

REVISITING THE BRAIN DRAIN LITERATURE WITH INSIGHTS FROM A GENERAL EQUILIBRIUM WORLD MODEL

Elisabetta Lodigiani ^{a,b} Luca Marchiori^c I-Ling Shen^d

^a Università Ca' Foscari, Venice

^b Centro Studi Luca d'Agliano

^c Central Bank of Luxembourg

^d South Coast Air Quality Management District

International conference on "International labor mobility and inequality
across nations"

Clermont-Ferrand, January 23-24, 2014

Introduction

Introduction - Motivation (1)

General Context:

- Skilled migration = major source of concern for developing countries (*South*)
- Increasingly important issue if developed countries (*North*) reinforce the selection of immigrants (*German green cards, European blue card, UK Point system, etc.*)

General Aim:

What is the effect on the South if North increases skilled immigration ?
(*because of aging, occupational shortages, etc.*)

Introduction - Motivation (2)

Brain drain (BD) impacts on source countries through multiple channels.

In addition to the direct *demographic* impact, many theoretical and empirical studies show BD may be + or -:

- wage distortions and fiscal externality (*Bhagwati and Hamada 1974, 1975*).
- negative externality on HC formation in HC-driven endogenous growth models (*Miyagiwa 1991, Haque and Kim 1995, and Wong and Yip 1999*).
- incentive effect on HC formation (*Mountford 1997, Stark et al. 1997, 1998, Beine et al. 2008, etc.*).
- emigrant networks help to increase FDI inflows (*Kugler and Rapoport 2007, Docquier and Lodigiani 2009*).
- skilled diaspora facilitates technology diffusion (*Kerr 2008, Lodigiani 2008*).
- migrants can send remittances back home

...

⇒ *But what is the global impact of all these effects?*

⇒ *Which effect is dominant?*

Introduction - Aim of the paper

The aim of this paper is to provide suggestive guidelines for future research by identifying the brain drain mechanisms that can generate larger economic impacts at the aggregate and thus have significant policy implications.

Questions:

- 1 What is global impact of the different channels on *GDP per capita*, *GNI per capita*, *Income Inequality*?
- 2 What are the relative impacts of each channels on these indicators?
What is (are) the dominant channel(s) ?

We consider a general equilibrium OLG model with 3 developed regions (North) and 7 developing regions (South) as constructed in Marchiori, Shen and Docquier (2013).

Effects of the brain drain

What channels?

Brain drain affects the sending economy through four main channels:

- 1 **Incentive effect:** better migration prospects for the highly educated stimulates more human capital formation at the origin country.
- 2 **Remittances:** migrants remit money earned in the destination country back to the origin country.
- 3 **TFP externality:** brain drain facilitates the origin country's adoption of the more advanced technologies that have been developed in the destination country.
- 4 **FDI externality:** brain drain facilitates FDI inflows to the origin country because it enhances foreign investors' knowledge about the origin country, thus reducing transaction costs and investment risks.

Introduction - General methodology- Refer to Marchiori, Shen and Docquier (2013)

- **‘Upstream block’**

(calibrated outside the core of the model using data + empirical studies):

predictions for demography ($\frac{L}{POP}$), human capital ($\frac{L^S}{L^U}$), diaspora externalities (A, π)

- **‘Micro-founded CGE model’:**

predictions for world output, asset accumulation, geographical allocation of assets (K), international flows of capital income, etc.

Micro-Founded Model - Regions

Table: List of ten world regions

NORTH	
NAM	North America
JAP	Japan
ADV	other high-income advanced countries
SOUTH	
EAS	Eastern Europe
MEN	Middle East and Northern Africa
LAC	Latin America and the Caribbean
SSA	Sub-Saharan Africa
RUS	the Former Soviet Union
CHI	the Chinese world
IND	the Indian world and Pacific Islands

Micro-Founded Model - Individuals

- Each individual, either high-skilled or low-skilled, maximizes his/her lifetime utility (derived from consumption) s.t. lifetime budget constraint. Migrants remit a fraction of their consumption.
- Each period is considered to cover 10 years of life time, i.e., $a = 0$ stands for age 15-24, $a = 1$ for 25-34, and so on, up to $a = 7$ for 85-94.
- Part of the population aged 55-64 is retired, and everybody aged 65-94 is retired

