# Regional Migration and Wage Inequality in the West African Economic and Monetary Union *

Esther Mirjam Girsberger†, Romuald Méango‡and Hillel Rapoport§

February 21, 2019

**Abstract**

This paper investigates the impact of regional migration on average wages and wage inequality in the West African Economic and Monetary Union (UEMOA). We exploit a unique data from a unified labour force household survey which covers natives and migrants in the seven economic capitals of the region. We estimate the counterfactual wage distributions of UEMOA migrants in absence of migration to evaluate the effect of regional migration. We find that regional migration increases the average wage by 1.8% and it entails a decrease in inequality in the UEMOA region between -1.5% (for the Gini coefficient) and -4.5% (for the interquartile ratio). The decrease in inequality in the UEMOA region is driven by a reduction in inequality between countries, while the migration effect on within-inequality differs across countries and remains overall small. When accounting for possible general equilibrium effects of migration on stayers' wages, we find a similar or even stronger decrease in inequality, yet a smaller increase in the average wage. With general equilibrium effects, (negatively-)intermediately selected UEMOA migrants depress the average wage of natives in their host country and lead to a slight increase of the average wage among natives in the sending country, with the former effect dominating. Moreover, regional migration in the UEMOA mostly flows from countries with low wages to countries with higher wages. In combination with the general equilibrium effects described above this leads to a larger decrease in between-country inequality than in a setting with exogenous wages.

**Keywords:** Migration, inequality, Gini index, West Africa.

**JEL classification:** F22, J61, O15.

*The authors thank the *Agence Française de Développement* for its financial support (convention IRS/ECO/437-2017). The authors thank DIAL - especially Constance Torelli and Francois Roubaud - for making the 1-2-3-Survey data available. The paper benefitted from comments from conference participants at the CISEA.

†University of Technology Sydney & IZA. Corresponding author. Contact: EstherMirjam.Girsberger@uts.edu.au. Address: UTS Business School, Department of Economics, 14-28 Ultimo Rd, Ultimo NSW 2008, Australia. Phone: +61 2 9514 3371.

‡Max-Planck Institute for Social Law and Social Policy, Munich. Contact: Meango@mea.mpisoc.mpg.de

§Paris School of Economics, Université Paris 1 Panthéon-Sorbonne, CEPII & IZA. Contact: Hillel.Rapoport@univ-paris1.fr

# 1 Introduction

Population mobility is a powerful force with important economic consequences for the individual migrant as well as for host and home societies. Economic theory postulates that an efficient allocation of agents to the sectors where they are the most productive should reduce within and overall inequality when wages are exogenous (see e.g., Roy, 1951; Heckman and Honoré, 1990). In such a setting, we would expect that regional migration increases the average wage and contributes to the reduction of wage inequality in the region. In a similar vein with endogenous wages, the neoclassical framework (e.g. Harris and Todaro, 1970) predicts that migration should serve as an equilibrium mechanism, bringing home and destination countries/regions' wages closer. There are forces, however - such as agglomeration effects and human capital externalities - that play in the other direction (see e.g. Kanbur and Rapoport, 2005, for a theoretical exposition on how these forces balance out). Hence, it is theoretically uncertain whether destination wages and wages at home will converge or diverge.

The difficulty in empirically assessing how migration affects incomes and income inequality is that one cannot observe the counterfactual wage distribution and level of inequality in the absence of migration. Moreover, most data sets only cover the host or the source economy, but rarely both. This makes it difficult to concurrently study the effects of migration on the source and host country.

In this paper we exploit a unique data set covering several countries to study the effect of regional migration on average wages and wage inequality in the West African Economic and Monetary Union (UEMOA). UEMOA countries have a long history of population mobility. Due to their common colonial history, all seven founding members share the same official language (French), a common currency and similar institutions. Furthermore, at the political level, free movement of persons in the region has been institutionalised since 1979. The colonial heritage, as well as other socio-economic factors such as land degradation, drought, limited economic opportunities, political and ethnic tensions have encouraged regional mobility.

Our empirical analysis relies on household survey data from the first phase of the 1-2-3-Survey (Brilleau, Roubaud, and Torelli, 2004) conducted in 2001 and 2002 in the economic capitals of the founding member states of UEMOA. More specifically, these include Benin (Cotonou), Burkina Faso (Ouagadougou), Côte d'Ivoire (Abidjan), Mali (Bamako), Niger (Niamey), Senegal (Dakar) and Togo (Lomé). In our data, we observe migrants from UEMOA countries living in one of the seven cities, but also the natives in the destination city, as well as the natives in the capital of the country of origin. The data set has more than 50,000 observations of working age individuals, of which around 5% have migrated within the UEMOA.

To estimate the counterfactual wage distribution of these UEMOA migrants, we first assume a framework of exogenous wages and apply the methodology developed by Chiquiar and Hanson (2005), which is an extension of the methodology developed by DiNardo, Fortin, and Lemieux (1996). In this setting, the counterfactual wage distribution of migrants is a weighted average of the observed conditional wage distributions of natives in the origin.

Our main finding is that regional migration increases the average wage in the UEMOA by 1.8% and it entails a decrease in overall wage inequality between -1.5% (for the Gini coefficient) and -4.5% (for the interquartile ratio).[1] This is a moderate, yet non-negligeable effect, given that around 5% of the UEMOA working age population migrate within the UEMOA. Our results also show that the effect of regional migration is heterogeneous across countries. Côte d'Ivoire, the main destination of migrants in the UEMOA, sees its average wage and inequality drop as a result of regional migration, which alters the composition of the Ivorian working population. In the main source countries, in contrast, regional migration leads to a higher average wage and mixed effects on inequality (i.e. not significant effects or increases in within-country wage inequality). Decomposing the effect of regional migration on inequality in the UEMOA into its between-country and within-country components[2], we show that regional migration operates through a reduction of inequality between countries (by -30%), but leaves within-country inequality by and large unaffected.

To gauge the robustness of our analysis, we first implement an instrumental variable framework to test for selection-on-unobservables. We do not find evidence of selection on unobservables once we control for selection on observables. Second, we extend our analysis to account for general equilibrium effects of migration on wages in the host and source countries. To do so, we presume two skill groups (low and high) which are affected differently by migration. Using different values of the wage elasticity with respect to migration reported in the literature[3], we show that general equilibrium effects on wages tend to exacerbate our previous result that regional migration decreases wage inequality in the UEMOA through lowering between-country differences. The effect of regional migration on the average wage is positive, but smaller and no longer statistically significant compared to the framework with exogenous wages. These findings are driven by the following two facts. First, UEMOA migrants tend to be selected from the lower-intermediate part of the wage distribution (both at origin and destination). Secondly, regional migration in the UEMOA generally flows from low wage countries to countries with higher wages. When accounting for general equilibrium effects, regional migration results in a depression of the average wage of natives in the destination country and a slight increase in the average wage among natives in the sending country, with the former effect dominating. Furthermore, this results in a larger decrease in between-country inequality than in a setting with exogenous wages.

Our paper ties into a rich methodological and empirical literature, which analyses the effect of migration on income and income inequality in source and host countries. There is a vast empirical literature studying the effects of immigration on labour market outcomes of natives in host countries, most of it focuses on estimating wage elasticities of natives to immigration in the US and other OECD countries as host countries (for a recent review of the literature

[1] Overall inequality refers to the degree of inequality measured across the whole UEMOA region, that is, when pooling all UEMOA countries into one region.

[2] We define within and between inequality with reference to the country of residence. An alternative approach is to define it with reference to the country of origin. We find the first definition more appealing as migrants are often long-term immigrants.

[3] See Mishra (2007) for evidence on Mexico as a source country and Dustmann, Schönberg, and Stuhler (2016) for a recent review of the effect of immigration on host countries.

see Dustmann, Schönberg, and Stuhler, 2016). The effect of migration on income inequality is oftentimes analysed in terms of how educated and less educated natives are differently affected by immigration. For the US, Card (2009) argues that the relative skill mix of immigrants was similar to the one of natives, leaving native wage inequality in the US mostly unaffected, but increasing wage inequality over all workers (given that immigrants are clustered at the extreme ends of the education distribution).

Empirical evidence on the effect of emigration on incomes/wages in source countries, and in particular, on developing countries, is far less abundant.[4] Barham and Boucher (1998) study how migration and remittances affect income inequality in Bluefields (Nicaragua) and find that emigration (coupled with remittances) increase income inequality in the origin. Mishra (2007) estimates that emigration from Mexico has a strong, positive effect of wages on Mexico: A 10% decrease in the number of Mexican workers due to emigration in a skill group, increases the average wage in that skill group by about 4 percent. Moreover, she suggests that emigration could be a possible explanation for the increasing wage inequality in Mexico.[5] Using the rich information on labour market outcomes and wages of migrants and natives within all Francophone capitals of the UEMOA allows us to study the effect of regional migration in an economic and monetary union in a Sub-Saharan context and concurrently quantify its effect on source and host countries.[6] In contrast to these earlier findings for the Latin American context, our estimates uncover more nuanced effects and show that wage inequality in source countries can either decrease or increase as a result of emigration. As for the host country, our results also highlight a difference with respect to the evidence reported for the US: Wage inequality in the capital of Côte d'Ivoire, the main destination of UEMOA migrants, decreases as a result of immigration, which is mostly intermediately selected.

This paper is also related to another vein of research which investigates the effects of labour mobility on regional income convergence from a macroeconomic perspective. An interesting paper by Phan and Coxhead (2010) on Vietnam finds mixed (positive and negative) effects of regional migration on income ratios between pairs of provinces. A robust inequality-reducing impact of migration is only found for migration flows into trade-oriented provinces. Yang (2004) offers empirical evidence that regional migration in Thailand helps to reduce cross-province inequality in household incomes. Our empirical results provide further support to these previous findings on the inequality-reducing effect of regional migration between regions in a development context. The unique data set structure allows us to go beyond measuring inequality between regions/countries, but instead to decompose overall inequality in the UEMOA into its 'between-' and 'within-country' components. Our results highlight the importance of within-country inequality for overall wage

[4] A different, but related question on migration and inequality is analysed by McKenzie and Rapoport (2007) who study how wealth affects migration and inequality. They find that migration has had an inequality-reducing effect across communities with relatively high past migration levels.

