

The impact of labor mobility on unemployment: a comparison between Jordan and Tunisia

Anda David* Mohamed Ali Marouani †

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Abstract

Jordan and Tunisia are two non-oil exporting MENA countries characterized by high unemployment rates and significant migrant populations. A comparative analysis of the impact of international mobility in the two countries allows us to shed light on the mechanisms through which emigration affects labor market outcomes and reciprocally. We develop a dynamic general equilibrium framework for each economy, with a full-fledged modeling of migration, labor market and education issues. Developing Mode 4 type of exports improves the labor market situation, mainly for high skilled workers. As a consequence, migration and brain-drain would be reduced. Furthermore, an increase in foreign wages has higher benefits in Jordan despite a higher induced migration increase in Tunisia. When the rise is limited to high-skilled migrants' wages, low and medium skilled workers are positively affected in Tunisia and negatively in Jordan. Finally, Mode 4 and high skilled wages increases have clear positive effects on transition rates to superior education, while the other shocks have variable effects, depending on labor market structural parameters in the two countries.

Keywords: International migration, Remittances, Labor supply, CGE, Tunisia and Jordan
JEL codes: F22 F24, J21, C68

*LEDA-DIAL Université Paris-Dauphine. Address: DIAL, 4 rue d'Enghien 75010 Paris, France, e-mail: david@dial.prd.fr

†Paris1-Panthéon-Sorbonne University, DIAL and Economic Research Forum. E-mail: marouani@univ-paris1.fr. We gratefully acknowledge the financial support provided by the Economic Research Forum. We would also like to thank Denise Konan and Chahir Zaki for fruitful discussions. This paper has also benefited from comments of Björn Nilsson, participants in the ERF Workshop on "Capital and Labor Mobility within the ERF Region" and participants in the DIAL-Dauphine research seminar. Finally, we would like to thank all the policy makers met at the different stages of the research project.

1 Introduction

There is a dynamism within Arab labor markets that brings both opportunity and challenge for economic development. The Arab world is unusually young, with about one third of the MENA population under the age of fourteen. Due to strong investments in public education, those entering the job market for the first time are more highly educated than a generation ago. These factors combine to create an educated Arab workforce that is growing rapidly. For a variety of reasons, domestic markets have not been able to absorb the availability of talent.

Traditionally, attractive wages in oil-exporting Arab countries, the EU and elsewhere has spurred emigration. Remittances have become an important source of external finance in the MENA region, representing over 2 percent of GDP. While some MENA nations are among the top recipients globally of immigration (Saudi Arabia, UAE) others are significant sending nations.

Bilateral negotiations are taking place between host and sending countries involving an increase in temporary migration quotas as an incentive for the latter to better cooperate with the former on illegal migration (for example the agreement between Tunisia and France and the two labor agreements between Egypt and Italy). Moreover, MENA countries involved in the Euro-Mediterranean process started negotiating services liberalization with the EU and their main objective is to obtain the highest concessions for Mode 4 to increase services exports and also to alleviate high unemployment for skilled workers, which is increasing in the region for new graduates (Marouani, 2010).

Increased labor mobility can have a dual payoff: fighting unemployment and enhancing growth through a more efficient use of the available resources, especially human capital. As some countries are labor abundant and other labor importers, a greater cooperation to smooth labor movements can be beneficial for all (Hoekman and Sekkat, 2009). However, the receptivity of governments to facilitate labor mobility is usually lower than for capital mobility, as witnessed by the much larger number of bilateral investment treaties and by countries' reluctance to include labor mobility provisions in trade agreements (Stephenson and Hufbauer, 2010). This disfavors labor abundant developing countries.

Jordan and Tunisia are both labor abundant, migrant sending countries. They followed almost the same path of economic liberalization in the past two decades and suffer from high unemployment rates despite relatively high and sustained growth paths. Tunisia is characterized by a higher stock of migrants, while Jordan is characterized by higher flows and a higher share of remittances to GDP¹. Tunisians emigrate mainly to Europe while Jordanians seek jobs mainly in the Gulf.

This article explores the economic issues involved with greater labor mobility in Jordan and Tunisia with a focus on the impact on employment and education. The proposed analysis addresses the following questions. How does a variation in migrant wages affect unemployment, wages and the participation rate in sending countries? The role that foreign remittances play may be well understood. Will services exports involving temporary labor mobility alleviate migration pressures and brain drain? In return, how do domestic employment imbalances affect migration behavior? Finally, what is the impact of selective migration policies that are being pushed for-

¹see Figure 1 in the Appendix

ward in destination countries? To our knowledge, there are few papers that look closely at the impact of selective migration on the source countries' labor market in a general equilibrium framework. [Grossmann and Stadelmann \(2013\)](#) use data international bilateral migration data flows and estimate that an increase in skilled migration results in higher wage inequality between host and home countries.

A general equilibrium framework seems well suited for such an analysis due to second round and feed-back effects which can not be captured through a partial equilibrium model. For example, an increase in exports induces a currency appreciation which can have a negative impact on remittances. Lower transfers can lead to a higher domestic activity rate which can offset the initial positive effect of the shock on labor demand. The model developed is intended to take into account these multiple interactions through the endogenization of emigration flows, duration and the remittance rate as well as the activity rate and human capital accumulation.

The rest of the article is organized as follows. Section 2 introduces the main conceptual issues related to the migration-labor market nexus and on the service exports entailing labor mobility. Section 3 offers a detailed description of the model, highlighting the innovative aspects, while section 4 presents the main features of the Tunisian and Jordanian labor markets and migration profiles. In section 5 we conduct the counterfactual experiments and section 6 concludes.

2 Conceptual issues

While studies on the impact of migration on host countries are still dominant, interest in the emigration impact on the home country's labor market is increasing ([Hanson, 2009](#)). We will limit our review of existing literature to three main channels through which migration impacts home countries' labor market: emigration outflows, remittances and incentive to improve one's education. The outflow of workers has various effects, depending on workers' skill composition and their substitutability or complementarity ([Hanson, 2010](#)). Most studies on this issue focus on the impact of immigration on the country's wage structure. Adapting the framework proposed by [Borjas \(2003\)](#) to a sending country case, [Mishra \(2007\)](#) uses census data and estimates that the decrease in the Mexican labor supply between 1970 and 2000 due to emigration increased the wage level by 8%. With a more detailed approach, [Aydemir and Borjas \(2007\)](#) show that due to the skill composition of the Mexican emigration, relative wages increased for the medium skilled and decreased for those at the bottom of the skill distribution. Finally, taking into account both emigration and immigration effects, [Bayangos and Jansen \(2011\)](#) argue that emigration had a negative impact on European wages, thus offsetting the positive effect of immigration. This result is due to a higher skill composition of the European outflows compared to the inflows.

The literature on remittances is very extensive, covering all aspects, from their determinants² to their macroeconomic impacts³. [McKenzie and Sasin \(2007\)](#) draw a complete picture of the relevant questions in migration research and highlight the importance, in terms of policy making, of disentangling the channels through which migration and remittances impact welfare. One of these channels is the labor market, with its various components. Thus, they highlight that the impact of migration can not be studied separately from the impact of remittances and vice versa.

