

Immigration and the Macroeconomy

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Immigration and Remittances - some facts

Immigration

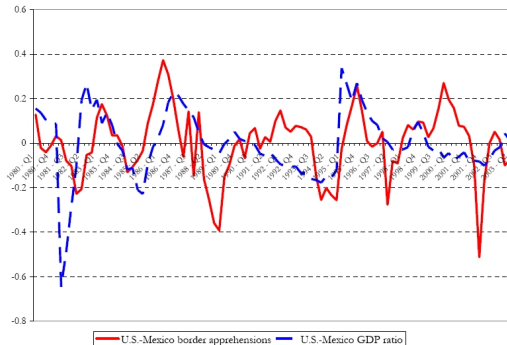
- Immigration is important and on the rise.
- Approximately 13% of the US population is foreign-born (it was less than 6% twenty years ago);
- Around 1/3 of the U.S. immigrants, and up to 56% of new arrivals, are undocumented and mostly unskilled (Hanson, 2006);
- Mexican immigrants in the US represent 10% of the total Mexican population (65% return within four years)

Remittances

- *Recorded* remittances received by *developing economies* reached \$240 bn in 2007 (i.e. the equivalent of 2/3 of their FDI).
- Represent more than 20% of the GDP in several countries (Moldova 36.2%, Honduras 25.6%, Jordan 20.3%, Philippines 10%, Mexico 2.5%)

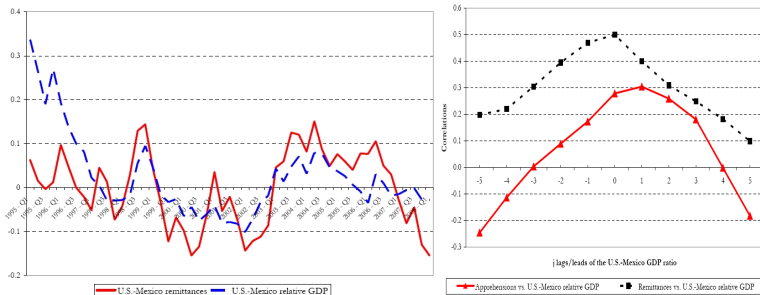
- Labor Migration varies over the cycle
Jerome (1926) documented the procyclical pattern of European immigrants (e.g. arrivals declined by 39.1% during the recession of 1908)
- Proxy for new arrivals of undocumented workers: **Number of arrests at the border.**

Figure 1. U.S.-Mexico border apprehensions and the U.S.-Mexico GDP ratio



- Remittances increase when the US/Mexico GDP ratio increases (Consumption Smoothing-Insurance Mechanism).

Figure 2. U.S.-Mexico remittances and the U.S.-Mexico GDP ratio



Objective of this paper

- **Existent Immigration models ignore the cyclical dynamics of immigration flows, while open macro models assume labor is immobile.**
- Our main goal is to bridge this gap.
- Introduce labor mobility and study their role in the international transmission of business cycles.
- Study the potential insurance role of remittances to smooth consumption across members residing in both countries (Yang, 2007)
- Evaluate the welfare implications of different immigration policies.

Model Structure

- Baseline IRBC model (Backus, Kehoe and Kydland, 1994)
- Introduce Microfounded Migration decision and remittances.
- **Extension:** Introduce Skill-heterogeneity among natives and study the impact of unskilled immigration.
- We assume Capital-Skill complementarity (Krusell et al, 2000) and unskilled immigrants being substitutes for native unskilled workers (Borjas 2008)

Building the Model

(1) Microfoundations of immigration

Labor migration as an investment decision (Sjaastad, 1962)

- “The data strongly supports income maximization (in the decision to migrate); migration is increasing in the **level earnings difference between destination and the source**, although the estimated effect of earnings appears to be attenuated due to **fixed (sunk) costs of migration.**” (Grogger and Hanson, 2008).

