}, \underset{+}{w^*}, \underset{-}{p_w^*}, \underset{-}{w}, \underset{+}{p_w}).$$

- Higher innate ability lower income threshold.
- Age increases minimum threshold.
- Tradeoff between human capital (direct payoff) and innate ability (profits associated with learning by doing).

The Migration Decision: Selection

- **Case II**: $w^*(1-\eta) - w < 0$. Optimal rule is migrate if and only if

$$y(a, z_h, w, p_w) \leq y^L_{II}(a, z_h, \eta, w^*, p^*_w, w, p_w) = \underbrace{D^L_{II,0}(a, \eta, w^*, w)}_{-} +$$

$$\underbrace{(z_h)^{\frac{1}{1-\gamma}} D^L_{II,1}(a, \eta, w^*, p^*_w, w, p_w)}_{+}.$$

- Low innate ability will not migrate.
- Age decreases maximum threshold.
- Who migrates? Low human capital high ability.
  - Individuals who can benefit from better opportunities of advancement on the job.
  - North-North migration: negative selection on income but high ability

Temporary Migrants: Returns to Human Capital

- Unexpected (but not unplanned for) return migration associated with a Poisson process. When the Poisson (parameter λ) hits the migrant returns.
- An increase in λ (higher probability of return) reduces incentives to accumulate human capital.

Temporary Migrants: Assimilation

- Let $(\partial y/\partial a)(a;\lambda,w) \equiv \dot{y}(a;\lambda,w)$ be the age-earnings profile of an immigrant who faces a given return probability to the w country.
- Assume $\gamma \geq 1/2$, then:
  - There exists an $\bar{a}$ such that for all $a \leq \bar{a}$, $\partial \dot{y}(a;\lambda,w)/\partial\lambda < 0$.
  - If $\delta_h = 0$ then $\bar{a} = R$.
  - There exists an $\tilde{a}$ such that for all $a \leq \tilde{a}$, $\partial \dot{y}(a;\lambda,w)/\partial w > 0$.
  - If $\delta_h = 0$ then $\tilde{a} = R$.
- Higher probability of return $\longrightarrow$ less assimilation.
- The poorer the country the smaller the level of assimilation.
- Stricter enforcement of immigration laws (higher λ) imply less assimilation.

Quantitative Results (very preliminary)

- Question: Quantitative implications of the model for
  - Income differences between migrants and natives as a function of schooling and age at migration over the life cycle. (Assimilation)
  - Rate of return on foreign experience.
  - Income assimilation of temporary migrants.

Calibration

- Pick parameters to match age-earnings profiles for U.S. workers.
- Pick w in each country to match output per worker relative to U.S.
- All individuals to devote at least 50% of their time on the job to productive activities once they leave school.
- Report results for a country with output per worker about 50% of U.S. (e.g. Greece, Mauritius, Portugal) and 20% of U.S. (e.g. Ecuador, Jordan, Romania, Thailand)
- Only U.S. data are used to calibrate the model.

Migrants vs. Natives: Income Gap

Younger Migrants

Table 1: Relative Income $[a_m = 26]$				
Income	$y = .50 * US$		$y = .20 * US$	
	$s = 12$	$s = 16$	$s = 12$	$s = 16$
Initial	50%	45%	31%	36%
+15	86%	62%	68%	70%
+25	90%	64%	83%	85%

- Large initial gap and catch up rates.
- Larger differences for immigrants from poorer countries.
- Non-monotonicity (GDP origin) in relative income as a function of schooling.

Migrants vs. Natives: Income Gap

Older Migrants

Table 2: Relative Income (%) $[a_m = 36]$				
Income	$y = .50 * US$		$y = .20 * US$	
	$s = 12$	$s = 16$	$s = 12$	$s = 16$
Initial	69%	67%	35%	31%
+15	81%	83%	65%	68%
+25	82%	83%	67%	68%

- Initial gap is smaller.
- Assimilation is slower.

Migrants vs. Natives: The Penalty for Foreign Experience

- Impact on relative income at age 50 of early migration.

Table 3: Income Gain			
$y = .50 * US$		$y = .20 * US$	
$s = 12$	$s = 16$	$s = 12$	$s = 16$
9%	11%	18%	17%

- Immigrant from a poor country that migrates at age 26 and has a high school education earns, at age 50, 18% more than a "similar" individual who migrates 10 years later.