[5] .

[6] Most of the literature has focused on analysing either the effect on source or on host countries. Docquier, Özden, and Peri (2014) present an exception by studying the effect of immigration and emigration in the OECD, where migrants tend to be positively selected. Using a model to simulate the effect of migration in the OECD between 1990 and 2000, they find that immigration has had a positive effect on wages of less educated natives, while it increased (or left unaffected) the average native wages. Emigration, however, has decreased wages of less educated native workers and increased inequality within countries.

inequality in the West African Economic and Monetary Union.

In what follows, Section 2 describes the data and provides descriptive statistics on migration and inequality. Section 3 reviews the assumptions and econometric methodologies to estimate a counterfactual distribution of wages for migrants. Then, Section 4 presents the empirical results on the change in average wages and inequality from the counterfactual to the observed scenario, along with some robustness analyses. Section 5 extends the previous analysis to account for potential general equilibrium effects. Section 6 concludes.

## 2 Data and descriptive statistics

### 2.1 1-2-3-Survey Data

The empirical analysis of this paper draws on the first phase of the 1-2-3-Survey (see Brilleau, Roubaud, and Torelli (2004)) conducted in 2001/2002 in the economic capitals of the founding member states of the West African Economic Monetary Union (UEMOA). The founding member states of the UEMOA include (economic capitals in brackets): Benin (Cotonou), Burkina Faso (Ouagadougou), Côte d'Ivoire (Abidjan), Mali (Bamako), Niger (Niamey), Senegal (Dakar) and Togo (Lomé).[7] For reasons of simplicity, we henceforth use the name of the country, rather than the name of the economic capital.

The 1-2-3-Survey is a household survey with approximately 7,500 to 14,000 individual observations per country. It contains rich information on socio-demographic characteristics, current labour market status, part of the employment history (max. last two spells), and actual earnings of employed individuals (including self-employed). The attractiveness of this data set for our study comes from the harmonisation of questions and variable definition across all countries. In particular, labour market status (employment, self-employment, and unemployment), wage and hours worked are similarly defined. Moreover, the survey provides a representative sample of the labour market of all seven capitals at the same period of time. One drawback of the survey lies in its restriction to the economic capital of each country, this leads us to miss out the rural/agricultural labour markets from where part of the emigration originates and which attracts a part of the regional migration.

In order to produce a sample of the population of interest, we implement the following steps: First, we restrict the sample to individuals with a UEMOA citizenship and who are of working age (15-65).[8] Second, we distinguish natives from UEMOA migrants. We define a UEMOA migrant in country $i$ from country $j$ as an individual who i) is not a citizen of country $i$, ii) has last lived in country $j$ and iii) has arrived in country $i$ after the age of 15. All other individuals are classified as natives (i.e. citizens of country $i$, young immigrants, etc.).[9]

[7] The eighth member of the UEMOA, who joined the union in 1997, is Guinea-Bissau. It is the only non-Francophone country in the union and was not covered by the survey.

[8] Among the working age population, less than 1.4% of the sample have a non-UEMOA nationality.

[9] This definition of natives and migrants is partly driven by the fact that the survey only identifies the citizenship of resident natives (i.e. those who are born and live in one of the seven capitals). For all other individuals, we only

## 2.2 Descriptive statistics

Table 1 presents some sample statistics on natives and UEMOA migrants by country of residence.

| | | BE | BF | CI | MA | NI | SN | TG | Total |
|---|---|---|---|---|---|---|---|---|---|
| Observations | Natives | 6,986 | 8,169 | 5,587 | 7,129 | 7,628 | 11,745 | 5,888 | 53,132 |
| | Migrants | 181 | 37 | 940 | 43 | 292 | 19 | 162 | 1,674 |
| | Net migrants | -41 | -465 | 903 | -349 | 102 | -68 | -52 | 0 |
| Population (weighted) | | 493,009 | 524,643 | 1,778,258 | 627,119 | 372,753 | 1,195,161 | 491,617 | 5,482,560 |
| Share of Migrants | | 2.1% | 0.4% | 12.9% | 0.5% | 3.5% | 0.1% | 2.7% | 5.0% |
| From... | | | | | | | | | |
| Benin | | | 14.8% | 5.9% | 1.5% | 23.8% | 46.3% | 61.5% | 9.3% |
| Burkina Faso | | 0.8% | | 45.9% | 57.6% | 16.5% | 0.0% | 4.8% | 40.7% |
| Côte d'Ivoire | | 1.8% | 16.5% | | 19.7% | 0.6% | 11.0% | 3.8% | 0.6% |
| Mali | | 5.1% | 17.7% | 23.5% | | 38.6% | 33.9% | 5.8% | 22.6% |
| Niger | | 26.3% | 0.0% | 8.9% | 5.8% | | 0.0% | 21.6% | 9.5% |
| Senegal | | 0.2% | 2.2% | 6.2% | 15.4% | 1.6% | | 2.5% | 5.6% |
| Togo | | 65.7% | 48.8% | 9.7% | 0.0% | 18.8% | 8.9% | | 11.6% |

Source: Authors' calculation from 1-2-3 Survey. All average calculations use individual weights.
Notes: Net migrants are calculated as the difference between the number of (im)migrants and emigrants (not shown) by country.

Table 1: Migration sample statistics by country of residence

In our sample, 5% of the working age population are UEMOA migrants. Côte d'Ivoire (CI) hosts by far the largest share of migrants (13% of the working age population); this represents two thirds of regional migration in the UEMOA. Other common destinations are Niger (NI) and Togo (TG) where migrants make up 3% of the capital's population. In Burkina Faso (BF), Mali (MA) and Senegal (SN), the sample of immigrants is small (less than 100 observations).[10] Because the sample size of migrants living in Senegal is too small, we will keep the discussion of results on migrants in Senegal to a minimum.[11]

Burkina Faso and Mali are the main source countries, together they account for two thirds of the regional emigration. Ivorians are the least mobile regionally as they constitute less than 1% of the regional migration stock. Morever, only Côte d'Ivoire and Niger have a positive net migration inflow, while all other countries have a net outflow, with Burkina Faso and Mali reporting the largest net (and gross) outflows.

know whether she has UEMOA citizenship and the last country of residence.

[10] The survey sample is representative for the migrant population in Abidjan (Côte d'Ivoire), Lomé (Benin) and Bamako (Mali), while the representativeness may be questioned for the other countries (De Vreyer, Gubert, and Roubaud (2009)). According to the World Development Indicators of the World Bank, the international migrant stock (% of population) for each country in our sample in year 2000 were: 1.9% (Benin), 4.5% (Burkina Faso), 12.1% (Côte d'Ivoire), 1.7% (Mali), 1.1% (Niger), 2.4% (Senegal), 2.8% (Togo). The important discrepancy between the migrant share of our sample (Ouagadougou) and the World Bank data on Burkina Faso comes from the fact that rural Burkina Faso hosts many Malian migrants, and thus, they are not accounted for in the 1-2-3 survey (De Vreyer, Gubert, and Roubaud (2009)).

[11] Many UEMOA migrants have lived in a non-UEMOA country before migrating to Senegal and thus, they are dropped from our sample.

Descriptive statistics on socioeconomic variables are summarised in Table 2. As our main measure of individual wage, we consider the hourly wage in the main activity calculated as the ratio between the wage in the self-reported main activity and the number of hours worked in this activity.[12] We trim the obtained hourly wage distribution at the top percentile to minimize concerns of measurement error.

| | | BE | BF | CI | MA | NI | SN | TG | Total |
|---|---|---|---|---|---|---|---|---|---|
| Age | Natives | 33.0 | 31.4 | 31.1 | 33.0 | 33.0 | 32.3 | 31.6 | 31.9 |
| | Migrants | 31.8 | 30.7 | 34.5 | 31.7 | 35.1 | 40.0 | 32.0 | 34.3 |
| Female | Natives | 52.7% | 45.0% | 50.5% | 46.2% | 40.2% | 45.7% | 52.1% | 48.2% |
| | Migrants | 53.5% | 31.1% | 30.1% | 39.4% | 46.8% | 37.2% | 35.9% | 31.9% |
| Active on labour market | Natives | 92.8% | 76.9% | 81.0% | 87.0% | 75.1% | 79.7% | 88.6% | 82.5% |
| | Migrants | 95.0% | 76.0% | 93.4% | 90.0% | 86.1% | 100.0% | 91.3% | 92.9% |
| Self-employed | Natives | 73.9% | 62.4% | 49.2% | 69.7% | 57.1% | 56.5% | 71.1% | 60.1% |
| | Migrants | 74.9% | 77.2% | 67.2% | 68.2% | 74.2% | 65.4% | 79.1% | 68.3% |
| In formal sector | Natives | 16.7% | 21.6% | 31.8% | 19.6% | 22.7% | 23.1% | 18.7% | 24.0% |
| | Migrants | 13.2% | 19.6% | 24.4% | 6.2% | 21.7% | 34.6% | 24.9% | 23.8% |
| Without schooling | Natives | 24.8% | 39.9% | 24.2% | 49.5% | 39.5% | 34.1% | 18.0% | 31.1% |
| | Migrants | 49.9% | 18.0% | 64.4% | 34.6% | 65.3% | 4.3% | 32.8% | 61.7% |
| With some upper secondary schooling | Natives | 43.5% | 13.5% | 22.6% | 64.5% | 55.6% | 45.4% | 32.6% | 36.1% |
| | Migrants | 54.4% | 21.1% | 4.8% | 52.2% | 71.2% | 47.2% | 40.2% | 11.6% |
| Years of schooling (if some schooling) | Natives | 8.2 | 8.0 | 8.5 | 8.5 | 8.2 | 7.6 | 7.9 | 8.2 |
| | Migrants | 6.9 | 7.9 | 6.4 | 9.9 | 6.6 | 11.1 | 7.0 | 6.7 |
| Earnings ( ,000 FCFA ) | Natives | 43.3 | 46.7 | 91.9 | 55.9 | 58.1 | 70.4 | 30.1 | 64.8 |
| | Migrants | 34.9 | 42.6 | 56.6 | 95.3 | 34.6 | 235.6 | 48.5 | 55.6 |
| Hourly earnings ( ,000 FCFA ) | Natives | 1.1 | 1.1 | 2.4 | 1.4 | 1.5 | 1.9 | 0.8 | 1.7 |
| | Migrants | 0.7 | 0.9 | 1.4 | 2.2 | 0.9 | 6.4 | 1.1 | 1.4 |

Source: Authors' calculation from 1-2-3 Survey. All average calculations use individual weights.
Notes: In 2001, 1,000 CFA are worth 1.71 US dollars (nominal).