Micro-Founded Model - Individuals

- Each individual, either high-skilled or low-skilled, maximizes his/her lifetime utility (derived from consumption) s.t. lifetime budget constraint. Migrants remit a fraction of their consumption.
- Each period is considered to cover 10 years of life time, i.e., $a = 0$ stands for age 15-24, $a = 1$ for 25-34, and so on, up to $a = 7$ for 85-94.
- Part of the population aged 55-64 is retired, and everybody aged 65-94 is retired

Micro-Founded Model - Production

- Total outputs:

$$Y_t = K_t^\alpha (A_t L_t)^{1-\alpha}, \quad \alpha \in [0, 1]$$

K_t : physical capital,

A_t : Harrod-neutral technology progress,

L_t : efficient labor = $[v_t(L_t^s)^\sigma + (1 - v_t)(L_t^l)^\sigma]^{1/\sigma}$, $\sigma < 1$.

- Gross returns to capital comprise partly of a region-specific risk premium (π_t):

$$R_t^* (1 + \pi_t) = \alpha \left(\frac{A_t L_t}{K_t} \right)^{1-\alpha}$$

Micro-Founded Model - Government

The regional government

- levies taxes on labor earnings and on consumption expenditures;
- finances general public consumption, pension benefits, and other welfare transfers;
- issues bonds and pays interests on public debt;
- in every developing region, receives foreign development aid.
- The government budget constraint is satisfied at each period by adjusting the wage tax rate.

Migration Shocks - Demographic Shock of Additional “Brain Drain”

In each decennial period from 2010-20 to 2050-60,

- Increase by 20 percent the forecast *flow* of high-skilled migrants from every developing region to each developed region.
- The forecast migration flows are calibrated according to the U.N. population projections (2006).
- At the baseline, future migrants’ skill composition and regional distribution are assumed to remain as in 2000, based on the Docquier-Marfourk dataset (2006).

Migration Shocks - Resident Human Capital After Shock

- The **Brain Gain** effect of brain drain is taken into account, i.e., better migration prospects for the high-skilled inspires more human capital formation.
- The after-shock levels are calibrated using the elasticity estimated by Beine et al. (*Econ. J.*, 2008).

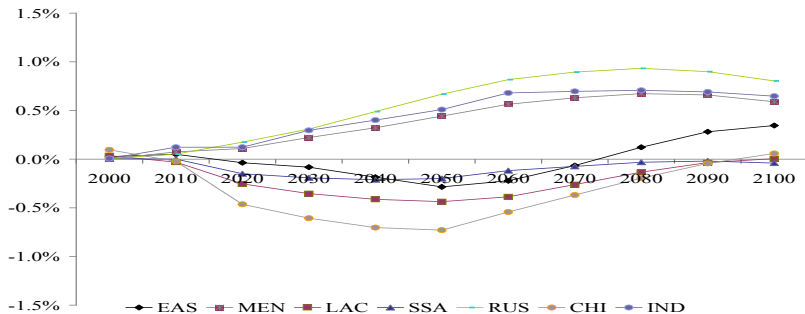
Migration Shocks - Technology After Shock

- Neo-Schumpeterian type of technological progress.
- **Resident human capital** affects a regions' capacity to innovate or to adopt modern technologies (Vandenbussche et al., *J. Econ. Growth*, 2006).
- **Skilled diaspora** facilitates technology diffusion back to the home country, particularly for countries far from the technology frontier (Lodigiani, *Econ. Int.*, 2008) – used for calibration.

Migration Shocks - Risk Premium After Shock

- **Migration networks** decrease risk-related investment risks at origin, and thus help to increase foreign capital inflows.
- Dynamic complementarity between emigration and FDI inflows (Kugler and Rapoport, *Econ. Letters*, 2007).
- For calibration of risk premiums, we transform the elasticity of FDI per worker growth rate to the lagged size of skilled diaspora, estimated by Docquier and Lodigiani (*Open Economies Rev.*, 2009).