Building the Model

(1) Microfoundations of immigration

The sunk cost of labor migration:

- The cost of relocation, learning a new language, cultural integration, etc.
- Job search costs;
- The effort exerted by the migrants' local network (in the destination country) to accommodate the new entrant;
- Paying a smuggler (*coyote*) to enter the country; the physical and legal risks of crossing the border illegally.

Main Results: Cyclical Dynamics

- A temporary economic expansion leads to rise in immigration wage, however sunk costs (barriers to entry) deter the entry of immigrants.
- Immigrants become relatively scarce, wages significantly increase, as well as remittances.
- Since it is difficult to re-enter, the number of immigrants do not change much during recessions.
- Immigrants thus become relative abundant, putting downward pressure on the wages of the native unskilled workers.

Main Results: Welfare

- Gains of immigration are critically determined by capital accumulation.
- The higher the degree of complementarity between natives and immigrants, the larger the welfare gain from immigration (or loss from preventing it) for the destination economy.

1. The Home Economy

Household preferences

- Home representative household:

$$\max_{\{C_t, L_{n,t}, K_{t+1}\}} E_t \sum_{s=t}^{\infty} \beta^{s-t} \left\{ \ln C_s - \chi \frac{(L_{n,s})^{1+\psi}}{1+\psi} \right\},$$

s.t.

$$w_{n,t} L_{n,t} + (1 + r_t) K_t \geq C_t + K_{t+1}.$$

- FOC:

$$1 = \beta E_t \left[(1 + r_{t+1}) \frac{C_t}{C_{t+1}} \right],$$
$$\frac{w_{n,t}}{C_t} = \chi L_{n,t}^{\psi}.$$

1. The Home Economy (cont'd)

(A) Baseline model:

- Immigrant labor in the production function:

$$Y_{h,t} = A_t (K_t)^\alpha \left[\gamma^{\frac{1}{\theta}} (L_{i,t})^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}} (\zeta L_{n,t})^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta(1-\alpha)}{\theta-1}},$$

$$\frac{\partial Y_{h,t}}{\partial L_{i,t}} = w_{i,t}; \quad \frac{\partial Y_{h,t}}{\partial L_{n,t}} = w_{n,t}; \quad \frac{\partial Y_{h,t}}{\partial K_t} = r_t + \delta.$$

- Trade:

$$Y_{h,t} = Y_{h1,t} + Y_{h2,t}.$$

$$Y_t = \left[\omega^{\frac{1}{\mu}} (Y_{h1,t})^{\frac{\mu-1}{\mu}} + (1-\omega)^{\frac{1}{\mu}} (Y_{f1,t})^{\frac{\mu-1}{\mu}} \right]^{\frac{\mu}{\mu-1}},$$

1. The Home Economy (cont'd)

(A) Baseline model:

- The Home composite good:

$$Y_{h1,t} = \omega (p_{h,t})^{-\mu} Y_t, \quad Y_{f1,t} = (1 - \omega) (p_{f,t} Q_t)^{-\mu} Y_t,$$

- Resource Constraint:

$$Y_t = C_t + I_t + \frac{L_{i,t}}{L_t^*} C_t^* Q_t$$

- Capital Accumulation

$$K_{t+1} = (1 - \delta) K_t + I_t.$$

2. The Foreign Economy (cont'd)

Household preferences and labor migration

$$\max_{\{C_t^*, L_t^*, L_{e,t}, K_{t+1}^*\}} E_t \sum_{s=t}^{\infty} \beta^{*s} \left\{ \ln C_s^* - \chi^* \frac{(L_s^*)^{1+\psi^*}}{1+\psi^*} \right\},$$

- The Foreign household supplies a total of L_t^* hours, worked either abroad or domestically:

$$L_t^* = L_{i,t} + L_{f,t}.$$

- Immigrant labor starts producing one period after arriving at the destination. Return home with probability δ_l every period:

$$L_{i,t} = (1 - \delta_l)(L_{i,t-1} + L_{e,t-1}).$$

- The calibration and the magnitude of the macro shocks ensures that $0 < L_{i,t} < L_t^*$ every period.