Table 2: Sample characteristics of natives and migrants by country of residence

In our sample of the urban working age population in the UEMOA, migrants are generally older, less educated, more likely to be male, have higher labour force participation rates and lower earnings than the native population. However, some country-specific differences emerge.

First, differences between migrants and natives are particularly stark in Côte d'Ivoire. The labour force participation rate of migrants is 12pp higher than the one of natives (93% versus 81%), with two out of three migrants being self-employed (compared to one out of two among natives). Côte d'Ivoire also has the largest educational gap between migrants and natives: 64% of migrants have never gone to school (compared to 24% among natives), and less than 5% of

[12]Some individuals report intervals instead of actual numbers. The results using the imputed version of wages or the median of the bracket are very similar, therefore, we report only the results using imputed wages.

migrants have upper secondary education and more (compared to 23% among natives). In terms of earnings, migrants earn on average 38% less than Ivorian natives (56,600 CFA per month compared to 91,900 CFA).

Second, we observe that migrants in Mali, Senegal and Togo have on average higher earnings than the natives. Part of this difference is likely driven by the positive selection of migrants in terms of education (i.e. fewer migrants without schooling and/or more migrants with upper secondary schooling or higher). However, both in Senegal and Mali the size of the migrant sample is small and hence, these numbers should be taken with a grain of salt.

Third, despite a common colonial past, French as a common language, a history of population mobility and being part of the same economic and monetary union, large discrepancies between the UEMOA countries remain both in terms of educational attainment and earnings. For example, migrants in Côte d'Ivoire earn on average more than natives in Benin, Burkina Faso, Mali and Togo, in spite of a lower average schooling level.

Average earnings hide the variability of earnings. Table 3 thus presents data from different measures of inequality in hourly earnings. These include the Gini index, the interquartile ratio, the mean log-deviation, and the Theil T. The later two measures allow us to decompose inequality into a 'between' and a 'within' component. We show these measures separately for each country (columns 2 to 8) and for the whole of the UEMOA (last column), where all countries are pooled.

| Inequality measures | BE | BF | CI | MA | NI | SN | TG | Total |
|---|---|---|---|---|---|---|---|---|
| Gini | 0.54 | 0.60 | 0.53 | 0.53 | 0.55 | 0.51 | 0.58 | 0.55 |
| IQR | 4.03 | 5.36 | 4.57 | 4.29 | 4.41 | 4.13 | 4.33 | 4.59 |
| Mean log-deviation | 0.52 | 0.69 | 0.53 | 0.54 | 0.56 | 0.47 | 0.62 | 0.58 |
| Between | | | | | | | | 0.03 |
| Within | | | | | | | | 0.55 |
| Theil T | 0.53 | 0.65 | 0.49 | 0.51 | 0.54 | 0.45 | 0.64 | 0.54 |
| Between | | | | | | | | 0.03 |
| Within | | | | | | | | 0.51 |

Source: Authors' calculation from 1-2-3 Survey. All averages use individual weights.

Table 3: Measures of inequality in hourly wages in the UEMOA

All measures tend to agree that wage inequality is largest in Burkina Faso and Togo, lowest in Senegal, and relatively similar among the remaining four countries.[13] When decomposing overall inequality in the UEMOA, we find that a modest 6% of the inequality is attributed to inequality between countries, while the large bulk of inequality stems from within-country inequality.

[13]In terms of international comparisons, the UEMOA countries have lower income inequality than most East African, Southern African and Latin Amercian countries, but higher income inequality than European and many Middle Eastern countries according to the Gini of income inequality index of the World Bank in 2013.

Focussing on the impact of migration to Côte d'Ivoire, Figure 1 shows the observed wage distributions of UEMOA migrants in Côte d'Ivoire, Ivorian natives and UEMOA natives.

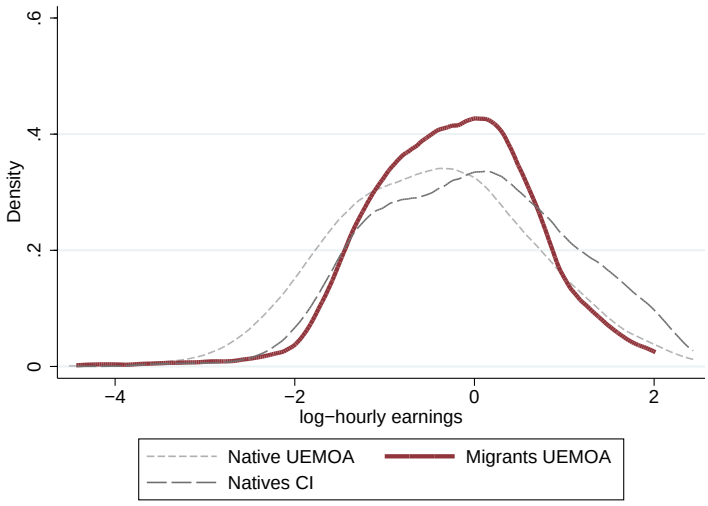
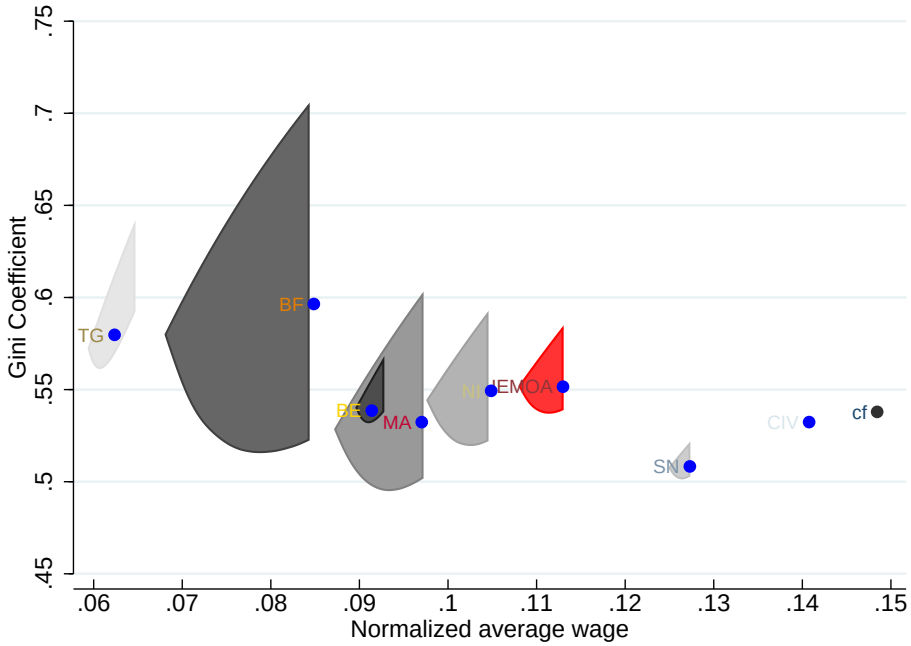



Figure 1: Wage densities of natives and migrants in Abidjan (Côte d'Ivoire), and natives in other UEMOA capital cities

Figure 1 illustrates the mechanism by which regional migration could reduce inequality in the UEMOA. The wage distribution of UEMOA migrants in Côte d'Ivoire is more compressed than the wage distributions of UEMOA and Ivorian natives. It dominates almost everywhere the wage distribution of UEMOA natives (first-order stochastic dominance), with less density in the lower intermediate part and more density in the upper intermediate part. However, it is (first-order stochastically) dominated by the wage distribution of Ivorian natives. Abstracting momentarily from issues of self-selection into migration and potential general equilibrium effects, UEMOA migrants seem to achieve better wages after migration, though not as high as those of natives in Côte d'Ivoire. In this simplified context, we expect the average wage over all UEMOA countries (now including Côte d'Ivoire) to increase as a result of regional migration, and overall inequality in the region to decrease. Inequality in Côte d'Ivoire would decrease (because of a higher density of intermediate wages) with regional migration, while inequality in the remaining UEMOA countries could either increase (with intermediate selection of migrants), remain constant (with random selection) or decrease (with negative or positive selection).

The effect of regional migration on inequality - assuming exogenous wages - can be substantial and crucially depends on the selection pattern of migrants. To further illustrate this point, we use the results from (Stoye, 2010, Corallary 4, p. 337) and compute the range of all possible values of the average wage and Gini index for all countries for any admissible counterfactual wage distribution, assuming only that the average wage of migrants in their home country is lower than the average wage earned abroad. Figure 2 shows the observed average wage and Gini index for each country (blue dot), and the range of possible values for the average wage and Gini index in the counterfactual scenario without migration.