Total Impacts on GNI per capita

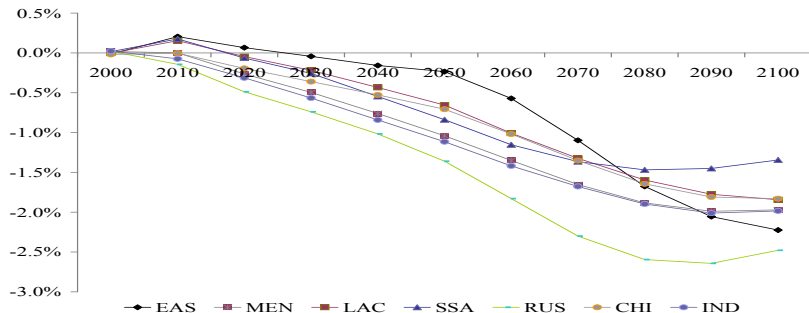


Losers: CHI, LAC, SSA, EAS

Winners: RUS, MEN, IND.

General picture is more optimistic

Total Impacts on High-to-Low Skilled Inequality

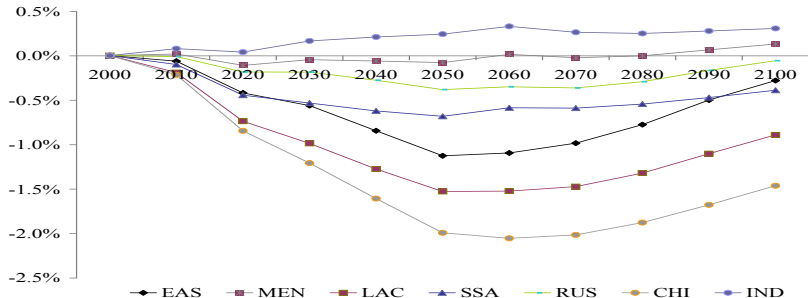


Winners: income inequality decreases in all the seven regions.

The incentive effect - Literature

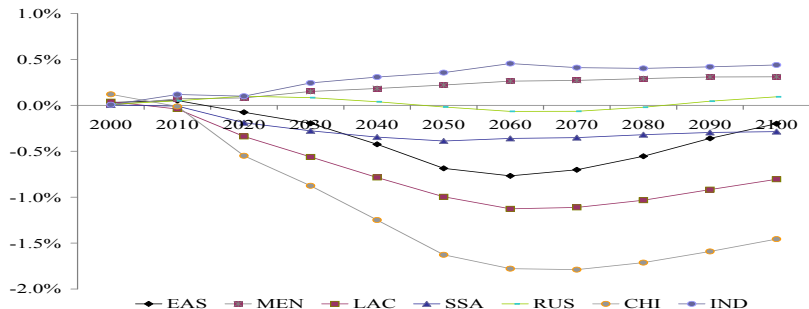
- Increased migration prospects for the high-skilled could stimulate more human capital formation, thanks to higher expected returns to education (see for example, the theoretical works of Mountford, 1997; Stark and Wang, 2002; Stark et al., 1997, 1998; Stark, 2004; Vidal, 1998, and for empirical evidence Beine et al., 2001, 2008, 2010).
- Positive micro evidence Batista et al. (2012); Gibson and McKenzie (2011).
- In contrast with the traditional literature ((Bhagwati and Hamada, 1974; Miyagiwa, 1991; Haque and Kim, 1995). Questioned by some authors (e. g., Schiff, 2006).