Temporary Migrants (from poor country)

- Schooling $= 12$ and expected duration of stay is either 2 or 8 years.
- Age at migration $a_m = 26$ $(a_m = 36)$

Table 4: Income Relative to Natives

Age (income)	$s = 12$		
	Permanent	2 Years	8 Years
Initial	31% - (35%)	75% - (58%)	72% - (57%)
+15	68% - (65%)	44% - (48%)	47%- (50%)
+25	83% - (67%)	40% - (48%)	44% - (50%)

- Differences in expected duration of stay (8 vs. 2) have a small effect on income.
- Assimilation is negative.
- Older migrants' relative income flatter.

Temporary Migrants (from poor country)

- Schooling $= 16$ and expected duration of stay is either 2 or 8 years.
- Age at migration $a_m = 26$ $(a_m = 36)$

Table 4: Income Relative to Natives

Age (income)	$s = 16$		
	Permanent	2 Years	8 Years
Initial	36% - (31%)	89% - (60%)	83% - (58%)
+15	70% - (68%)	42% - (47%)	43%- (50%)
+25	85% - (68%)	37% - (47%)	39% - (50%)

- Pattern is similar to $s = 12$.

Concluding Comments

- Models in which income over a lifetime is endogenous show promise as a framework to understand the dynamics of immigrant earnings.
- Current version is consistent with both positive and negative selection. If the loss of human capital varies across occupations (small for farm workers?, large for lawyers?), the model implies that the nature of selection changes with occupations.
- Age influences selection as well.
- Changes in expected duration have a large impact on assimilation.

Additional Material

Migrants: The Initial Income Gap

- Data: Individuals who were granted a green card in May-November 2003 with more than 12 years of schooling acquired in their home countries.

Income Gap at Migration			
GDP (% U.S.)	$a_m = 25$	$a_m = 40$	$a_m = 50$
2%	0%	0%	0%
50%	11%	34%	51%
80%	33%	56%	92%

Migrants: The Slope of Age-Earnings Profile

- Data: Individuals who were granted a green card in May-November 2003 with more than 12 years of schooling acquired in their home countries.

Rates of Return to Experience (%)			
GDP (% U.S.)	$a_m = 25$	$a_m = 40$	$a_m = 50$
2%	11.0	9.4	8.3
50%	8.2	6.6	5.5
80%	6.3	4.8	3.7
Native (roughly)	5-8	0	0

Migrants: Initial Income Gap (Natives)

- Controlling for education Borjas finds values that range from 13-16%. Lubotsky (close to Borjas for early periods) but larger (44%) for 85-89.
- Rho (for 95-99) estimates 18% (bachelor) to 30 % (high school). Older migrants (41-45): 54%.
- Lemos (UK) from 10% to 70%.
- Hirsch (Germany) from 12% to 30%
- Rodriguez-Planas (Spain). Ten year rate: 12% (high school) to 27% (college).

Migrants: Economic Assimilation

- Borjas: Early cohorts 12%-14% first ten years. More recent cohorts: zero.
- Lubotsky: 10-15% over 20 years.
- Rho: 8-10%
- Lemos: Gap is zero after 10 years and positive afterwards.
- Hirsch: 7% in first ten years and then 9% at 15.
- Rodriguez-Planas (Spain) 24% (high school) to 41% (college)

Migrants: Rate of Return to Schooling

- Chiswick-Miller estimate that the return to schooling to immigrants is 50% of the return to natives.
- Li and Sweetman: Additional return of moving from 20% to 50% US GDP is 0.6%.
- Schoellman: Additional return of moving from 20% to 50% US GDP is 1.3%, and the difference in return between natives and 20% is 2.4%.

Calibration

- Human capital accumulation technology: $\gamma_1 = 0.571$ and $\gamma_2 = 0.289$, $\nu = 0.505$, $\delta_h = 0.01$, $r = 0.04$, $p_w = p_e = 1$, $p_s = 0.67$, $\bar{n} = 0.5$ These parameters are held constant across individuals and countries.
- Moments:
  - $y50/y25$: 2.33 (US), 1.94 (M), 1.62 (P)
  - $y64/y55$: 0.92 (US), 0.92 (M), 0.92 (P)
- Ability:
  - z_h (for $s = 12$) : 0.1512 (US), 0.1576 (M), 0.1663 (P)
  - z_h (for $s = 16$) : 0.1636 (US), 0.1706 (M), 0.1802 (P)