²For a review of the literature on the determinants of remittances see [Rapoport and Docquier \(2006\)](#); [Carling \(2008\)](#)

³See [Amuedo-Dorantes and Pozo \(2004\)](#); [Acosta et al. \(2009\)](#); [Bayangos and Jansen \(2011\)](#)

A first strand of the literature shows that remittances tend to decrease non-migrants labor supply acting as a disincentive for labor participation and/or worked hours, which are replaced by extra leisure (Funkhouser, 1995; Rodriguez and Tiongson, 2001; Kim, 2007). However, lower labor participation in remittance receiving households can be explained by a higher probability to be involved in self employment or non-wage activities, in order to replace the migrant, or to be involved in higher education since, due to remittances, households can invest in education (Yang, 2008; Lokshin and Glinskaya, 2009).

Nevertheless, as Dustmann and Mestres (2010) point out, remittances have to be studied in connection to different migration forms since the remitting behavior depends strongly on whether the migration is temporary or permanent. Indeed, the decision to remit (and the amount remitted) and the decision on the migration length are taken jointly. On the one hand, the migrant (and her family) can decide on the optimal amount to be remitted accordingly to the expected time to be spent abroad. For instance Bauer and Sinning (2011), as well as Dustmann and Mestres (2010), confirm that temporary migrants remit more on average than permanent migrants. On the other hand, the length of migration can be decided in order to meet the family needs and the migrant earnings. While this mechanism of remittances determining the optimal migration duration is almost absent in the literature, it has already been shown that savings⁴ determine the length of the stay in the host country (Kirdar, 2009; Dustmann and Mestres, 2011).

The temporary nature of migration is far from new in economic debates and the importance of return migration has been often highlighted in the literature (Böhning (1987); Jasso and Rosenzweig (1982); Dustmann et al. (1996)). Nevertheless, in macroeconomic models, migration is always considered as permanent (Dessus and Nahas, 2008), except for the recent works on workers' mobility under Mode 4 (Walmsley and Winters, 2005; Commander et al., 2008). However, the latter's shortcoming is the use of a global model that does not allow a detailed analysis of a specific country's labor market.

Finally, another channel through which migration impacts labor supply is education. In addition to higher returns to education being the main driver for skilled migration (Hicks, 1932), the most common mechanism highlighted in the literature is the incentive to pursue higher education.

Brain-drain remains the most debated issue regarding the topic "migration and education" (Bhagwati and Hamada, 1973; Docquier and Rapoport, 2009). As Mountford (1997) and Stark et al. (1997) argue, the outflow of skilled migrants will have a positive externality on non-migrants, by increasing their skill premium and thus encouraging them to invest in education. Of course, the magnitude of this effect will depend on the probability to migrate and is conditioned on stayers not fulfilling their expectations. Stark and Wang (2002) even argue that this effect can replace education subsidies if the Government allows an optimal level of skilled migration. Pointing out the endogeneity of education subsidies, Docquier et al. (2008) emphasize the increase in inequality entailed by the replacement of education subsidies with a prospect to migrate.

Dessus and Nahas (2008) introduce the education and migration aspects in a general equilibrium model and find that higher migration rates do not always entail higher investment in education, the migration-education nexus being strongly influenced by structural parameters.

⁴Savings can be treated as remittances, such as in Bauer and Sinning (2011)

Using a general equilibrium model with altruistic households, [Baas and Melzer \(2012\)](#) analyze the macroeconomic impact of remittances through three main channels, namely the exchange rate, savings decisions and labor supply. They show that the increase of migrant outflows of transfers from Germany has a positive effect on the German economy through a converse dutch disease effect. The manufacturing sector which exports a significant part of its production is the main beneficiary, while the effects on the service sector are less favorable.

[Bussolo and Medvedev \(2008\)](#) analyze the interactions between remittances and labor supply in Jamaica using a general equilibrium model. They find that an increase in remittances generates a reduction of labor supply and a wage increase. This induces an appreciation of the real exchange rate and thus reduces the country's competitiveness.

The two main shortcomings of the general equilibrium analyses presented above are the absence of unemployment modeling as well as a modeling of the emigration decision for the latter paper.

Temporary migration has been seen as a means to limit illegal migration ([Amin and Mattoo, 2005](#)) and, using a theoretical model, [Bchir \(2008\)](#) shows how, more than temporary migration, labor mobility under Mode 4 agreements is a better solution for fighting illegal migration. Nevertheless, literature on mode 4 mobility remains scarce and mostly based on GTAP⁵ simulations. Hence, [Walmsley and Winters \(2005\)](#) and [Winters et al. \(2003\)](#) find significant welfare gains associated with the increase of mobility through Mode 4 agreements. Their conclusion is supported by [Collyer \(2004\)](#) in his review of the existing labor mobility schemes for Morocco and Egypt. After putting into perspective the relative advantages of temporary migration compared to permanent migration, [Hoekman and Özden \(2010\)](#) highlight the relevance of temporary mobility for the MENA context and develop the idea of using Mode 4 as a partial substitute to migration. Indeed, they argue that the temporary nature of the demographic 'bulge'⁶, the magnitude of the brain-drain phenomenon and the 'reciprocity' conditions of trade agreements place the temporary movement of natural persons as one of the best means to strengthen economic ties within the European Neighborhood Policy. Yet, the same is true not only for the EU-MENA ties, but also for the intra-MENA integration, as argued by [Hoekman and Sekkat \(2009\)](#) and [Hoekman and Sekkat \(2010\)](#).

3 Description of the model

The analysis is based on a general equilibrium model with a focus on migration and labor market issues. The model formalizes the emigration decision, its duration and the evolution of the remittances rate. It includes an endogenous labor supply function which depends among other factors on migrants remittances. Labor demand is disaggregated by sector, skill and age following [Marouani and Robalino \(2012\)](#). Finally the production of skills is modeled with an endogenization of transition rates between cycles.

⁵General equilibrium model developed under the Global Trade Analysis Project by the Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University.

⁶[Fargues \(2009\)](#)

Table 1: Factors of production

YLSK	Youth low-skilled labor
NYLSK	Non-youth low-skilled labor
YMSK	Youth medium-skilled labor
NYMSK	Non-youth medium-skilled labor
YHSK	Youth high-skilled labor
NYHSK	Non-youth high-skilled labor
K	Capital
KLAND	Land

3.1 Migration, local labor supply and education

Migration decision

Each labor category decides on staying at home or migrating depending on relative wages, following a constant elasticity of transformation function:

$$LST_{f,a} = \left(al_{f,a} \cdot LSL_{f,a}^{1+\frac{1}{sig1}} + am_{f,a} \cdot EMIG_{f,a}^{1+\frac{1}{sig1}} \right)^{\frac{1}{1+\frac{1}{sig1}}} \quad (1)$$

$$EMIG_{f,a} = al_{f,a} \cdot LST_{f,a} \left(\frac{W_{EMIG_{f,a}}}{W_{LS_{f,a}}} \right)^{sig1} \quad (2)$$

We consider that all those who want to emigrate, succeed in doing so. We agree that this assumption is not always valid in reality due to visas, migration costs and emigration quotas. However, if one takes into account the illegal migration, our hypothesis stands. Moreover, in the case of Tunisia, during the Arab Spring and the turmoil that followed, the border controls were practically suspended, resulting in massive migrant flows in and out of Tunisia.

Along the lines of [Karam \(2010\)](#), we consider the stock of migrants to be composed of three generations. Therefore, the new emigrants will increase the stock of first generation migrants, having taken into account the migration duration. This divide will also allow to better take into consideration the remitting behavior of migrants, which will be described below.