The incentive effect - Results



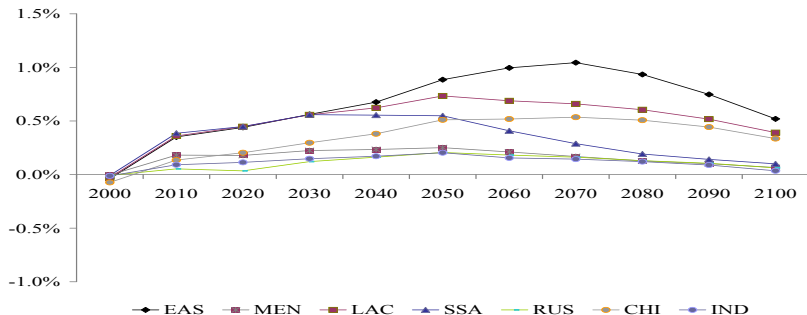
a. Effect on GDP per capita All the regions benefiting less/suffering more from the migration shocks.

The incentive effect - Results



b. Effect on GNI per capita All the regions benefiting less/suffering more from the migration shocks.

The incentive effect - Results



c. Effect on Income inequality Strong rise in income inequality.

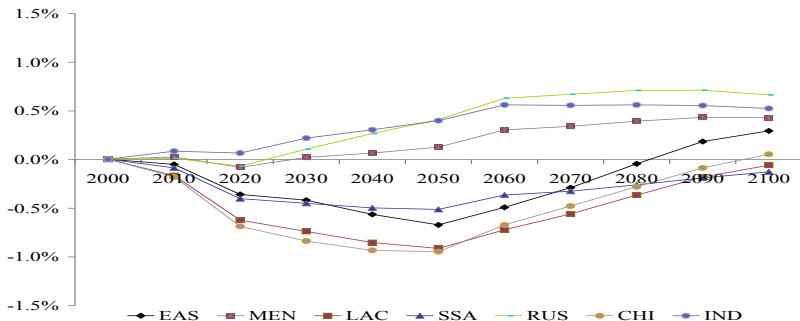
The incentive effect - State of the art

- Strong impact both in terms of productivity and inequality.
- Better data, better estimation method etc.

Remittances - Literature

- Remittances increased strongly during the last decades, becoming an important source of funds for many developing countries.
- Remittances are generally thought to have positive effects, for instance, they can contribute to poverty reduction in recipient countries. (e.g. Adams, 2006; Acosta et al., 2006, respectively for Guatemala and Mexico); spent on consumption, but also invested in education, health care and physical assets, alleviating liquidity constraints (e.g. Woodruff and Zenteno, 2007; Cox Edwards and Ureta, 2003; Adams, 2006).
- Macroeconomic evidence: positive impact on economic growth, by promoting financial development (e.g. Aggarwal et al., 2011). Dutch disease (e.g. Acosta et al., 2009; Larrey et al., 2012).
- Controversy relates to the question whether remittances come mainly from low-skilled or high-skilled migrants (the high-skilled remits less: Faini (2007) and Nimii et al. (2008)); Bollard et al. (2011): positive effect of education on the amount remitted; Docquier et al. (2012) show that immigration policies determine the sign and magnitude of the relationship between remittances and migrants' education.

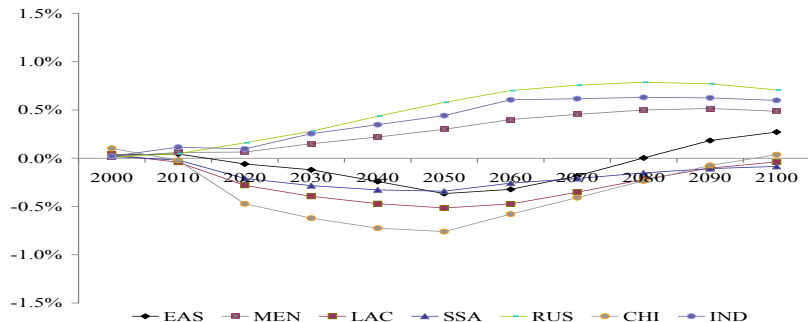
The high-skilled may have lower propensity to remit - Results