$$\underbrace{w_t^* (L_t^* - L_{i,t})}_{\text{domestic income}} + \underbrace{w_{i,t} Q_t^{-1} L_{i,t}}_{\text{immigrant income}} + (1 + r_t^*) K_t^* \geq C_t^* + \underbrace{f_e w_{i,t} Q_t^{-1} L_{e,t}}_{\text{sunk cost}} + K_{t+1}^*$$

2. The Foreign Economy (cont'd)

Household preferences and labor migration (cont'd)

- It is useful to re-write the budget constraint as:

$$w_t^* L_t^* + d_t L_{i,t} + (1 + r_t^*) K_t^* \geq C_t^* + f_e w_{i,t} Q_t^{-1} L_{e,t} + K_{t+1}^*$$

- where:

$$d_t \equiv w_{i,t} Q_t^{-1} - w_t^*,$$
$$L_{i,t} = (1 - \delta_l)(L_{i,t-1} + L_{e,t-1}).$$

- The FOC w.r.t. $L_{e,t}$:

$$\underbrace{f_e w_{i,t} Q_t^{-1}}_{\text{sunk cost}} = \underbrace{\sum_{s=t+1}^{\infty} [\beta^*(1 - \delta_l)]^{s-t} E_t \left(\frac{C_t^*}{C_s^*} \right) d_t}_{\text{present discounted gain from emigration}}$$

- In equilibrium, the sunk emigration cost equals the present discounted gain from emigration.

2. The Foreign Economy (cont'd)

Household preferences and labor migration (cont'd)

- The usual FOC's:

$$1 = \beta E_t \left[(1 + r_{t+1}^*) \frac{C_t^*}{C_{t+1}^*} \right],$$

$$\frac{w_t^*}{C_t^*} = \chi^* L_t^{*\psi}.$$

2. The Foreign Economy (cont'd)

Production of the Foreign-specific good:

$$Y_{f,t} = A_t^* (K_t^*)^{\alpha^*} (L_{f,t}^*)^{1-\alpha^*},$$

- Trade:

$$Y_{f,t} = Y_{f1,t} + Y_{f2,t}.$$

- The Foreign composite good:

$$Y_t^* = \left[\omega^{*\frac{1}{\mu}} (Y_{f2,t})^{\frac{\mu-1}{\mu}} + (1 - \omega^*)^{\frac{1}{\mu}} (Y_{h2,t})^{\frac{\mu-1}{\mu}} \right]^{\frac{\mu}{\mu-1}}. \quad (1)$$

- Consumption and investment in both physical capital and emigration are in units of the Foreign composite good:

$$Y_t^* = \underbrace{\left(1 - \frac{L_{i,t}}{L_t^*}\right) C_t^*}_{\text{Consumption Residents}} + \underbrace{I_t^*}_{\text{investment in capital}} + \underbrace{f_e w_{i,t} Q_t^{-1} L_{e,t}}_{\text{investment in emigration}}, \quad (2)$$

3. The Current Account

- Define Remittances, Ξ_t , as:

$$\Xi_t = w_{i,t} L_{i,t} - \frac{L_{i,t}}{L_t^*} C_t^* Q_t$$

- Under financial autarky, the CA balance is:

$$CA_t = \underbrace{p_{h,t} Y_{h2,t}}_{\text{exports}} - \underbrace{p_{f,t} Q_t Y_{f1,t}}_{\text{imports}} - \Xi_t.$$

- Remittances serve as a substitute for contingent claims since no other financial instruments are available.