Local labor supply

To endogenize the labor force participation rate we introduce a consumption-leisure trade-off in a Stone-Geary utility function following [Barzel and McDonald \(1973\)](#) and [Bussolo and Medvedev \(2008\)](#). After taking into account the household's budget constraint, labor supply is determined by the following equation:

$$LS_{f,a} = (1 - \mu_0)LSpot_{f,a} - \frac{\mu_0}{W_{LS_{f,a}}} \left(HC - \sum_{i=1}^N p_i c_i \right) \quad (3)$$

where LS is the labor force participation, $LSpot$ is the working age population, μ_0 is the share of leisure in total consumption, W_{LS} is the local wage, HC is total household consumption and c_i is the consumption of good i with price p_i .

The implication of this equation is that a decrease in HC due to lower remittances will induce an increase in labor force participation.

Migration duration and remittances

We introduce the idea of temporary migration in a CGE model using the theoretical models developed by [Dustmann \(2003\)](#) and [Kirdar \(2010\)](#), along the lines of [\(Stark et al., 1997\)](#). Since consumption and migration duration are intertwined, the model is based on a joint decision framework where the migrant maximizes her consumption in the host and home country according to her preferences under three constraints. The first one is a usual budget constraint that takes into account wages in the home country, wages in the host country less remittances and purchasing power parity between the host and home country. We add two other constraints: the existence of a minimum consumption level and a migration duration that has to be higher than zero and lower than the duration of the remaining worklife.

Therefore, the optimal migration duration will be:

$$t_f^* = \frac{\tau_f(1 - \alpha)p^{\alpha/(\alpha-1)}[W_{LSf,a}/W_{EMIGf,a} - RR_f] + \tau_f\{\alpha p - [W_{LSf,a}/(W_{EMIGf,a} - RR_f)]\}}{(1 - p^{\alpha/(\alpha-1)})\{p - [W_{LSf,a}/(W_{EMIGf,a} - RR_f)]\}} \quad (4)$$

where t^* is the optimal migration duration, τ is the total lifetime, $W_{LSf,a}$ and $W_{EMIGf,a}$ the wage level in origin and destination country, $1/(1 - \alpha)$ the elasticity of intertemporal substitution of consumption, f the remittance rate per migrant and p the purchasing power parity between the two countries.

The time spent abroad will have an impact on the migration outcomes through the variation of the migrant stock.

Following [Rapoport and Docquier \(2006\)](#), we consider that a migrant's utility function depends not only on her income, but also on the welfare of her family in the home country and her degree of altruism. The household's welfare is proxied by its disposable income. By deriving this utility function, we compute the remittance rate per migrant as follows:

$$RR_f = \text{gamma}_{mf} * W_{EMIGf} + (1 - \text{gamma}_{mf}) * YD \quad (5)$$

with gamma_{mf} being the altruism coefficient, dynamically calibrated.

The total amount of remittances will be given by the following equation :

$$REM_f = RR_f * STK1_f + 0.5 * RR_f * STK2_f \quad (6)$$

Once again, we follow [Karam \(2010\)](#) in assuming that second generation migrants remit less than the first generation and third generation does not remit.

Education and supply of skills

The evolution of the total labor force by skill is driven by the population growth rate, by the current stocks of students in each cycle and by the performances of the education system at each level (pass, repetition and drop-out rates by cycle and transition rates from each cycle to the next one).

We use a model developed by [Fredriksson \(1997\)](#) in order to link migration and education incentives and endogenize the transition rates from primary to secondary and from secondary to tertiary. [Fredriksson \(1997\)](#) shows that an increase in the university wage premium has a positive effect on enrollment decisions. He argues that, when faced with the decision to follow their education to the university level, individuals make their choice depending on their schooling abilities and the relative wage premium. Our approach is similar in the sense that individuals will choose to pursue their education according to the relative skill wage premium, which also depends on foreign skilled wages. The equation for the transition rate from primary to secondary will be the following:

$$\log \frac{PERF_{trans,edus}}{(1 - PERF_{trans,edus})} = \alpha_{perf} * \log \frac{wmoy_{MSK} * (1 - U_f)}{wmoy_{LSK} * (1 - U_f)} \quad (7)$$

and the equation for the transition rate from secondary to tertiary:

$$\log \frac{PERF_{trans,edut}}{(1 - PERF_{trans,edut})} = \alpha_{perf} * \log \frac{wmoy_{HSK} * (1 - U_f)}{wmoy_{MSK} * (1 - U_f)} \quad (8)$$

3.2 Production, labor demand and wages

The production function

Production factors are subdivided in 4 items, capital plus three labor categories: unskilled (primary and less, LSL), skilled (secondary, MSL) and highly skilled workers (tertiary education, HSL).

The production function is a nested one⁷. At the highest level we assume that production is a Leontief function of value added and total intermediate consumption. The demand for capital and the 3 skills levels is modelled through a nested CES (Constant Elasticity of Substitution)

⁷See figure 5 in the Appendix

function at 2 levels, which allows for differentiated elasticities of substitution between the different factors (see equations 10, 11, 12 and 13 in the Appendix).

Capital and highly skilled labor have been modeled as relatively complementary (see equation 14 in the Appendix), following the Fallon-Layard hypothesis which has been confirmed by various empirical studies (Fallon and Layard, 1975). The third level describes the allocation of labor demand between youth and non youth (see equation 15 in the Appendix).

Wage setting

At the macro-economic level, formal wages by skill are set following a wage curve which allows a trade-off between wages and unemployment. This means that formal wages are not adjusted to "clear" the formal labor market (see equation 23 in the Appendix). Sectoral wages are linked to macro-economic wages by exogenous wage differentials which reflect different productivity levels (see equation 17).

3.3 Closures and dynamics

The closures of the model

The model has five closures: a macro closure, a government closure, an external balance closure, a labor market closure and a closure of the social security accounts. Concerning the macro closure, it is savings driven (households' marginal propensity to save is exogenous), which means that the level of investment is determined by the level of total available savings in the economy (including foreign savings). Hence as savings increase, the stock of capital and output increases. The government closure chosen consists in fixing government expenditure as a constant share of GDP and tax rates and leaving the government budget balance endogenous. The foreign balance closure consists in fixing the current account balance at its observed level. The formal labor market closure consists of a joint determination of unemployment and average formal wages through the wage curve described above.

The dynamics of the model

Model dynamics are of the sequential type. Capital accumulation is sectoral. Each year the stock of capital in each sector corresponds to last year's stock plus new investment, minus the depreciation of capital. Sectoral investment has been modeled as a function of the sectoral stocks of capital, sectoral rates of return to capital and capital acquisition costs. As previously mentioned, the evolution of the active population by skill is modeled within the education block, which relies on the actual performance rates of the education system in Jordan (pass, repetition and drop-out rates by cycle and transition rates between cycles). Government and foreign debts increase (decrease) with the yearly level of the net deficit (surplus) of Government and foreign savings.

4 Country context

4.1 Tunisia

The working age population represents 75% of the population in Tunisia and its growth rate is the double of the total population's growth rate (Mahjoub, 2010). The labor participation rate was estimated to be 47% in 2010, but important disparities are to be found concerning women (whose participation rate is 25%) and youth. Indeed, for those aged between 15 and 29 years, the participation rate falls to 34% and this can be partly explained by the high enrollment rates and the lack of job opportunities. Tunisians are becoming increasingly qualified and this is reflected by the share of the highly educated labor force that went from 6.5% of the total labor force in 1994 to 20% of the total labor force in 2011.