Note: The blue dot corresponds to the observed average wage and Gini index. The grey regions represent, for each country, all admissible values of average wage and Gini index in the counterfactual scenario, under the assumption that average wage of migrants in the capital of their home country would be lower than the average wage earned in Côte d'Ivoire. For Côte d'Ivoire (CI), the region collapses to a point (marked as "cf"). Wages are normalized so that the maximum wage in the population equals 1.

Figure 2: Average wage and Gini index in observed and counterfactual scenario

Without regional migration, Côte d'Ivoire would see its average wage and Gini index increase. For most other countries, the average wage would decrease in absence of regional migration and the effect on inequality could either be positive or negative. Regional migration potentially has had large effects on inequality in Burkina Faso (between -10pp and +8pp of the observed Gini), Mali (between -7pp and +3pp), Niger (between -4pp and +3pp) and Togo (between -5pp and +2pp). In the UEMOA without regional migration, the overall average wage would decrease and the impact on wage inequality could be positive or negative. In order to evaluate this question empirically, we need to estimate the wage distribution of UEMOA migrants in the counterfactual scenario.

# 3 Counterfactual wages

What would have been the UEMOA migrants' wage distribution if they had stayed in their home country? The counterfactual wage distribution of UEMOA migrants is the answer to this question. It is the key element required for quantifying the effect of regional migration on wage inequality in the UEMOA. In particular, it allows us to shed light unto the selection pattern of individuals who migrate within the UEMOA (i.e. selection effect), and to estimate by how much regional migration affects the migrants' wages (akin to a treatment effect).

To identify the wage distribution in the counterfactual scenario, we apply two methods which rely on different sets of assumptions. First, we use the framework developed by Chiquiar and Hanson (2005), in which the counterfactual wage distribution of migrants is a weighted average of observed conditional wage distributions. This method assumes that selection into migration depends only on a set of observable characteristics (selection-on-observables). Second, we make use of a parametric framework where there exists an instrumental variable $Z$. This variable is assumed to affect the decision to migrate, but is independent of the wage in the origin country (instrumental variable). We describe both methods in more detail below.

## 3.1 Selection-on-observables

We first compute the counterfactual wage distribution of UEMOA migrants by applying the method developed by Chiquiar and Hanson (2005). Under the assumption that regional migration in the UEMOA only depends on observable characteristics $x$, the counterfactual wage distribution of UEMOA migrants can be computed as a weighted average of observed conditional wage distributions of UEMOA natives (i.e. those individuals who have not migrated). More specifically, the counterfactual wage distribution of UEMOA migrants $g^{CF}_{mig}(w)$ is given by:

$$g^{CF}_{mig}(w) = \int \theta f^{native\ UEMOA}(w|x)h(x|i = mig, D_i = 1)dx, \quad (1)$$

where $f^{native\ UEMOA}(w|x)$ is the observed wage distribution of UEMOA natives conditional on characteristics $x$, $h(x|i = mig, D_i = 1)$ is the density of observed characteristics of UEMOA migrants who are working abroad (i.e. $D_i = 1$), and $\theta$ is the appropriate weight. In our setting, we use:

$$\theta = \frac{Pr(i = mig|x)}{Pr(i = native\ UEMOA|x)}, \tag{2}$$

where $\theta$ is the ratio of the probability that an individual with characteristics $x$ is a UEMOA migrant over the probability of remaining in her home country (i.e. being a UEMOA native). This ratio also adjusts the labour force participation of UEMOA migrants to the one of UEMOA natives, for as long as it only depends on the same observable characteristics $x$ as the migration decision. In terms of observable characteristics $x$, we control for gender, age and age squared, skill group, (polynomial expression of) years of schooling, and father's years of schooling. Given that Côte d'Ivoire hosts by far the largest UEMOA migration population in Francophone West Africa, we focus in our further analysis on UEMOA migrants who live in Côte d'Ivoire.

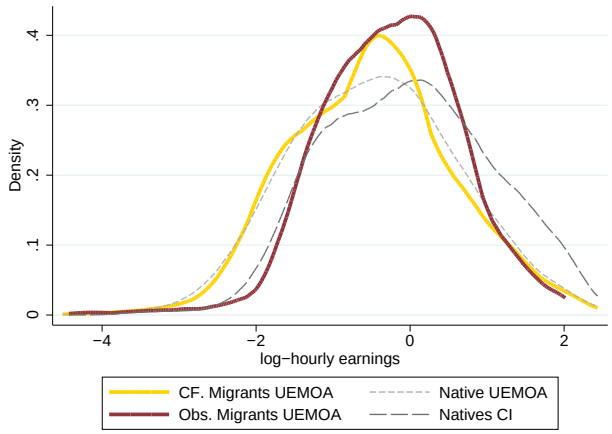
Panel a) in Figure **??** shows the observed wage distribution of UEMOA migrants in Côte d'Ivoire $g_{mig}(w)$ (brown line), the estimated counterfactual wage distribution of UEMOA migrants $g^{CF}_{mig}(w)$ based on the selection-on-observables method by Chiquiar and Hanson (2005) (yellow line), as well as the observed wage distribution of natives of Côte d'Ivoire $g_{native\ CI}(w)$ (dashed line) and the one of natives of the UEMOA $g_{native\ UEMOA}(w)$ (dotted line).

The counterfactual wage distribution of UEMOA migrants (yellow line) relative to the observed wage distribution of UEMOA natives (dotted line) has more mass for intermediate wages, and slightly less mass for wages in the lower and upper (intermediate) part of the distribution. This indicates that UEMOA migrants are intermediately selected. Moreover, we find that the observed wage distribution of UEMOA migrants (brown line) first order stochastically dominates the counterfactual wage distribution (except for the most upper part of the tail). Moreover, the former distribution also appears to be more concentrated.

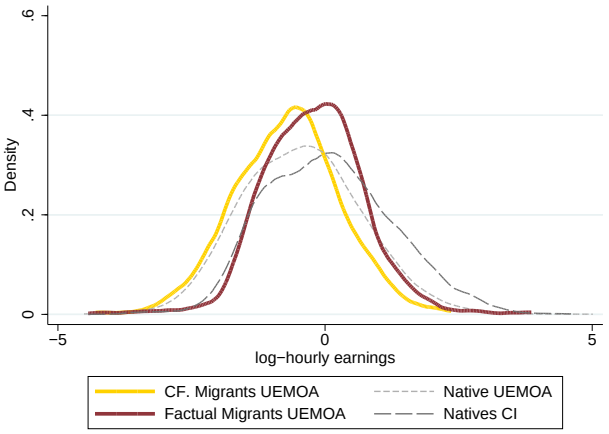
Selection and treatment effect of regional migration in the UEMOA can also be observed in Figure 4 which presents the differences in observed and counterfactual wage densities. Panel a) shows the treatment effect of migration, whereas Panels b) and c) show the selection patterns at origin and destination, respectively.

UEMOA migrants see their wages increase, with a shift from the lower intermediate to the upper intermediate part of the wage distribution (Panel a)). At origin, we find evidence of (lower) intermediate selection of UEMOA migrants (Panel b)). The evidence on intermediate selection in the UEMOA is different from the negative-selection hypothesis established in Borjas (1987), but similar to Chiquiar and Hanson (2005). Compared to Ivorian natives, however, UEMOA migrants are clearly negatively selected with a relatively large mass with wages below the Ivorian median wage (Panel c)). Overall, we find that regional migration shifts the wage distribution upwards for migrants and leads to more compressed wages.

Two remarks are in order at this point. First, the previous analysis hinges on the assumption that migrants are not different from natives once observable characteristics are controlled for. This

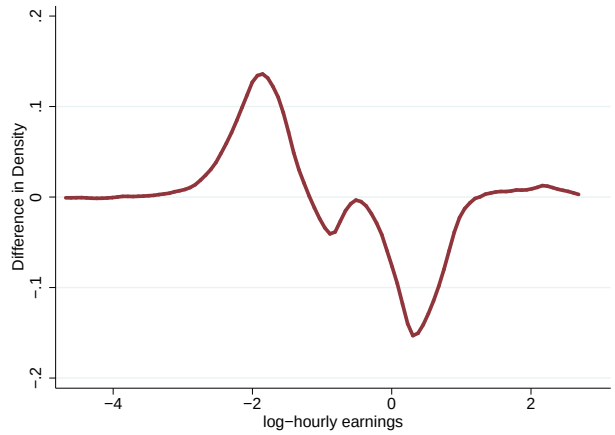



(a) selection-on-observables

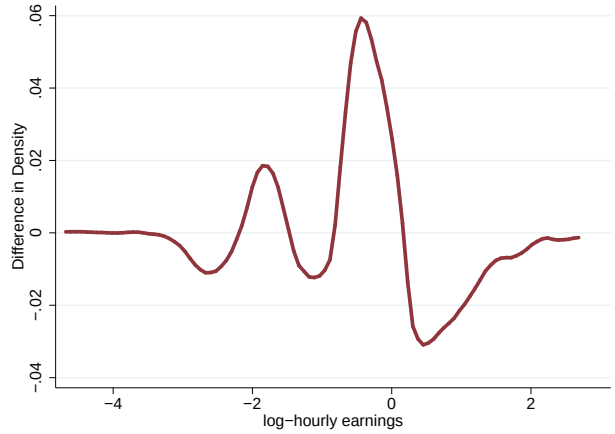



(b) Instrumental variable

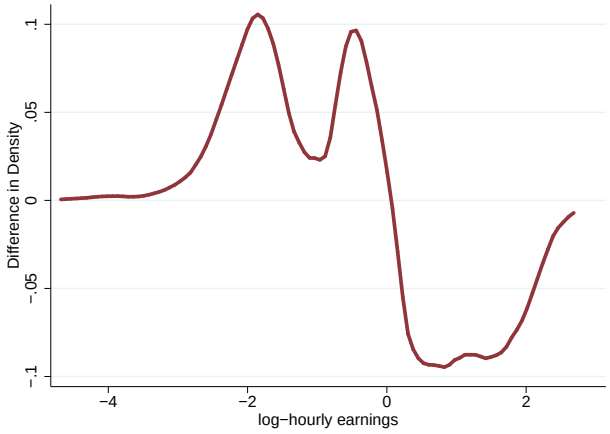
Figure 3: Observed and counterfactual wage densities in UEMOA capital cities




(a) Differences between counterfactual and observed wage densities of migrants (treatment effect)




(b) Difference between counterfactual wage density of migrants and observed wage density of UEMOA natives (selection effect at origin)




(c) Difference between observed wage density migrants and observed wage density of CI natives (selection effect at destination)

Figure 4: Differences in wage densities

assumption would be violated if migrants are, for example, more able or motivated than those staying behind. We relax this assumption in the next section, in which we present results from an instrumental variable approach. Second, the analysis in this and the next section also abstracts from any potential general equilibrium effects on wages entailed by these migration movements. However, such effects might be important, in particular for Côte d'Ivoire, where UEMOA migrants make up 13% of the population. We will return to this point in Section 5.