a. Effect on GDP per capita

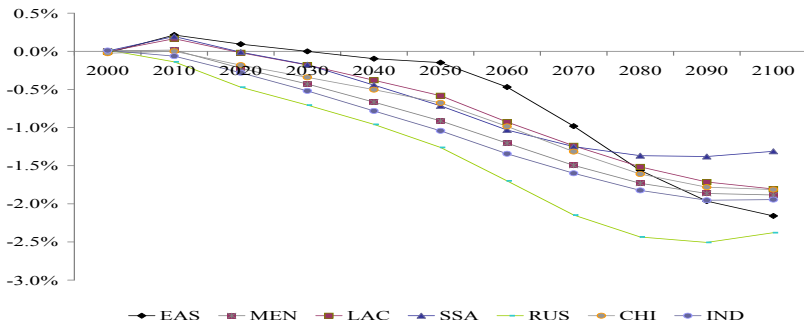
No effect

Remittances - Results



b. Effect on GNI per capita

Remittances - Results



c. Effect on High-to-Low Skilled Inequality

Inequality is worsened in each region.

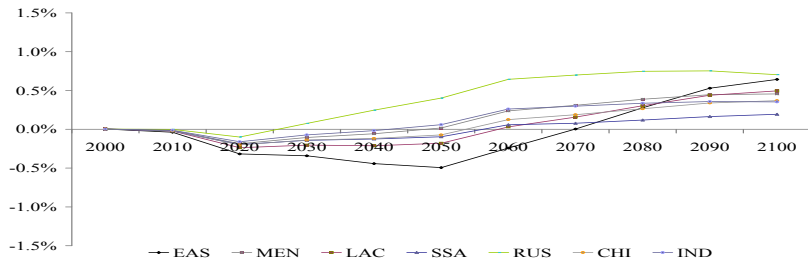
Remittances - State of the art

- We find that remittances from high-skilled have a negligible role in production.
- BUT all the regions are negatively affected in terms of GNI per capita. Income inequality is worsened too.
- Shed lights on distributional pattern of remittance receipts in migrants' home country and, in particular, on remittance-patterns of high-skilled migrants.

TFP Externality - Literature

- High-skilled diaspora abroad affecting technology diffusion.
- Wide anecdotal evidence (e.g. Biao, 2006; Meyer and Brown, 1999; Meyer, 2001; Saxenian, 1999, 2001, 2002).
- Few studies aim at investigating these issues: technology spill-over from the U.S. using patent-citation data (Kerr (2008); Agrawal et al. (2011; 2008)); Lodigiani (2008).

TFP Externality - Results

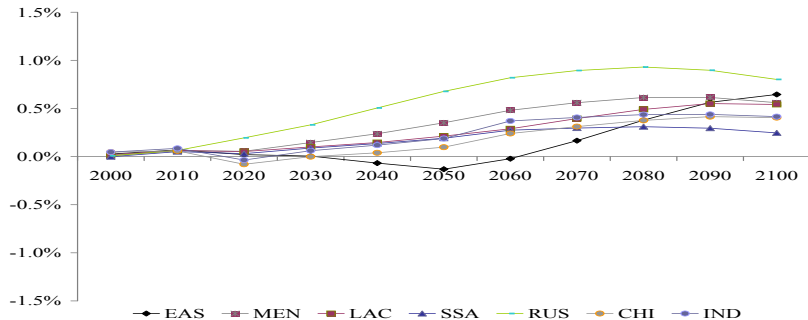


a. Effect on GDP per capita

Losers: MEN, IND

Winners: EAS, LAC, SSA, CHI

TFP Externality - Results

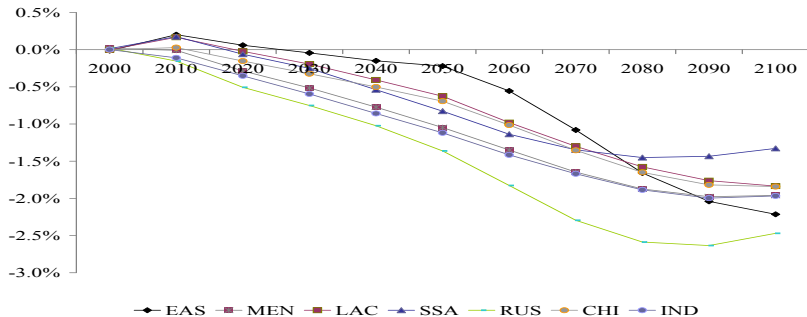


b. Effect on GNI per capita

Losers: MEN, IND

Winners: EAS, LAC, SSA, CHI

TFP Externality - Results



c. Effect on High-to-Low Skilled Inequality

Negligible Impacts.