The unemployment rate slightly decreased, from 15.6% in 1994 to 13.3% in 2010, but surged to 18.9% in 2011. The share of medium and highly-educated unemployed increased significantly during the same period with the noticeable rise of highly-educated which went from 2% in 1994 to 32% in 2011. In other words, unemployed individuals with a university diploma represent one third of total unemployment. In 2011, the unemployment rate among graduates was 30.5% while it is 9.3% for those who have no education. Graduates' unemployment has therefore become one of the biggest challenges in Tunisia (Marouani, 2010).

Furthermore, there seems to be a correlation between age and unemployment, with high unemployment rates for the young (28.7% for those between 15-19 years old and 29.7% for those being 20 to 24 years old) that decline with age, reaching 3% for those aged 45 years and above (see Table 2).

Table 2: Unemployment rates by education level

	2005	2007	2009	2011
Illiterate	6.3	4.4	6.1	9.3
Primary	14.3	11.5	10.4	13
Secondary	13.3	13.5	14	19.9
Vocational training and university	14	18.7	21.9	30.5
Total	12.9	12.4	13.3	18.9

Source: INS

Venturini et al. (2009) point out that job creation in Tunisia does not manage to keep up with the increase in labor supply. In a survey on the Tunisian youth's willingness to migrate, Fourati (2008) stresses the importance of this phenomenon and how it evolved between 1996 and 2005, as a result of both economic and political factors. If only one quarter of the skilled youth wanted to migrate in the mid nineties, they were more than three quarters willing to leave their home country in 2005.

Along the same lines, a joint ETF (European Training Foundation) and World Bank survey shows that Tunisian have high expectancies to migrate, higher than the potential migrants in the

other surveyed countries (Albania, Egypt and Moldova).

Moreover, the intentions to migrate are high not only for the unemployed (81%) and the casual workers (75%), but also for those who have a stable job (56%) (Sabadie et al., 2010). Even though these intentions do not reflect the reality of migration flows, they highlight the problems and the frustration encountered by the Tunisian youth.

In Tunisia, the emigration policy, developed by the Ministry of Social Affairs and Solidarity, has different social, cultural, economic and information aspects. These policies are implemented by the Office of Tunisians Abroad and the National Social Security Fund. Furthermore, there are two institutions that govern controlled emigration: the National Employment and Self-Employment Agency (Agence Nationale de l'Emploi et du Travail Indépendant - ANETI) and the Tunisian Agency for Technical Cooperation (Agence Tunisienne de la Coopération Technique - ATCT). The former organizes and ensures placement of the Tunisian labor force abroad, mainly in France (62.2%), while the latter deals mainly with promoting Tunisian skills and favors the placement in Arab countries. On average, these two agencies ensure the placement abroad of 3000 Tunisian workers per year.

In terms of stock, the number of Tunisians residing outside their home country amounts to slightly more than 1 million, with the majority (almost 83%) living in Europe. The most popular destination is France, receiving around 40% of all Tunisian migrants, followed by Italy with 25%. Tunisian migration to France goes a long way back, with the first labor agreements signed in the sixties.

Table 3: Migrant stocks by region

	Europe	MENA	Other	Total
Tunisian migrants by region of residence (2005)	779200	128900	25800	933333

Source: UN Expert Group Meeting on Migration in the Arab Region, 2006

The most important share of Tunisian migrants (48.1%) has a secondary education, while university graduates represent 14.1% of migrants.

A FEMISE study (FEMISE, 2012) using the GTAP model shows that an increase in skilled migration from MENA will increase skilled wages, while decreasing the revenues of primary factors such as unskilled labor and land. They also show that the positive gain obtained by the increased migration comes at the expense of the MENA countries.

Finally, remittances play an important role in the Tunisian economy. In 2010, they amounted to 1.970 million US\$, representing 4.4% of GDP and 30 to 40% of the trade deficit.

In terms of migration to Europe, Tunisia has two main migration agreements, one with France and one with Italy. They both allow work related migration of Tunisians within quotas of 9000 workers per year for France and 4000 for Italy. Nevertheless, only a limited list of jobs is concerned (for Italy, mainly engineers, doctors and paramedical staff are allowed) and the requirements in terms of qualification are quite high, resulting in unattained quotas in both countries. Due to historical ties, Tunisia hosts an office of the French Agency for Immigration and Integration (Office Français d'immigration et d'intégration) that aims at facilitating and regulating

migration flows. Despite the bilateral agreement⁸ on concerted management of migratory flows, signed in 2008, only 25% of demanded visas have been issued in 2009.

4.2 Jordan

High population growth rates and massive immigration make the Jordanian case very interesting in terms of labor market behavior. Projections show a rapid increase in population, but a stagnation of the labor force participation rate (a stable average of 38.9% between 2000 and 2020 according to the DoS projections).

As a matter of fact, the Jordanian labor force participation rate is one of the lowest in the world (World Bank, 2008).

As in other Arab countries, the low participation rate is partly due to the female participation rate which only reaches 15%. Nevertheless, there is a significant difference with the other countries in the region and this is a high labor market participation of skilled (Amer, 2012; Assaad, 2012).

The labor force is also increasingly educated, with the share of university graduates moving from 8% to 13% over the last decade and that of those with no education declining from 18% to 12% over the same period.

Arouri (n.d.) estimates that over the next years there will be around 50,000 to 70,000 new entrants on the Jordanian labor market each year, meaning that 60,000 to 90,000 jobs need to be created each year in order to maintain a stable unemployment rate (Saif and El-Rayyes, 2010). In a thorough analysis of the Jordanian labor market, Saif and El-Rayyes (2010) highlight that even though there is no alarming trend in the labor force increase, the projections were made assuming that net migration is nil, pointing out the Government's strategy of encouraging outmigration in order to lower unemployment. Despite this, unemployment represents a significant challenge, with rates averaging 13.8% between 2003 and 2007 (Saif and El-Rayyes, 2010). Moreover, high unemployment rates increasingly concern the youth (more than the double of the national average) and the highly educated as their unemployment rate went from 12.1% in 1995 to 15.5% in 2007 for those holding a university diploma. A major concern is the unemployment's slow response to economic growth, as was the case between 2004 and 2007 when unemployment barely fell from 14 to 12% while GDP annual growth rates were averaging 8% (Assaad, 2012). A World Bank report identifies mismatches that concur to a high unemployment in Jordan. The first one is of geographical order since job creation is focused in areas with already low unemployment and Jordanian workers have insufficient regional mobility. Furthermore, high unemployment might also be due to the fact that Jordanian workers "maintain a false optimism about their employment prospects and earning potential" (World Bank, 2008). Assaad (2012) also notices this shift in the structure of Jordanian labor force towards more educated youth which, given that job creation mainly concerns low quality jobs, is willing to choose unemployment to downgrading.

Another feature of the Jordanian labor market is the significant share of public jobs, which, despite having decreased sharply between 1990 and 2000, now amounts to one third of total employment.

⁸The agreement also includes financial aid for development programs in areas such as vocational training and support for young entrepreneurs

Table 4: Unemployment rates trends by age and education level

		1995	2000	2007
Age	15-24	27.9%	26.7%	28.3%
	25-34	13.8%	11.6%	12.0%
	35-44	6.7%	6.7%	6.3%
	45-54	6.6%	7.0%	4.6%
	55-64	6.6%	5.2%	3.8%
Education level	None	10.1%	10.8%	9.3%
	Primary	14.0%	14.9%	12.6%
	Secondary	20.8%	13.5%	12.4%
	University	12.1%	11.8%	15.5%

DoS, Saif and El-Rayyes (2010)

In terms of migration, the most striking fact is the outflow of high skilled labor to GCC countries and the immigration of low-skilled foreign workers (Corm, 2009). The major destination for Jordanian migrants are the GCC countries, with an estimated stock of 141 202 Jordanian workers in 2008 (Ministry of Labor).