### 3.2 Instrumental variable

The assumption of selection-on-observable does not account for possible unobservable characteristics that might affect both the migration decision and wages in the country of origin. To address this problem, we follow Barham and Boucher (1998) in specifying (i) an outcome equation for the wage at origin and a selection equation for the migration decision, and (ii) a parametric form of the error terms such that:

$$\ln w_i^0 = X_i\alpha + U_i \tag{3}$$

$$M_i = I(Z_i\beta + V_i > 0) \quad \text{with } (U_i, V_i) \sim \mathcal{N}(0, \Omega) \tag{4}$$

where $i$ is a subscript for an individual, $\ln w_i^0$ is the natural logarithm of the hourly wage, and $M_i$ an indicator for migrant status, which equals 1 if $i$ is a UEMOA migrant in Côte d'Ivoire. $X_i$ are observable charateristics of individual $i$ (gender, age and age squared, skill group, years of schooling, father's years of schooling). $Z$ includes $X$ and a set of instrumental variables defined below. We observe $\ln w_i^0$ if and only if $M_i = 0$. Barham and Boucher (1998) estimate this model using Maximum log-likelihood and estimate inequality in the population using simulated draws of the random error term. The quality of the estimation hinges on the existence of a variable in $Z$ that is excluded from $X$.

In our framework, we use the price of cocoa and coffee on the commodity exchange market when the individual is age 15 as an excluded variable. We assume that these prices are correlated with wages in Côte d'Ivoire (and thus, affect migration decisions), but they are not correlated with wages in the home country $\ln w_i^0$. This assumption is insofar plausible as these two products are major exports from Côte d'Ivoire (and employ a significant share of the migrant labour force), whereas they are only marginally exported or imported by other UEMOA countries. To control for any confounding effect of general price on the commodity market, we also control for the price of oil when the individual is age 15.

Table 4 shows the parameter estimates of earnings equations. The first column represents the OLS estimation, and the second the estimation with the correction for selection as outlined above.

All coefficients have the expected signs. The $\rho$-parameter measures the extent to which selection bias is present in the OLS regression. We find that $\rho$ is small and statistically not different from zero. Indeed, a comparison between Columns (1) and (2) shows that the correction

| Variables | Coefficient estimates | |
|---|---|---|
| | (1) | (2) |
| | Without Correction | With Correction |
| Constant | -2.347*** | -2.370*** |
| | (0.085) | (0.083) |
| Women | -0.461*** | -0.433*** |
| | (0.016) | (0.022) |
| Age | 0.092*** | 0.090*** |
| | (0.005) | (0.006) |
| Age squared | -0.091*** | -0.089*** |
| | (0.008) | (0.008) |
| Years of schooling | 0.014*** | 0.025*** |
| | (0.004) | (0.006) |
| Year of schooling squared | 0.470*** | 0.422*** |
| | (0.028) | (0.029) |
| Father's education | 0.071*** | 0.066*** |
| | (0.021) | (0.020) |
| Crude Oil price | -0.002*** | -0.002*** |
| | (0.0006) | (0.0006) |
| $\rho$ parameter | | -0.046 |
| | | (0.155) |
| $\sigma$ (Std. Dev. of error) | | -0.147*** |
| | | (0.008) |
| Observations | 21,144 | 21,144 |
| Robust standard errors in parentheses | | |
| *** $p \leq 0.01$, ** $p \leq 0.05$, *$p \leq 0.1$ | | |

Table 4: Parameter estimates of earnings equations

for selection changes little to the coefficient estimates. Thus, conditioning on our set of observed characteristics, we find no evidence of selection bias.

To compute the counterfactual wage distribution of UEMOA migrants in this framework, we simulate a large number of draws from the distribution of $U$ with parameter values as estimated above. Panel b) Figure 3 shows the estimated counterfactual wage distribution for UEMOA migrants for one of these draws, as well as the observed wage distributions of UEMOA migrants, UEMOA natives and natives of Côte d'Ivoire. We find that the counterfactual wage distribution for UEMOA migrants estimated from the IV method (Panel b)) is qualitatively similar to, but somewhat smoother than, the one based on the selection-on-observables method (Panel a)). Panel b) shows that UEMOA migrants are selected from the intermediate (and lower) part of the wage distribution.

As the instrumental variable strategy does not find evidence of selection once we control for observable characteristics, we rely on the selection-on-observables procedure by Chiquiar and Hanson (2005). Indeed, if there is no concern of selection on unobservable variables, the former estimator is preferable as it allows for non-parametric estimation.

# 4 The effect of migration on wage inequality

## 4.1 Baseline results

Table 5 shows average wages and different measures of inequality in the observed and counterfactual (no migration to Côte d'Ivoire) scenarios. The effect of migration on average wages and inequality is calculated as the difference between the observed and counterfactual scenario. The different measures of inequality include the Gini, the interquartile ratio, the mean log-deviation, and the Theil T. The later two measures also allow us to decompose inequality into a 'between-country' and a 'within-country' component.

| | Average wage | | | | Gini | | | | IQ-Ratio | | | | Mean log-deviation | | | | Theil T | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | |
| BE | 1.043 | 1.058 | -0.015<br>-1.4% | *** | 0.539 | 0.538 | 0.000<br>0.1% | | 4.034 | 4.048 | -0.013<br>-0.3% | | 0.521 | 0.521 | -0.001<br>-0.1% | | 0.535 | 0.533 | 0.002<br>0.4% | |
| BF | 0.969 | 0.910 | 0.059<br>6.1% | *** | 0.596 | 0.587 | 0.009<br>1.5% | *** | 5.357 | 5.000 | 0.357<br>6.7% | *** | 0.687 | 0.655 | 0.032<br>4.6% | *** | 0.651 | 0.636 | 0.014<br>2.2% | *** |
| CI | 1.607 | 1.709 | -0.102<br>-6.4% | *** | 0.532 | 0.538 | -0.006<br>-1.1% | *** | 4.571 | 5.143 | -0.571<br>-12.5% | *** | 0.533 | 0.552 | -0.020<br>-3.7% | *** | 0.488 | 0.495 | -0.007<br>-1.4% | *** |
| MA | 1.108 | 1.093 | 0.015<br>1.4% | | 0.532 | 0.528 | 0.005<br>0.9% | * | 4.287 | 4.176 | 0.111<br>2.6% | | 0.542 | 0.531 | 0.012<br>2.2% | ** | 0.506 | 0.497 | 0.009<br>1.8% | |
| NI | 1.197 | 1.181 | 0.017<br>1.4% | | 0.549 | 0.549 | 0.001<br>0.1% | | 4.411 | 4.398 | 0.013<br>0.3% | | 0.564 | 0.562 | 0.002<br>0.4% | | 0.539 | 0.538 | 0.001<br>0.1% | |
| SN | 1.453 | 1.407 | 0.046<br>3.2% | ** | 0.508 | 0.503 | 0.005<br>1.0% | | 4.132 | 3.844 | 0.288<br>7.0% | *** | 0.474 | 0.462 | 0.012<br>2.5% | | 0.450 | 0.442 | 0.008<br>1.8% | |
| TG | 0.712 | 0.701 | 0.011<br>1.5% | * | 0.580 | 0.579 | 0.001<br>0.2% | | 4.329 | 4.393 | -0.064<br>-1.5% | | 0.620 | 0.617 | 0.003<br>0.5% | | 0.641 | 0.640 | 0.001<br>0.2% | |
| UEMOA | 1.290 | 1.266 | 0.024<br>1.8% | *** | 0.552 | 0.560 | -0.008<br>-1.5% | *** | 4.593 | 4.800 | -0.207<br>-4.5% | *** | 0.579 | 0.598 | -0.019<br>-3.3% | *** | 0.538 | 0.557 | -0.018<br>-3.4% | *** |
| Between | | | | | | | | | | | | | 0.033 | 0.043 | -0.010<br>-31.1% | *** | 0.030 | 0.041 | -0.011<br>-35.4% | *** |
| Within | | | | | | | | | | | | | 0.546 | 0.556 | -0.009<br>-1.7% | *** | 0.508 | 0.516 | -0.008<br>-1.5% | *** |

Notes: The counterfactual scenario is defined as the *no migration to Abidjan* scenario. p-values calculated from 500 bootstrap replications.
*** : $p < 0.01$ ; ** : $p < 0.05$; * : $p < 0.1$

Table 5: Changes in average wages and inequality

Average wages in UEMOA increase by 1.8% as a result of migration to Côte d'Ivoire. Wages decrease on average in Côte d'Ivoire (by -6.4%) due to the inflow of UEMOA migrants who are negatively selected in comparison to Ivorian natives (Panel b) in Figure 4). The increase in the average wage as a result of regional migration is substantial for those originally from Burkina Faso (+6.1%) and Senegal (+3.2%), and somewhat smaller for the other source countries of immigrants in Côte d'Ivoire. Benin is the only net emigration country which sees its average wage decrease by a small, but significant amount as a result of migration (-1.4%), reflecting a positive selection of emigrants and/or a negative wage effect for those who emigrate.