Calibration

- $\beta > \beta^*$: larger capital stock in Home generates extra wage incentive for Foreign immigrants;
- $\mu = 1.5$; $\delta = 0.025$;
 $\omega = 0.85 > \omega^* = 0.75$; $\psi = 0.33 < \psi^* = 0.66$. (Hotchkiss & Quispe-Agnoli, 2008)
- $\delta_I = 0.07$ (quarterly return rate), based on Reyes (1997):
 - 50% exit within 2 years after arrival ($\delta = 0.0635$)
 - 65% exit within 4 years ($\delta = 0.0830$)

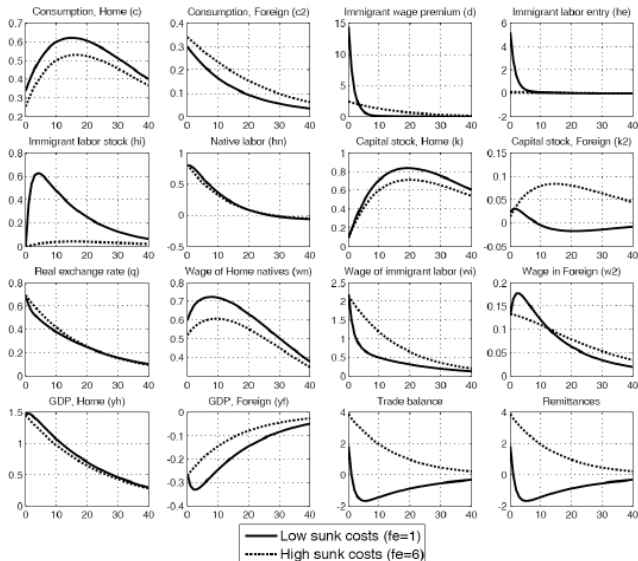
Calibration

- (1) $\frac{L_i}{L^*} = 0.1$
- (2) $\frac{w}{w_i} = 2.1$ (Hanson, 2006)
- (3) US/Mex ratio GDP per capita (PPP) 3.3.
- (4) Remittances to Mexico 2.5% GDP.

$\theta = 1.55$	Elasticity of substitution, native vs. immigrant labor (benchmark $\theta = 1.26$, from Krusell et al., 2007)
$\gamma = 0.08$	Share of immigrant labor in total labor income
$\zeta = 5.4$	Relative productivity of native vs. immigrant labor
$f_e = 4$	The sunk cost of labor migration

2. Labor migration, baseline model

High complementarity native-immigrant labor, positive technology shock in Home



Financial Integration

- The budget constraint for Home:

$$w_t L_t + (1 + r_t^k) K_t + (1 + r_t^b) B_{h,t} + (1 + r_t^{b*}) Q_t B_{f,t} + T_t \\ \geq C_t + K_{t+1} + B_{h,t+1} + \frac{\pi}{2} (B_{h,t+1})^2 + Q_t B_{f,t+1} + \frac{\pi}{2} Q_t (B_{f,t+1})^2,$$

- The Euler equations for bonds (in Home):

$$1 + \pi B_{h,t+1} = \beta E_t \left[(1 + r_{t+1}^b) \frac{C_t}{C_{t+1}} \right], \\ 1 + \pi B_{f,t+1} = \beta E_t \left[\frac{Q_{t+1}}{Q_t} (1 + r_{t+1}^{b*}) \frac{C_t}{C_{t+1}} \right].$$

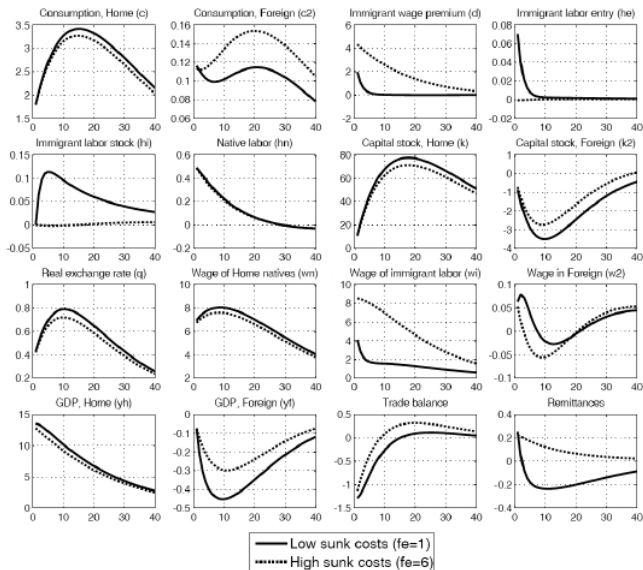
- The balance of international payments:

$$\underbrace{p_{h,t} Y_{h2,t} - p_{f,t} Q_t Y_{f1,t}}_{\text{Trade balance}} - \underbrace{\Xi_t}_{\text{Immigrant labor income}} + \underbrace{r_t^b B_{h,t} + r_t^{b*} Q_t B_{f,t}}_{\text{Investment income}} \\ = \underbrace{(B_{h,t+1} - B_{h,t}) + Q_t (B_{f,t+1} - B_{f,t})}_{\text{Change in bond holdings}}$$

- In steady-state financial integration allows capital to migrate where labor is more abundant dampening the incentives to migrate.
- However, temporary expansions at Home lead to capital inflows (i.e trade deficits), creating more incentives to migrate and work there.

2. Financial Integration

Positive technology shock in Home



Alternative Specification (Skill Heterogeneity)

- Two types of native labor in Home (skilled and unskilled)
- Perfect substitutability between immigrant and native unskilled labor (Borjas et al, 2008)
- Complementarity between capital and native skilled labor ($\theta > \eta$, Krusell et al, 2007)

$$Y_{h,t} = A_t \left\{ \gamma^{\frac{1}{\theta}} (\Upsilon_{1,t})^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}} (\Upsilon_{2,t})^{\frac{\theta-1}{\theta}} \right\}^{\frac{\theta}{\theta-1}},$$

- with

$$\Upsilon_{1,t} = L_{i,t} + L_{u,t},$$

$$\Upsilon_{2,t} = \left[\lambda^{\frac{1}{\eta}} (K_t)^{\frac{\eta-1}{\eta}} + (1-\lambda)^{\frac{1}{\eta}} (\zeta L_{s,t})^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}},$$

- FOC

$$\frac{\partial Y_{h,t}}{\partial L_{i,t}} = \frac{\partial Y_{h,t}}{\partial L_{u,t}} = w_{u,t}; \quad \frac{\partial Y_{h,t}}{\partial L_{s,t}} = w_{s,t}; \quad \frac{\partial Y_{h,t}}{\partial K_t} = r_t + \delta.$$

1. The Home Economy

(B) Alternative specification (cont'd):

- The Home economy includes a continuum of two types of infinitely-lived households: skilled and unskilled;
- The planner maximizes the weighted sum of utilities:

$$\max_{\{c_{s,t}, l_{s,t}, c_{u,t}, l_{u,t}, K_{t+1}\}} E_0 \sum_{t=0}^{\infty} \beta^t \{ \phi s U(c_{s,t}, l_{s,t}) + (1 - \phi)(1 - s) U(c_{u,t}, l_{u,t}) \},$$

- s.t.

$$w_{s,t} L_{s,t} + w_{u,t} L_{u,t} + (1 + r_t) K_t \geq C_{s,t} + C_{u,t} + K_{t+1},$$

$$L_{s,t} = s l_{s,t},$$

$$L_{u,t} = (1 - s) l_{u,t},$$

$$C_{s,t} = s c_{s,t},$$

$$C_{u,t} = (1 - s) c_{u,t}.$$

Calibration

- **Alternative model calibration (B)**

$1 - s = 0.1$	Share of adults with high school (U.S. Census)
$\tilde{\gamma} = 0.1$	Share of native + immigrant unskilled in GDP
$\tilde{\lambda} = \alpha / (1 - \tilde{\gamma})$	Share of capital in GDP
$\tilde{\eta} = 1.1$	Elasticity of substitution, capital vs. skilled labor
$\tilde{\theta} = 1.25$	Elasticity of substitution, capital vs. unskilled labor (benchmarks $\tilde{\eta} = 0.67, \tilde{\theta} = 1.67$, Krusell et al., 2007)
$\tilde{\zeta} = 4.26$	Relative productivity of native vs. immigrant labor
$\tilde{f}_e = 7.5$	Sunk cost of labor migration
$\phi = 0.688$	Weight on the utility of skilled labor

- so that (1) $\frac{L_i}{L^*} = 0.1$, (2) $\frac{w_s}{w_u} = 2.2$, (3) $\frac{w_i}{Q_{w^*}} = 3.64$ (Hanson, 2006).