Table 5: Jordanian workers in GCC countries

Country	Number of workers
United Arab Emirates	54 834
Saudi Arabia	50 928
Kuwait	18 880
Qatar	10 000
Oman	3 500
Libya	3 060
Total	141 202

Source: Saif and El-Rayyes (2010), MoL

The direct consequence is the temporary nature of Jordanian migration and Wahba (2012) shows that 38% of Jordanian migrants have left in the last two years. Using the 2010 Jordan Labor Market Panel Surevy (JLMPS), she analyzes the main characteristics of Jordanian migration and its interlinkages with the local labor market. The study points out the high skill intensity of outmigration, with 62% of emigrants holding a university degree, and finds evidence of an increase in local wages due to emigration. It is important to notice that despite the high expatriation rate of skilled workers, Beine et al. (2008) find that Jordan, together with Syria and Egypt, experiences a beneficial brain drain. OECD countries attract fewer Jordanian migrants, their number having been estimated at 36 thousands according to DIOC-E database, with the United States as the main destination.

However, except the figures on migrant stocks coming from international institutions, there is very little general information on outmigration from Jordan and practically no data on emigration flows.

The World Bank ranked Jordan as 10th in terms of remittance receiving country proportionally to GDP. Remittances' share of GDP went from 16 percent in 2008 to 23 percent in 2009.

The importance of remittances is also stressed by [Chaaban and Mansour \(2012\)](#), who find that remittances have a significant positive impact on educational attainment in Jordan.

5 Experiments

This section discusses the impact of various shocks on labor supply and demand, unemployment, emigration (level and duration), remittances and the other variables mentioned above. For each simulation, the results presented in the tables are in comparison to the baseline or reference scenario. Three experiments are run: Simulation (A): What would be the impact of service exports increase? Simulation (B): What are the effects of an increase in foreign wages? Simulation (C): What happens if the increase in foreign wages is limited to skilled workers?

5.1 The impact of a Mode 4 agreement

The General Agreement on Trade in Services (GATS) emerged from the Uruguay Round covers all types of trade in services except for public services and those related to traffic rights in air transport services. GATS defines four modes of supply :

- *Mode 1* : Cross-border supply
- *Mode 2* : Consumption abroad
- *Mode 3* : Commercial presence
- *Mode 4* : Movement of natural persons

Under Mode 4 movements of service suppliers are contract-based while under temporary migration there is an employer-employee relationship.

[Marchetti and Roy \(2009\)](#) consider that the WTO, where power relationships are not as asymmetrical as in bilateral negotiations, constitutes a better forum for developing countries to obtain concessions in the area of services liberalization and especially mode 4 issues. In the Uruguay Round, under the auspice of the WTO, commitments related to mode 4 were limited to two categories: intra-company transferees (managers and technical staff related to a commercial presence) and business visitors (short-term visitors). In 1995, only six WTO members improved their commitments related to the movement of natural persons (Australia, Canada, Norway, the European Committee, India and Switzerland).

Later on, many countries, including those of the MENA region participated in the Mode 4 negotiations. These talks ended up with very shallow commitments characterized by two things: first, most of the commitments were made on a horizontal basis (applicable without distinctions to all sectors included in the schedule of a member); second, most of the members' commitments

were unbound and then they have added some exceptions by granting admission to selected categories of persons such as those who are linked to a commercial presence and highly skilled ones (managers, executives and specialists).

At the MENA region level, all countries except Egypt have unbound commitments with some exceptions for special groups as it will be shown later. In addition, it is worth to mention that there are two particular cases. The first one is Lebanon that is not a member of the WTO, so it has no commitments. Second, while Bahrain has some commitments in Mode 3, it does not have any commitment related to Mode 4.

In order to estimate the potential Mode 4 flows, the literature suggests looking at the balance of payments components such as exports in services and compensation of employees or migration and tourism statistics (Cattaneo and Walkenhorst, 2010; Magdeleine and Maurer, 2008).

Despite a low integration in terms of merchandise trade, the Arab region is better integrated regarding trade in services and this expansion of services might prove to be a significant opportunity in terms of employment (Hoekman and Sekkat, 2010). Nevertheless, services tradability is often limited by nationality or qualification requirements and Borchert et al. (2012) show that mobility under Mode 4 is the most heavily regulated, with the Gulf countries having the most restrictive trade policies regarding services.

The balance of payments can give us an idea on the value of service exports, but it does not distinguish between Mode 1, Mode 2 and Mode 4 exports. Isolating the value of Mode 4 services in total exports might prove to be difficult, but, as Cattaneo and Walkenhorst (2010) point it out mobility under Mode 4 exports is an important component in service sectors such as accounting, construction, engineering, information technology, or legal services. Therefore, we simulated an increase of 20%⁹ per year in exports potentially intensive in mode 4 transactions.

Table 6: Macro results

	Tunisia	Jordan
GDP Growth (p.p.)	0.1%	0.1%
Emigration	-2.9%	-1.1%
Total investment	1.1%	0.5%
Local labor demand	0.3%	0.5%
Total potential active population	-0.5%	0.1%
Total Unemployment (p.p.)	-0.8%	-0.2%
Total activity rate (p.p.)	-0.1%	0.1%
Remittances	-3.1%	-1.6%
Exchange rate	-0.9%	-0.5%

The impact of the shock on GDP is similar in both countries (Table 6). However, we notice a higher impact on investment (1.1% versus 0.5%) due to higher capital gains in Tunisia. Given that service exports represent a higher share in total exports in Tunisia the currency apprecia-

⁹This corresponds to a high average of the growth in service exports over the period 2005-2010 according to the Balance of payments.

tion is higher (-0.9% versus -0.5%), resulting in lower migration¹⁰ (-2.9% versus -1.1%) and remittances (-3.1% versus -1.6%) than in Jordan. While the activity rate increases slightly (0.1 percentage point) in Jordan due to the remittances reduction, it decreases in Tunisia (-0.1 percentage point) reflecting the higher impact of capital gains on households' income. Thus the unemployment reduction is higher in Tunisia (-0.8 percentage point versus -0.2 in Jordan). Our results thus show that, as predicted by Hoekman and Özden (2010), trade in Mode 4 services can be an alternative to migration.

Table 7: Results by skill

	Tunisia	Jordan
Number of unemployed		
Low skilled	-2.5%	-0.7%
Medium skilled	-5.4%	-1.4%
High skilled	-7.3%	-1.9%
Emigration		
Low skilled	-2.0%	-0.8%
Medium skilled	-2.9%	-1.2%
High skilled	-4.2%	-1.6%
Activity rate (p.p.)		
Low skilled	-0.1%	0.1%
Medium skilled	-0.1%	0.2%
High skilled	-0.1%	0.3%
Transition rates		
<i>Secondary education</i>	11.2%	1.7%
<i>Higher education</i>	1.1%	0.5%

We find evidence of a skill bias regarding unemployment reduction for the two countries, slightly higher in Tunisia due higher investment growth, given the capital-skill complementarity. This bias translated in migration by skill, with high skilled migration intentions decreasing the most (-4.2% in Tunisia and -1.6% in Jordan in Table 7).