As for inequality, we find that regional migration in the UEMOA significantly decreases inequality according to all four measures of inequality (Gini, IQ-Ratio, mean log-deviation and Theil T). The overall decrease ranges between -1.5% (for the Gini) and -4.5% (for the IQ-Ratio). This is a moderate, yet non-negligeable effect, given that around 5% of the UEMOA population are migrants. More specifically, we uncover that inequality significantly decreases in Côte d'Ivoire as a result of regional (im-)migration, while it increases or remains constant in all (net) source countries. Migrants tend to originate from the (lower) middle part of the wage distribution of their home country (hereby lowering the relative density of intermediate wages) and move to the lower middle part of the wage distribution in Côte d'Ivoire. This creates a less dispersed wage distribution in Côte d'Ivoire and somewhat more dispersed wage distributions in the rest of UEMOA. The inequality-increasing effect is particularly large in Burkina Faso, the main source country of immigrants to Côte d'Ivoire.

However, the main inequality-reducing effect of regional migration does not come from decreased within-inequality, but from a decrease of inequality between UEMOA countries. While within-inequality makes up a large share of wage inequality in the UEMOA (i.e. around 94%) as measured by the mean log-deviation and the Theil T index, regional migration leaves within-inequality almost unchanged (-1.5%). In contrast, it drastically reduces between-inequality (by more than -30%).

### 4.2 Robustness checks

We entertain different specifications to check the robustness of our results.

First, we compute the counterfactual wage distribution by using matching estimators (see e.g. Imbens, 2015). This method also assumes that there is a set of observable variables $X$ so that, conditional on $X$, the counterfactual wage distribution of migrants and stayers is the same. This assumption is known as selection-on-observable (Barnow, Cain, and Goldberger, 1981), ignorable treatment assignment (Rosenbaum and Rubin, 1983) or conditional independence assumption Lechner (1999). In our framework, we have the advantage of a large number of so-called control observations, since we observe stayers in the capital cities of the origin country. Besides, the data set provides an extensive list of control variables about individual, parental and other family characteristics. We apply nearest-neighbor matching with replacement, matching the three closest neighbours with respect to the Mahalanobis distance. Note that the matching method, in contrast to method by Chiquiar and Hanson (2005) implemented in the previous analysis, excludes

unemployed individuals from the analysis.

The results displayed in the Table in Appendix A.2 are qualitatively similar to the previous results. Using the matching approach, we estimate that migration to Côte d'Ivoire increases the average wage in the UEMOA by 1.4%, while it decreases inequality. Overall, inequality in the UEMOA decreases between 0.7% (for the Gini) and 3.4% (for the IQ-Ratio), a similar range (marginally smaller) as reported for the baseline results.

Second, we define an alternative counterfactual to quantify the effect of migration. While our leading counterfactual only substituted migration to Abidjan (Côte d'Ivoire), we now define a counterfactual of no regional migration at all. In other words, migrants to any of the seven economic capital are returned to the capital city of their country of origin. The results of this alternative counterfactual exercise are presented in the Table in Appendix A.3. The estimated effects are qualitatively and quantitatively very similar to the baseline results. This suggests that while migration to Côte d'Ivoire is driven by economic considerations and has an impact on average wages and inequality both in the source and destination countries, the remaining migration flows (which only account for one third of UEMOA migrations) seem to be driven by other motives and hence, do not have a measurable impact on either average wages nor inequality.[14]

Finally, we conduct some further robustness checks. In ones of these checks, we use monthly earnings instead of hourly wages. In another one, we rely on the non-imputed wage. In both alternative specifications, the results are qualitatively similar to the previous results (not shown).

## 5 Sensitivity to general equilibrium effects

In this section, we study to what extent the previous results are sensitive to possible general equilibrium effects (GE effects). GE effects might be important, especially for a destination country such as Côte d'Ivoire, where migrants account for 13% of the working age population, or for source countries like Burkina Faso and Mali whose emigrant population would make up 17% and 9% of the home population, respectively.

We presume that two skill groups (low and high) are affected differently by immigration. Indeed, only 5% of immigrants to Côte d'Ivoire have an upper secondary education (against 25% of native Ivorians). We assume that highly skilled native workers are left unaffected by immigration, whereas lowly skilled workers can be substituted with migrants. With no prior information on the elasticity of wages in Sub-Saharan Africa to an inflow or outflow of migrants, we consider a range of wage elasticity between 0 and -0.8 on the source and destination country as documented by the literature.[15]

[14] For Burkina Faso, Girsberger (2015) shows that men primarily migrate for work, financial and education-related motives, while women migrate mostly for family reasons.

[15] Mishra (2007) finds a wage elasticity of -0.4 on the source country in the case of Mexico. That is, a decrease of 10% in the working population due to emigration in a specific skill group, increases the average wage of this skill group by 4% in Mexico. In terms of the effect of immigration on wages, several studies find a similarly strong effect on the wages in the host country. For example, Borjas (2003) reports wage elasticities of immigration of -0.3 to

We consider a wage elasticity of -0.8 for low-skilled workers, assuming it to be equal in source and host countries. That is, an increase (decrease) of 10% of the workforce due to immigration (emigration) decreases (increases) wages by -8%. Considering a wage elasticity of -0.8 both in the source and host countries, Figure 5 illustrates the effect of this correction on the wage distributions of natives in the UEMOA and Côte d'Ivoire. The grey lines show the observed wage distribution of UEMOA natives (full) and natives in Côte d'Ivoire (dashed), respectively. In the absence of general equilibrium effects, the wage distributions of natives do not shift in response to migration. Assuming a wage elasticity of -0.8, the brown lines show how the wage distributions of natives would shift in the counterfactual scenario (i.e. no migration to Côte d'Ivoire) if general equilibrium effects are present.

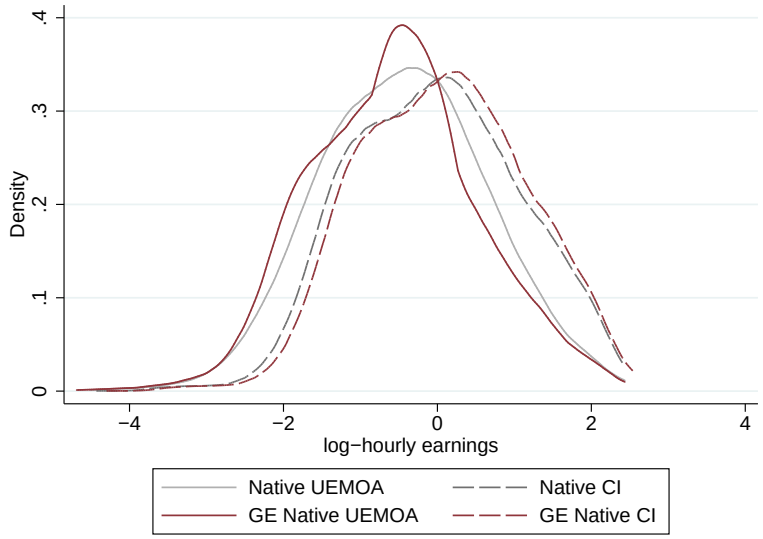



Figure 5: Wage distributions in the capital of Côte d'Ivoire and all other capital cities of the UEMOA without and with GE correction (wage elasticity: $\beta = -0.8$)

In the presence of general equilibrium effects, the wage distribution of natives of Côte d'Ivoire moves to the right in the counterfactual scenario (i.e. without migration to Côte d'Ivoire). In particular, wages in the lower tail see a small increase, while wages in the upper tail remain fairly constant. This reflects our assumption that migration to Côte d'Ivoire only impacts low-skilled native workers. Altogether, the counterfactual wage distribution of Ivorian natives is now more concentrated and has a higher mean than without the GE correction. In contrast, general equilibrium effects of migration move in the other direction in the rest of the UEMOA: Without emigration low-wage earners stay in their home country and hereby depress wages of the UEMOA natives.

Table 6 presents average wages and different measures of inequality in the observed and the counterfactual scenario, in which migration to Côte d'Ivoire is absent and general equilibrium effects with a wage elasticity of -0.8 are taken into account.

-0.4 on the host country (i.e. the United States). On the more extreme end, Llull (2014) finds a wage elasticity to immigration of -1 in the United States and Canada.