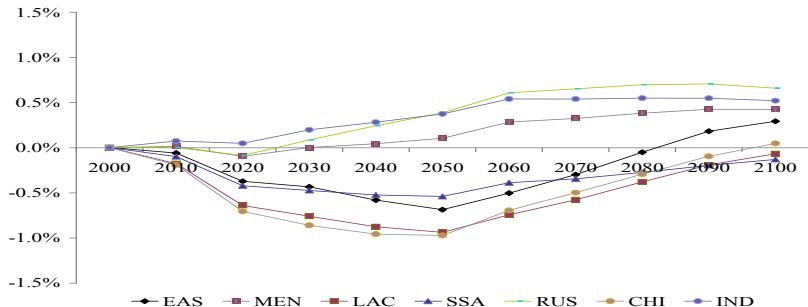
TFP Externality - State of the art

- Non-negligible effect of the TFP externality in production.
- Since the literature on migration and technology adoption is new and relatively not exhaustive, more research should be conducted along the productivity channel.
- Shortcomings of existing studies...
- Investigate whether high-skilled migrants can foster innovation as well: the knowledge acquired by emigrants abroad and transferred to their origin countries, could enhance the skills of the remaining workers there and facilitate the creation of new ideas, given an appropriate institutional context. (e.g., Naghavi and Strozzi (2011)).

FDI Externality - Literature

- Skilled migrants may induce positive externalities by reducing transaction costs and favoring foreign direct investment (Kugler and Rapoport, 2007; Docquier and Lodigiani, 2010; Javorcik et al., 2011).
- Kim and Park (2013) emphasize the role of foreign educated workers in attracting FDI from the countries where they acquired education.

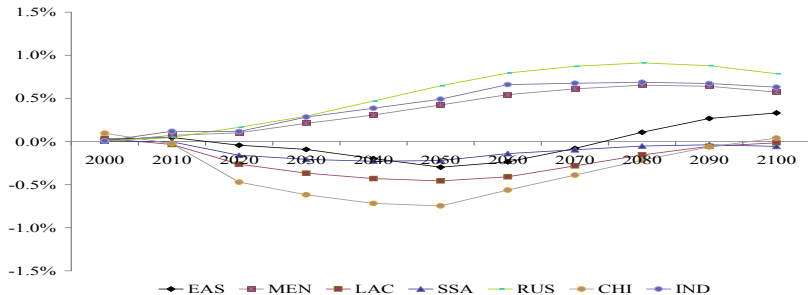
FDI Externality - Results



a. Effect on GDP per capita

Predictions are more pessimistic for all the regions. Modest changes.

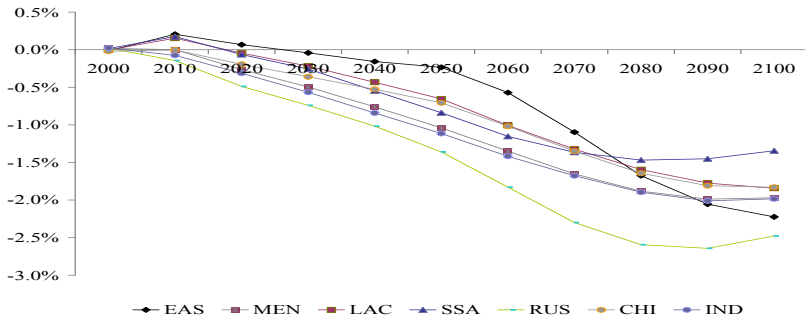
FDI Externality - Results



b. Effect on GNI per capita

Predictions are more pessimistic for all the regions. Modest changes.

FDI Externality - Results



c. Effect on High-to-Low Skilled Inequality

No changes.