Activity rates decrease in the same proportions for all categories in Tunisia, while they increase with the education level in Jordan. As we explained above, the Tunisian outcome is explained by the high increase in capital gains that offsets the positive impact of lower remittances and higher skilled wages on skilled labor supply.

Furthermore, non youth benefit more than youth in terms of wages and unemployment reduction (Table 8). In Tunisia, highly educated youth reap the same benefits as high skilled non youth, while in Jordan highly educated non youth benefit more in terms of both wages and unemployment. The reason lies in a higher skilled youth intensity of labor demand in service sectors in Tunisia. Thus increasing mode 4 exports would be more efficient in terms of youth inclusiveness in Tunisia.

¹⁰We remind that the migration decision and the remittance rate vary positively with the local currency depreciation.

Table 8: Simulation results by skill and age

	Tunisia	Jordan		Tunisia	Jordan
Number of unemployed			Equilibrium Formal Wage		
<i>Low skilled</i>			<i>Low skilled</i>		
Youth	-2.2%	-1.0%	Youth	0.4%	0.2%
Non youth	-3.9%	-0.6%	Non youth	0.9%	0.2%
<i>Medium skilled</i>			<i>Medium skilled</i>		
Youth	-4.4%	-1.1%	Youth	0.9%	0.3%
Non youth	-5.6%	-1.6%	Non youth	1.1%	0.4%
<i>High skilled</i>			<i>High skilled</i>		
Youth	-7.4%	-1.3%	Youth	0.8%	0.4%
Non youth	-7.4%	-4.4%	Non youth	1.5%	1.1%

The skill bias mentioned above entails a significantly higher incentive to pursue secondary education in Tunisia (11.2% versus 1.7% in Jordan). It also has a positive impact on transition rates to tertiary education in both countries (1.1% in Tunisia and 0.5% in Jordan).

5.2 The impact of an increase in foreign wages

This scenario analyzes the impact of an increase in foreign wages (by 3% per year¹¹) on domestic labor markets. Symmetrically, it could be to infer the impact of a negative shock affecting host countries. Given that the migration decision is endogenous in our model, we cannot apply an exogenous shock on the number of migrants. We therefore proxy the increase in emigration flows by an increase in foreign wages. As [Grogger and Hanson \(2011\)](#) observe, migration patterns are shaped by wage differentials.

Table 9: Macro results

	Tunisia	Jordan
GDP Growth (p.p.)	0.0%	0.2%
Emigration	6.5%	2.7%
Total investment	1.3%	3.5%
Local labor demand	-0.1%	-0.3%
Total potential active population	0.0%	-0.2%
Total unemployment (p.p.)	-0.4%	-1.0%
Total activity rate (p.p.)	-0.3%	-0.5%
Remittances	15.3%	10.4%
Exchange rate	-0.6%	-1.7%

¹¹We simulated a shock of this amplitude based on the ILO's estimation that the maximum world wage growth rate for the period 2006-2009 was of 2.9%.

The shock induces a significant increase in remittances (15.3% in Tunisia and 10.4% in Jordan in Table 9). The rise is lower in Jordan because remittances represent a higher share of GDP, thus affecting relatively more the exchange rate and households revenues, which by feed-back¹² exert a downward pressure on the remittance rate. Another reason for the lower rise of remittances in Jordan is the higher currency appreciation (-1.7% versus -0.6% in Tunisia). Furthermore, given that remittances have a higher impact on the Jordanian economy, they lead to a higher increase in investment (3.5% versus 1.3% in Tunisia) and in GDP (0.2% versus 0% in Tunisia). The rise in remittances and the higher increase in investment result in a higher impact on the activity rate in Jordan (-0.5 percentage point versus -0.3 percentage point in Tunisia).

The higher decrease of the activity rate in Jordan is reflected in a more significant unemployment reduction (-1 percentage point versus 0.4 percentage point in Tunisia). Still, the fall in unemployment in Jordan is also due to the decline of the working age population induced by the increase in emigration. Indeed, migrant outflows represent a higher share of the total labor force in Jordan, therefore their increase reduces the working age population, whereas there is no such effect in Tunisia.

In terms of emigration, the initial positive effect induced by the increase in foreign wages is limited in Jordan by the feedback effects resulting from the fall in unemployment and the rise in local wages. Moreover, this increase in wages induces a fall in labor demand, which, coupled with the investment increase, indicates evidence of substitution of labor by capital.

Table 10: Results by skill

	Tunisia	Jordan
Number of unemployed		
Low skilled	-4.3%	-11.8%
Medium skilled	-3.4%	-10.2%
High skilled	-1.2%	-6.9%
Activity rate (p.p.)		
Low skilled	-0.2%	-0.5%
Medium skilled	-0.3%	-0.6%
High skilled	-0.1%	-0.5%

High skilled unemployment decreases the least of all skill categories because their initial unemployment was the highest. In Tunisia, the difference is more important with regard to the other skill levels because the high skill activity rates decrease only slightly thus limiting the unemployment reduction (see Table 12).

5.3 Increase in high skilled wages

The scenario consists in increasing high skilled foreign wages by 6% (the double of the growth rate from the previous simulation) per year above the baseline scenario. The wages of the other categories continue to grow at the reference scenario rate. The aim of this simulation is to

¹²The domestic household feed-back effect acts through the altruism mechanism.

Table 11: Macro results

	Tunisia	Jordan
GDP Growth (p.p.)	0.0%	0.1%
Emigration	2.3%	1.2%
Total investment	0.6%	1.9%
Local labor demand	0.1%	0.0%
Total potential active population	0.0%	-0.2%
Total unemployment (p.p.)	-0.1%	-0.3%
Total activity rate (p.p.)	0.0%	-0.1%
Remittances	6.4%	5.6%
Exchange rate	-0.2%	-1.0%

analyze the impact of a high skilled biased shock on the labor market and in particular the indirect effects on the other categories.

The results at the macro level are similar to the ones observed in the previous scenario, but of lower intensity (Table 11). The main differences are that remittances variations in both countries are much closer in this simulation. Despite this similarity, the impact on investment and the exchange rate is higher in Jordan due to a larger share of remittances in GDP. Moreover, the total activity rate does not vary anymore in Tunisia, while it slightly decreases in Jordan (-0.1%).

The shock benefits high skilled workers in terms of unemployment reduction in both countries, but the magnitude is very different (-2.1% in Tunisia versus -14.1% in Jordan as Table 12 shows). The unemployment outcomes of the other categories are also dissimilar with an increase of unemployment for low and medium skilled in Jordan and a decrease in Tunisia. The higher decrease of unemployment in Jordan is due to a higher decline of activity rates (-0.9% versus -0.2% in Tunisia) despite a lower increase in emigration (8.2% versus 16.9% in Tunisia). The negative impact on low and medium skilled workers is due to an increase of their activity rates in Jordan, while these rates do not vary in Tunisia. These two results reflect the significant impact of remittances on households' incomes in Jordan.

The outcomes observed in terms of unemployment (Table 13) are also reflected in terms of wage variations with a significant increase of high skilled wages in Jordan (2% for the youth and 4.9% for the non youth), versus a limited rise for Tunisian high skilled workers (0.3 and 0.4%). The increase for the non youth is higher than for the youth in Jordan because their unemployment rate is initially much lower, thus putting additional upward pressure on their wages when unemployment decrease. The consequences of these wage variations are a slightly stable labor demand in Tunisia versus a decrease in Jordan, more marked for elderly workers.