| | Average wage | | | | Gini | | | | IQ-Ratio | | | | Mean log-deviation | | | | Theil T | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | |
| BE | 1.043 | 1.045 | -0.002<br>-0.2% | | 0.539 | 0.540 | -0.001<br>-0.2% | * | 4.034 | 4.101 | -0.066<br>-1.6% | | 0.521 | 0.524 | -0.004<br>-0.7% | ** | 0.535 | 0.536 | -0.002<br>-0.3% | |
| BF | 0.969 | 0.817 | 0.152<br>15.7% | *** | 0.596 | 0.606 | -0.010<br>-1.7% | *** | 5.357 | 5.064 | 0.293<br>5.5% | ** | 0.687 | 0.703 | -0.015<br>-2.2% | *** | 0.651 | 0.691 | -0.040<br>-6.2% | *** |
| CI | 1.607 | 1.845 | -0.238<br>-14.8% | *** | 0.532 | 0.525 | 0.007<br>1.3% | *** | 4.571 | 4.971 | -0.400<br>-8.7% | *** | 0.533 | 0.524 | 0.009<br>1.7% | ** | 0.488 | 0.469 | 0.019<br>3.9% | ** |
| MA | 1.108 | 1.041 | 0.067<br>6.0% | *** | 0.532 | 0.532 | 0.000<br>0.0% | | 4.287 | 4.167 | 0.121<br>2.8% | | 0.542 | 0.540 | 0.002<br>0.5% | | 0.506 | 0.507 | -0.001<br>-0.2% | |
| NI | 1.197 | 1.136 | 0.061<br>5.1% | *** | 0.549 | 0.553 | -0.004<br>-0.7% | * | 4.411 | 4.240 | 0.172<br>3.9% | | 0.564 | 0.572 | -0.008<br>-1.4% | | 0.539 | 0.549 | -0.011<br>-2.0% | ** |
| SN | 1.453 | 1.393 | 0.061<br>4.2% | *** | 0.508 | 0.504 | 0.005<br>0.9% | | 4.132 | 3.889 | 0.243<br>5.9% | ** | 0.474 | 0.463 | 0.011<br>2.4% | | 0.450 | 0.443 | 0.007<br>1.5% | |
| TG | 0.712 | 0.686 | 0.026<br>3.7% | *** | 0.580 | 0.581 | -0.001<br>-0.2% | | 4.329 | 4.367 | -0.038<br>-0.9% | | 0.620 | 0.622 | -0.002<br>-0.3% | | 0.641 | 0.647 | -0.005<br>-0.9% | |
| UEMOA | 1.290 | 1.284 | 0.006<br>0.5% | | 0.552 | 0.565 | -0.013<br>-2.4% | *** | 4.593 | 4.877 | -0.284<br>-6.2% | *** | 0.579 | 0.615 | -0.036<br>-6.1% | *** | 0.538 | 0.566 | -0.028<br>-5.2% | *** |
| Between | | | | | | | | | | | | | 0.033 | 0.060 | -0.027<br>-82.0% | *** | 0.030 | 0.057 | -0.027<br>-89.9% | *** |
| Within | | | | | | | | | | | | | 0.546 | 0.555 | -0.009<br>-1.6% | *** | 0.508 | 0.509 | -0.001<br>-0.2% | |

Notes: The counterfactual scenario is defined as the *no migration to Abidjan* scenario. p-values calculated from 500 bootstrap replications.
*** : $p < 0.01$ ; ** : $p < 0.05$; * : $p < 0.1$

Table 6: Changes in average wages and inequality accounting for GE - $\beta = -0.8$

Taking into account the general equilibrium effects, brings some slight differences with respect to the baseline estimation results to light. We find that the average wage in Côte d'Ivoire in the counterfactual scenario with general equilibrium effects would be higher than in the case without. Migration to Côte d'Ivoire depresses Ivorian wages by -14.8% when factoring in GE effects, while it was only -6.4% in the baseline estimation. In the rest of the UEMOA, average wages in the counterfactual increase more when accounting for GE effects, again leading to a larger (positive) effect of migration. This result is driven by the fact that the migrating workforce is mostly low-skilled and that substituting native workers for migrant workers is assumed to occur only among low skilled. In this setting, both the selection and the general equilibrium effects of migration move in the same direction, resulting in higher average wages in source countries (less low-skilled workers, less pressure on low-skilled wages) and a lower average wage in Côte d'Ivoire (more low-skilled workers, more pressure on low-skilled wages).

We also estimate that migration leads to a stronger decline in inequality when correcting for general equilibrium effects. Depending on the measure of inequality, the estimated effect ranges from -2.4% to -6.2%. Inequality decreases as a result of decreasing inequality between countries (-80%), while inequality within countries remains by and large unchanged (-1.5%). The larger (relative) decrease in the between-inequality in the GE estimation comes from the fact that the GE effects in each country tend to reinforce the impact of migration. Hence, we now estimate in the counterfactual without migration to Côte d'Ivoire that between country inequality would be much larger than without correcting for GE effects. Moreover, country-specific changes in inequality as a result of migration are somewhat stronger than in the baseline. All in all, the findings on the GE effects corroborate the results from the baseline estimation. Table in Appendix A.4 also reports the results for a more intermediate wage elasticity of -0.4. The results are qualitatively similar.

Overall, taking into account general equilibrium effects strengthens our conclusion that regional migration tends to decrease regional inequality. However, the impact of migration on the average wage in the UEMOA is now smaller.

# 6 Conclusion

In this paper, we investigate and quantify the effect of regional migration on average wages and wage inequality in an economic and monetary union with free movement of people in a development context.

Using individual-level data from a household labour force survey conducted in the economic capitals of the seven founding members of the West African Economic and Monetary Union (UEMOA), we estimate the counterfactual wage distributions of migrants in absence of migration using a selection and an instrumental variable approach. Comparing the counterfactual wage distributions with the observed distributions allows us to quantify the overall and country-specific effect of regional migration.

Our results show that regional migration increased the average wage by 1.8% and reduced overall inequality in the UEMOA by something between -1.5% (for the Gini index) and -4.5% (for the IQ-Ratio). The effect on inequality is a moderate, yet non-negligeable effect, given that around 5% of the UEMOA population are migrants. However, the impact of regional migration differs across countries. Côte d'Ivoire, the most developed economy and main destination of migrants in the UEMOA, sees its average wage and inequality drop as a result of regional migration, while the main source countries experience a higher average wage and heterogeneous effects on inequality.

These results hold across different specifications and become even stronger (for inequality) when we account for general equilibrium effects of migration on wages at origin and destination. In particular, we find that the effect of migration and the resulting general equilibrium effects on wages of natives (both at origin and destination) move in the same direction. Hereby, this leads to an even larger decrease in inequality between countries by depressing the average wage in the destination country (with has relatively high wages within the UEMOA) as a result of regional migration and leading to a slight increase in the average wage among natives in the source countries (which are among the low wage countries within the UEMOA).

Our analysis on several countries offers a key insight into the underlying mechanism: Regional migration primarily operates through a reduction of inequality between countries (by -30%), while within-country inequality remains more or less constant on a high level. This finding is in line with previous research on the inequality-reducing (or convergence-inducing) effect of regional migration. However, it also highlights the importance of within-country inequality for overall inequality. Hence, while regional migration can contribute to reducing wage inequality in the UEMOA (and elsewhere) and convergence between countries, policies aimed at decreasing inequality within countries can have much larger effects on lowering overall wage inequality.

## References


Barham, B., and S. Boucher (1998): "Migration, remittances, and inequality: estimating the net effects of migration on income distribution," *Journal of Development Economics*, 55(2), 307–331.

Barnow, B., G. Cain, and A. Goldberger (1981): "Selection on observables," *Evaluation Studies Review Annual*, 5(1), 43–59.

Borjas, G. J. (1987): "Self-Selection and the Earnings of Immigrants," *The American Economic Review*, pp. 531–553.

Borjas, G. J. (2003): "The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market," *The Quarterly Journal of Economics*, 118(4), 1335–1374.

Brilleau, A., F. Roubaud, and C. Torelli (2004): "L'emploi, le chômage et les conditions d'activité dans les principales agglomérations de sept Etats membres de l'UEMOA - Principaux résultats de la phase 1 de l'enquête 1-2-3 de 2001-2002," Document de Travail, DIAL, Développement, Institutions and Analyses de Long Terme.

Card, D. (2009): "Immigration and Inequality," *American Economic Review: Papers & Proceedings*, 99(2), 1–21.

Chiquiar, D., and G. H. Hanson (2005): "International Migration, Self-Selection, and the Distribution of Wages: Evidence from Mexico and the United States," *Journal of Political Economy*, 113(2), 239–261.

De Vreyer, P., F. Gubert, and F. Roubaud (2009): "Migration, Self-selection and Returns to Education in the WAEMU," *Journal of African Economies*, 19(1), 52–87.

DiNardo, J., N. M. Fortin, and T. Lemieux (1996): "Labor Market Institutions and the Distribution of Wages, 1973-1992: A Semiparametric Approach," *Econometrica*, 64(5), 1001–1044.

Docquier, F., C. Özden, and G. Peri (2014): "The Labour Market Effects of Immigration and Emigration in OECD Countries," *The Economic Journal*, 124(579), 1106–1145.

Dustmann, C., U. Schönberg, and J. Stuhler (2016): "The Impact of Immigration: Why Do Studies Reach Such Different Results?," *Journal of Economic Perspectives*, 30(4), 31–56.

Girsberger, E. M. (2015): "Essays on Migration, Education and Work Opportunities," PhD Thesis, European University Institute.

Harris, J. R., and M. P. Todaro (1970): "Migration, unemployment and development: a two-sector analysis," *The American Economic Review*, 60(1), 126–142.

Heckman, J. J., and B. E. Honoré (1990): "The empirical content of the Roy model," *Econometrica*, pp. 1121–1149.

Imbens, G. W. (2015): "Matching methods in practice: Three examples," *Journal of Human Resources*, 50(2), 373–419.

Kanbur, R., and H. Rapoport (2005): "Migration selectivity and the evolution of spatial inequality," *Journal of Economic Geography*, 5(1), 43–57.

Lechner, M. (1999): "Earnings and employment effects of continuous gff-the-job training in east germany after unification," *Journal of Business & Economic Statistics*, 17(1), 74–90.

Llull, J. (2014): "The Effect of Immigration on Wages: Exploiting Exogenous Variation at the National Level," Barcelona GSE Working Paper Series, Working Paper no. 783.

McKenzie, D., and H. Rapoport (2007): "Network effects and the dynamics of migration and inequality: theory and evidence from Mexico," *Journal of Development Economics*, 84(1), 1–24.

Mishra, P. (2007): "Emigration and wages in source countries: Evidence from Mexico," *Journal of Development Economics*, 82(1), 180–199.

Phan, D., and I. Coxhead (2010): "Inter-provincial migration and inequality during Vietnam's transition," *Journal of Development Economics*, 91, 100–112.

Rosenbaum, P. R., and D. B. Rubin (1983): "The central role of the propensity score in observational studies for causal effects," *Biometrika*, 70(1), 41–55.