Quantitative analysis.

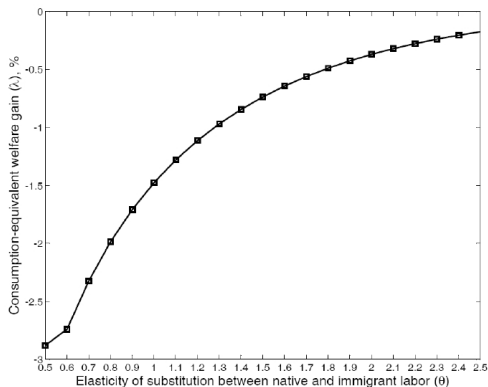
Tightening the Boder

- Following a sudden increase in the sunk cost f_e (from 4 to 5).
- The welfare analysis need to take into account not only the cyclical implications but also permanent effect on the steady-states.

5. Welfare Analysis

Baseline Model: Permanent Increase in Border Enforcement

Figure 9. Welfare analysis, baseline model with financial autarky



6. Welfare Analysis (b)

Extended Model: Increase in the Share of Native Skilled

- Let's consider a gradual and permanent increase in the share of skilled native labor in Home (from 0.60 to 0.67 over 20 years),
- We take into account the expected growth path of the share of skilled labor with perfect certainty (as well as cyclical stochastic dynamics)
- Compare the Home welfare in the initial steady state (V_0) with that as of period t' when the planner learns about the growth path $V_{t'}$:

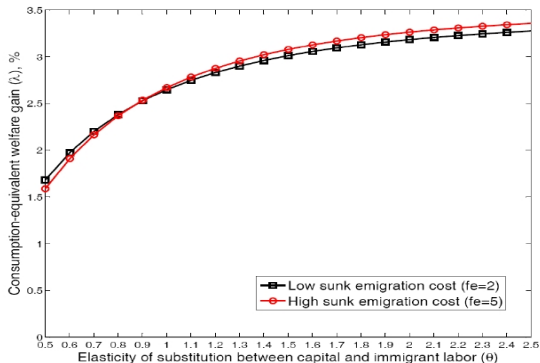
$$V_0 = \frac{1}{1-\beta} \{ \phi s U(\bar{c}_s, \bar{l}_s) + (1-\phi)(1-s) U(\bar{c}_u, \bar{l}_u) \}$$

$$V_{t'} = E_{t'} \sum_{v=t'}^{\infty} \beta^v \{ \phi s_v U(c_{s,v}, l_{s,v}) + (1-\phi)(1-s_v) U(c_{u,v}, l_{u,v}) \}$$

- and compute the consumption-equivalent welfare gain/loss λ .

6. Welfare Analysis (b)

Extended Model: Increase in the Share of Native Skilled (0.6 to 0.67) with relative capital intensive production at Home

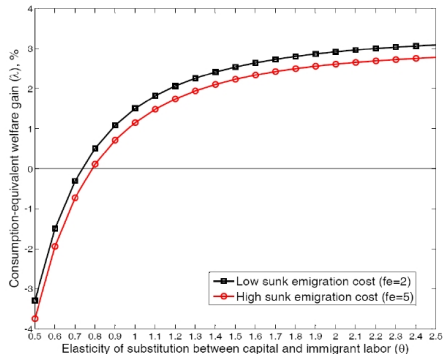


If unskilled workers are highly substitutable with capital and relative abundant... Lower immigration barriers reduce welfare, but...

6. Welfare Analysis (b)

Extended Model: Increase in the Share of Native Skilled (0.90 to 0.97) as in the US nowadays

Figure 10. Welfare analysis, alternative model with financial autarky: implications of a rising share of skilled labor (1)



Lower immigration barriers always leads to higher welfare.