Wage distribution effects are limited in Tunisia with a slight increase of high skilled wages vis a vis low and medium skilled ones. In Jordan wage inequality increases across skills and among age categories. High skilled see their wages increase significantly vis a vis the two other skill levels. If we consider the age dimension across skills, the low and medium skilled non youth are more affected, while the high skilled non youth are the main beneficiaries of the shock.

Higher skilled migrants' wages are a very strong incentive for tertiary education in Jordan (the

Table 12: Unemployment by skill and education

	Tunisia	Jordan
Number of unemployed		
Low skilled	-0.6%	1.1%
Medium skilled	-0.4%	0.1%
High skilled	-2.1%	-14.1%
Activity rate (p.p.)		
Low skilled	0.0%	0.2%
Medium skilled	0.0%	0.2%
High skilled	-0.2%	-0.9%
Emigration		
Low skilled	-0.5%	-0.8%
Medium skilled	-0.5%	-1.2%
High skilled	16.9%	8.2%
Transition rates		
Secondary education	-0.6%	0.7%
Higher education	0.4%	5.3%

transition rate increases by 5.3%) but have a limited impact on transitions to secondary education (0.7%). In Tunisia the positive effects on higher education are much lower (0.4%) and the effect on secondary education are negative (-0.6%). Our results are in line with the empirical literature that finds a positive impact of brain drain on the skill composition of the labor force, except for countries with a low level of human capital (Beine et al., 2001, 2008).

Table 13: Simulation results by skill and age

	Tunisia	Jordan	Tunisia	Jordan	
Number of unemployed		Equilibrium Formal Wage			
<i>Low skilled</i>		<i>Low skilled</i>			
Youth	-0.4%	0.6%	Youth	0.1%	0.0%
Non youth	-1.0%	1.2%	Non youth	0.3%	-0.2%
<i>Medium skilled</i>		<i>Medium skilled</i>			
Youth	-0.4%	-1.0%	Youth	0.1%	0.3%
Non youth	-0.4%	0.9%	Non youth	0.1%	-0.1%
<i>High skilled</i>		<i>High skilled</i>			
Youth	-2.7%	-12.5%	Youth	0.3%	2.0%
Non youth	-1.9%	-22.0%	Non youth	0.4%	4.9%

6 Conclusion

This article develops a framework allowing an in-depth analysis of the circular linkages between workers' international mobility and labor market outcomes in home countries. We built upon the recent microeconomic literature dealing with the migration decision, its duration and the remittance behavior and develop a dynamic general equilibrium model integrating these mechanisms as well as a detailed treatment of labor supply, demand and education. The model is applied to two MENA countries, Jordan and Tunisia, sharing many similarities, but with different migration profiles.

The simulation of the increase of services exports potentially involving professionals mobility has a positive impact on economic and labor outcomes in both countries. As suggested in the literature we find evidence of substitution of migration by services' exports, particularly for high skilled workers. Higher Mode 4 exports opportunities could thus reduce brain drain. However, we notice a substitution of labor by capital in both countries, which given the capital-skill complementarity induces higher wage inequality among skills. Furthermore, the scenario benefits more the youth in Tunisia, being potentially more youth inclusive than in Jordan.

Furthermore, an increase in foreign wages has higher benefits in Jordan despite a higher induced migration increase in Tunisia. The simulation results show a lower impact on high skilled employment outcomes, due to labor market structural patterns. When the increase in foreign wages only concerns high skilled emigrants, the effects are positive on local highly educated workers, particularly in Jordan. However, the impact on low and medium skilled local workers, ambiguous at first sight, depends on the weight of migrants flows in the working age population. In Jordan where migrants flows represent a higher share, the effects on low and medium skilled workers are negative, while the impact is positive in Tunisia on the same categories.

Mode 4 and high skilled wage increases have clear positive effects on transition rates to tertiary education, while the other shocks have variable effects, depending on labor market structural parameters in the two countries.

Among the limits of the current research we can cite the reliance on the altruism hypothesis as the sole determinant of transfers, while there could be other reasons such as investment, savings or reimbursement. If these various reasons had been taken into account, the remittance rate would have depended also on the interest rate in the origin countries, but we believe that the results would not have changed much. Moreover, we did not have data on the mapping by skill between senders and recipients of remittances. Finally the absence of data on Mode 4 transactions is a limitation to the analysis of its economic implications.

An extension of this research could consist in setting surveys in Tunisia and Jordan allowing to capture the determinants of migration and remittance behavior. These surveys would allow us to improve the accuracy of the macroeconomic analysis, but also to perform microsimulations in a general equilibrium framework. Another step would be taking into account migrants' skill acquisition during their time abroad, therefore adding another dimension to the human capital accumulation modeling.

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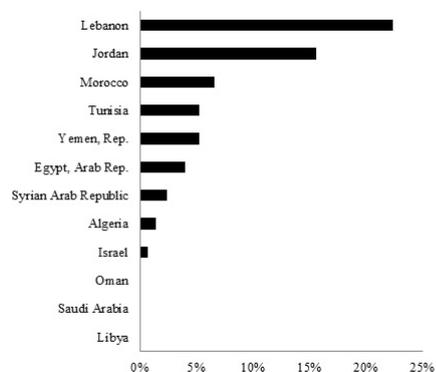
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7 Appendix

7.1 Figures

Figure 1: Inflow of remittances as a share of GDP



Source: [Borchert et al. \(2012\)](#)

World Bank staff estimates based on the IMF's Balance of Payments Statistics Yearbook 2008.

7.2 The model

Table 14: Main elasticities of the model

Elasticity of substitution	
Of the capital (K) and high-skilled demand (HSK) bundle	0.3
Of the medium-small bundle	0.9
Of the low-skilled bundle	0.9
Of the youth-non-youth bundle	0.5
Elasticity of the wage curve	-0.22
Elasticity of transformation of total labor supply	1.2
Elasticity of substitution between imports and local products	3
Elasticity of transformation between local products and exports	3

Table 15: Sets

<i>f</i>	Factors (low-, medium-, high-skilled, capital, land)
<i>a</i>	Age (youth, non-youth)
<i>ac</i>	Activities - commodities (37 sectors)
<i>c</i>	Educational cycles (primary, secondary, higher education)

Main equations of the model

Production and demand factor equations

$$VA_{ac} = A_1 [a_{KHS} \cdot KHS_{ac}^{(\frac{\sigma_1-1}{\sigma_1})} + a_{MSL} \cdot MSL_{ac}^{(\frac{\sigma_1-1}{\sigma_1})} + a_{LSL} \cdot LSL_{ac}^{(\frac{\sigma_1-1}{\sigma_1})}]^{(\frac{\sigma_1-1}{\sigma_1})} \quad (9)$$

$$KHS_{ac} = A_1^{(\sigma_1-1)} \cdot VA_{ac} \cdot (a_{KHS} \cdot \frac{PVA_{ac}}{PKHS_{ac}})^{\sigma_1} \quad (10)$$

$$KHS_{ac} = A_1^{(\sigma_1-1)} \cdot VA_{ac} \cdot (a_{KHS} \cdot \frac{PVA_{ac}}{PKHS_{ac}})^{\sigma_1} \quad (11)$$

$$MSL_{ac} = A_1^{(\sigma_1-1)} \cdot VA_{ac} \cdot (a_{MSL} \cdot \frac{PVA_{ac}}{PMS_{ac}})^{\sigma_1} \quad (12)$$

$$LSL_{ac} = A_1^{(\sigma_1-1)} \cdot VA_{ac} \cdot (a_{LSL} \cdot \frac{PVA_{ac}}{PLS_{ac}})^{\sigma_1} \quad (13)$$

$$KHS_{ac} = A_2 [a_K \cdot K_{ac}^{(\frac{\sigma_2-1}{\sigma_2})} + a_{HSL} \cdot HSL_{ac}^{(\frac{\sigma_2-1}{\sigma_2})}]^{(\frac{\sigma_2-1}{\sigma_2})} \quad (14)$$

$$LD_{ac,f} = \left[\sum_a a_a(a) \cdot LDA_{ac,f,a}^{(\frac{\sigma_3-1}{\sigma_3})} \right]^{(\frac{\sigma_3-1}{\sigma_3})} \quad (15)$$