FDI Externality - State of the art

- The recent literature on FDI and migration unambiguously finds that immigrants keep interacting with their origin countries with a positive effect on FDI flows.
- We show modest impacts.
- Analysis at sectoral level (in some sectors FDI externalities could be more relevant than in other sectors).
- More completed framework linking immigration, FDI, innovation and knowledge diffusion.

Concluding Remarks

Summary of Findings:

- Short-run impacts of brain drain on *resident human capital* is extremely crucial as it
 - determines the number of skilled workers available to domestic production, and
 - affects the sending region's capacity to innovate or to adopt modern technologies.
 - large economic inequality
- When we abstract from the TFP externality, the total impacts on GDP per capita are far more optimistic for some regions and more pessimistic for others, according to the region's relative distance to the technological frontier. Given that the literature on migration and technology adoption is new and relatively not exhaustive, more research should be conducted along the productivity channel.
- FDI externality is found to have a limited impact on migrants' sending countries.
- Impact of remittances from migrants abroad is non-negligible in improving the welfare of those left behind, it is important to shed lights on the debate on the distributional pattern of remittance receipts in migrants' home country and, in particular, on remittance-patterns of high-skilled migrants.

Concluding Remarks

Summary of Findings:

- Short-run impacts of brain drain on *resident human capital* is extremely crucial as it
 - determines the number of skilled workers available to domestic production, and
 - affects the sending region's capacity to innovate or to adopt modern technologies.
 - large economic inequality
- When we abstract from the TFP externality, the total impacts on GDP per capita are far more optimistic for some regions and more pessimistic for others, according to the region's relative distance to the technological frontier. Given that the literature on migration and technology adoption is new and relatively not exhaustive, more research should be conducted along the productivity channel.
- FDI externality is found to have a limited impact on migrants' sending countries.
- Impact of remittances from migrants abroad is non-negligible in improving the welfare of those left behind, it is important to shed lights on the debate on the distributional pattern of remittance receipts in migrants' home country and, in particular, on remittance-patterns of high-skilled migrants.

Concluding Remarks

Summary of Findings:

- Short-run impacts of brain drain on *resident human capital* is extremely crucial as it
 - determines the number of skilled workers available to domestic production, and
 - affects the sending region's capacity to innovate or to adopt modern technologies.
 - large economic inequality
- When we abstract from the TFP externality, the total impacts on GDP per capita are far more optimistic for some regions and more pessimistic for others, according to the region's relative distance to the technological frontier. Given that the literature on migration and technology adoption is new and relatively not exhaustive, more research should be conducted along the productivity channel.
- FDI externality is found to have a limited impact on migrants' sending countries.
- Impact of remittances from migrants abroad is non-negligible in improving the welfare of those left behind, it is important to shed lights on the debate on the distributional pattern of remittance receipts in migrants' home country and, in particular, on remittance-patterns of high-skilled migrants.

Concluding Remarks

Summary of Findings:

- Short-run impacts of brain drain on *resident human capital* is extremely crucial as it
 - determines the number of skilled workers available to domestic production, and
 - affects the sending region's capacity to innovate or to adopt modern technologies.
 - large economic inequality
- When we abstract from the TFP externality, the total impacts on GDP per capita are far more optimistic for some regions and more pessimistic for others, according to the region's relative distance to the technological frontier. Given that the literature on migration and technology adoption is new and relatively not exhaustive, more research should be conducted along the productivity channel.
- FDI externality is found to have a limited impact on migrants' sending countries.
- Impact of remittances from migrants abroad is non-negligible in improving the welfare of those left behind, it is important to shed lights on the debate on the distributional pattern of remittance receipts in migrants' home country and, in particular, on remittance-patterns of high-skilled migrants.

Concluding Remarks

- In order to better analyze several direct and feedback effects caused by high-skilled migration, and to assess the global impact of the brain drain on developing countries, much work remains to do.
- This is especially true regarding channels which are not well explored, and whose impact appears to be relevant, but requires additional studies in order to be considered as reliable.
- The inclusion of other channels, such as return migration, or additional networks effects, may be helpful for further investigations...

Thank you very much!