Labor supply

$$LS_{f,a} = (1 - \mu_0) LS_{pot_{f,a}} - \frac{\mu_0}{W_{LS_{f,a}}} (HC - \sum_{i=1}^N p_i c_i) \quad (16)$$

Migration decision

$$LST_{f,a} = \left(al_{f,a} \cdot LSL_{f,a}^{1+\frac{1}{sig1}} + am_{f,a} \cdot EMIG_{f,a}^{1+\frac{1}{sig1}} \right)^{\frac{1}{1+\frac{1}{sig1}}} \quad (17)$$

$$EMIG_{f,a} = al_{f,a} \cdot LST_{f,a} \left(\frac{W_{EMIG_{f,a}}}{W_{LS_{f,a}}} \right)^{sig1} \quad (18)$$

Migration duration

$$t_f^* = \frac{\tau_f(1-\alpha)p^{\alpha/(\alpha-1)}[W_{LS_f}/(W_{EMIG_f} - RR_f)] + \tau_f\{\alpha p - [W_{LS_f}/(W_{EMIG_f} - RR_f)]\}}{(1-p^{\alpha/(\alpha-1)})\{p - [W_{LS_f}/(W_{EMIG_f} - RR_f)]\}} \quad (19)$$

Remittances

$$RR_f = gamma_{mf} * W_{EMIG_f} + (1 - gamma_{mf}) * YD \quad (20)$$

$$REM_f = RR_f * STK1_f + 0.5 * RR_f * STK2_f \quad (21)$$

Education

$$\log \frac{PERF_{trans,c}}{(1 - PERF_{trans,c})} = \alpha_{perf} * \log \frac{wmoy_{MSK} * (1 - U_f)}{wmoy_{LSK} * (1 - U_f)} \quad (22)$$

Wage curve

$$\ln(WL_f) = \beta_1 + \beta_2 \cdot U_f \quad (23)$$

Capital accumulation

$$K_{ac,t} = K_{ac,t-1}(1 - \delta) + I_{ac,t} \quad (24)$$

Investment

$$INV_{ac} = \gamma \cdot KD_{ac} \cdot e \cdot \frac{\lambda_{ac} \cdot RK_{ac}}{PK_{ac}} \quad (25)$$

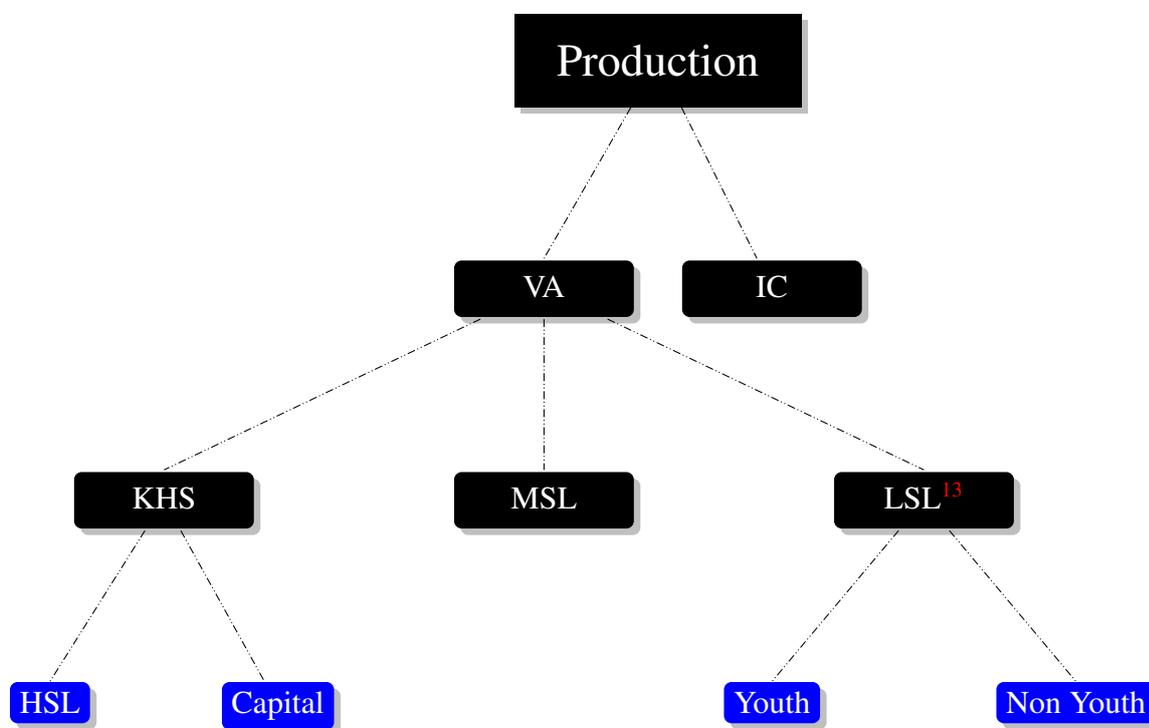
Main variables of the model

L^S Total labor supply

KHS_i	Capital and High Skilled labor bundle
LSL_i	Low skilled labour bundle
MSL_i	Medium skilled labour bundle
$LD_{i,f}$	Labor Demand by skill
$LDA_{i,f,a}$	Labor Demand by skill and age
$LDS_{i,f,a,s}$	Labor Demand by skill, age and status
PVA_i	Value Added Price
$PKHS_i$	Capital and High Skilled labor price
PMS_i	Medium Skilled labor price
PLS_i	Low labour supply price
K_i	Capital
W_f	Wages by skill
$WEMIG_f$	Foreign wages by skill
$WMOY_f$	Average wage by skill
LS	Total labour supply by skill and age
$EMIG$	Emigration by skill and age
RR	Remittance rate per migrant
REM	Total remittances
t^*	Migration duration
$STK1$	Migrant stock 1st generation (most recent)
$STK2$	Migrant stock 2nd generation
HC	Household consumption
HC	Household disposable income
$PERF$	Transition rate LSL
Local labour supply by skill and age	
$LSLT$	Local labour supply by skill and age including downgraded
LSD	Local downgraded by skill and age
$LSND$	Local non downgraded by skill and age
LSF	Formal labour supply by skill and age
LSI	Informal labour supply by skill and age
W	Wages by labour category and age
KD_i	Capital demand
PK_i	Capital price
RK_i	Return of capital

Production function and labor supply figures

Figure 5: The production function



¹³HSL and MSL are declined as LSL, but the formal/informal and youth/non youth branches have been omitted to keep the illustration simple