Roy, A. D. (1951): "Some thoughts on the distribution of earnings," *Oxford Economic Papers*, 3(2), 135–146.

Stoye, J. (2010): "Partial identification of spread parameters," *Quantitative Economics*, 1(2), 323–357.

Yang, L. (2004): "Unequal Provinces But Equal Families? An Analysis of Inequality and Migration in Thailand," University of Chicago, mimeo.

# A Appendices

## A.1 Definitions of inequality measures

In our analysis, we present the results for the following four inequality measures: the Gini index, the interquartile ratio, the mean log-deviation, and the Theil T.

The Gini index is defined as follows:

$$G = \frac{\sum_{i=1}^{N}\sum_{j=1}^{N} f(y_i)f(y_j)|y_i - y_j|}{2\sum_{i=1}^{N} f(y_i)y_i}, \tag{5}$$

where $y_i$ is the wage of individuals of group $i$ and $f(y_i)$ is the fraction of the population with wage $y_i$. The Gini index is bounded between 0 (no inequality) and 1 (maximal inequality).

The interquartile ratio is defined as follows:

$$IQR = \frac{Q_3}{Q_1}, \tag{6}$$

where $Q_3$ is the third quartile of the wage distribution and $Q_1$ is the first quartile of the wage distribution. The IQR has a lower bound of 1 (no inequality) and can go to infinity (maximal inequality).

The mean log-deviation is defined as follows:

$$MLD = \frac{1}{N}\sum_{i=1}^{N} ln\left(\frac{\bar{y}}{y_i}\right), \tag{7}$$

where $y_i$ is the wage of individual $i$ and $\bar{y}$ is the mean wage of all individuals. The MDL is non-negative with lower values indicating less inequality.

The Theil T is defined as follows:

$$T_T = \frac{1}{N}\sum_{i=1}^{N} \frac{y_i}{\bar{y}} ln\left(\frac{y_i}{\bar{y}}\right), \tag{8}$$

where $y_i$ is the wage of individual $i$ and $\bar{y}$ is the mean wage of all individuals. The Theil T has a lower bound of 0 (no inequality) and a maximum value of $ln(N)$ (when one individual has all income).

| | Average wage | | | | Gini | | | | IQ-Ratio | | | | Mean log-deviation | | | | Theil T | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | |
| BE | 1.043 | 1.044 | -0.001 | | 0.539 | 0.537 | 0.001 | | 4.034 | 3.968 | 0.066 | | 0.521 | 0.518 | 0.003 | | 0.535 | 0.532 | 0.002 | |
| | | | -0.1% | | | | 0.2% | | | | 1.6% | | | | 0.6% | | | | 0.5% | |
| BF | 0.969 | 0.903 | 0.066 | *** | 0.596 | 0.581 | 0.016 | *** | 5.357 | 5.037 | 0.321 | | 0.687 | 0.637 | 0.051 | *** | 0.651 | 0.620 | 0.031 | ** |
| | | | 6.8% | | | | 2.7% | | | | 6.0% | | | | 7.4% | | | | 4.8% | |
| CI | 1.607 | 1.695 | -0.088 | *** | 0.532 | 0.538 | -0.006 | *** | 4.571 | 5.102 | -0.531 | *** | 0.533 | 0.551 | -0.019 | *** | 0.488 | 0.495 | -0.007 | *** |
| | | | -5.5% | | | | -1.0% | | | | -11.6% | | | | -3.5% | | | | -1.4% | |
| MA | 1.108 | 1.074 | 0.034 | *** | 0.532 | 0.530 | 0.002 | | 4.287 | 4.198 | 0.089 | | 0.542 | 0.530 | 0.012 | | 0.506 | 0.502 | 0.004 | |
| | | | 3.1% | | | | 0.5% | | | | 2.1% | | | | 2.3% | | | | 0.7% | |
| NI | 1.197 | 1.187 | 0.010 | | 0.549 | 0.538 | 0.011 | *** | 4.411 | 4.286 | 0.125 | | 0.564 | 0.542 | 0.022 | *** | 0.539 | 0.518 | 0.021 | *** |
| | | | 0.8% | | | | 2.0% | | | | 2.8% | | | | 4.0% | | | | 4.0% | |
| SN | 1.453 | 1.450 | 0.003 | | 0.508 | 0.506 | 0.002 | * | 4.132 | 4.118 | 0.014 | | 0.474 | 0.469 | 0.005 | ** | 0.450 | 0.446 | 0.003 | |
| | | | 0.2% | | | | 0.4% | | | | 0.3% | | | | 1.0% | | | | 0.8% | |
| TG | 0.712 | 0.711 | 0.001 | | 0.580 | 0.579 | 0.001 | | 4.329 | 4.280 | 0.049 | | 0.620 | 0.617 | 0.003 | | 0.641 | 0.639 | 0.003 | |
| | | | 0.2% | | | | 0.2% | | | | 1.1% | | | | 0.5% | | | | 0.4% | |
| UEMOA | 1.290 | 1.272 | 0.018 | *** | 0.552 | 0.555 | -0.004 | *** | 4.593 | 4.751 | -0.158 | *** | 0.579 | 0.586 | -0.007 | *** | 0.538 | 0.547 | -0.009 | *** |
| | | | 1.4% | | | | -0.7% | | | | -3.4% | | | | -1.2% | | | | -1.6% | |
| Between | | | | | | | | | | | | | 0.033 | 0.040 | -0.008 | *** | 0.030 | 0.038 | -0.008 | *** |
| | | | | | | | | | | | | | | | -23.0% | | | | -26.2% | |
| Within | | | | | | | | | | | | | 0.546 | 0.546 | 0.001 | | 0.508 | 0.509 | -0.001 | |
| | | | | | | | | | | | | | | | 0.1% | | | | -0.1% | |

Notes: The counterfactual scenario is defined as the *no migration to Abidjan* scenario. p-values calculated from 500 bootstrap replications.
*** : $p < 0.01$ ; ** : $p < 0.05$; * : $p < 0.1$

Table A.1: Changes in average wages and inequality (matching estimator)

| | Average wage | | | | Gini | | | | IQ-Ratio | | | | Mean log-deviation | | | | Theil T | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | |
| BE | 1.043 | 1.058 | -0.015 | *** | 0.539 | 0.538 | 0.000 | | 4.034 | 4.048 | -0.013 | | 0.521 | 0.521 | -0.001 | | 0.535 | 0.533 | 0.002 | |
| | | | -1.4% | | | | 0.1% | | | | -0.3% | | | | -0.1% | | | | 0.4% | |
| BF | 0.969 | 0.910 | 0.059 | *** | 0.596 | 0.587 | 0.009 | *** | 5.357 | 5.000 | 0.357 | *** | 0.687 | 0.655 | 0.032 | *** | 0.651 | 0.636 | 0.014 | *** |
| | | | 6.1% | | | | 1.5% | | | | 6.7% | | | | 4.6% | | | | 2.2% | |
| CI | 1.607 | 1.709 | -0.102 | *** | 0.532 | 0.538 | -0.006 | *** | 4.571 | 5.143 | -0.571 | *** | 0.533 | 0.552 | -0.020 | *** | 0.488 | 0.495 | -0.007 | *** |
| | | | -6.4% | | | | -1.1% | | | | -12.5% | | | | -3.7% | | | | -1.4% | |
| MA | 1.108 | 1.093 | 0.015 | | 0.532 | 0.528 | 0.005 | | 4.287 | 4.176 | 0.111 | | 0.542 | 0.531 | 0.012 | ** | 0.506 | 0.497 | 0.009 | |
| | | | 1.4% | | | | 0.9% | | | | 2.6% | | | | 2.2% | | | | 1.8% | |
| NI | 1.197 | 1.181 | 0.017 | | 0.549 | 0.549 | 0.001 | | 4.411 | 4.398 | 0.013 | | 0.564 | 0.562 | 0.002 | | 0.539 | 0.538 | 0.001 | |
| | | | 1.4% | | | | 0.1% | | | | 0.3% | | | | 0.4% | | | | 0.1% | |
| SN | 1.453 | 1.407 | 0.046 | ** | 0.508 | 0.503 | 0.005 | | 4.132 | 3.844 | 0.288 | *** | 0.474 | 0.462 | 0.012 | | 0.450 | 0.442 | 0.008 | |
| | | | 3.2% | | | | 1.0% | | | | 7.0% | | | | 2.5% | | | | 1.8% | |
| TG | 0.712 | 0.701 | 0.011 | * | 0.580 | 0.579 | 0.001 | | 4.329 | 4.393 | -0.064 | | 0.620 | 0.617 | 0.003 | | 0.641 | 0.640 | 0.001 | |
| | | | 1.5% | | | | 0.2% | | | | -1.5% | | | | 0.5% | | | | 0.2% | |
| UEMOA | 1.290 | 1.266 | 0.024 | *** | 0.552 | 0.560 | -0.008 | *** | 4.593 | 4.800 | -0.207 | *** | 0.579 | 0.598 | -0.019 | *** | 0.538 | 0.557 | -0.018 | *** |
| | | | 1.8% | | | | -1.5% | | | | -4.5% | | | | -3.3% | | | | -3.4% | |
| Between | | | | | | | | | | | | | 0.033 | 0.043 | -0.010 | *** | 0.030 | 0.041 | -0.011 | *** |
| | | | | | | | | | | | | | | | -31.1% | | | | -35.4% | |
| Within | | | | | | | | | | | | | 0.546 | 0.556 | -0.009 | *** | 0.508 | 0.516 | -0.008 | *** |
| | | | | | | | | | | | | | | | -1.7% | | | | -1.5% | |

Notes: The counterfactual scenario is defined as the *no regional migration* scenario. p-values calculated from 500 bootstrap replications.
*** : $p < 0.01$ ; ** : $p < 0.05$; * : $p < 0.1$

Table A.2: Changes in average wages and inequality (counterfactual: no regional migration)

| | Average wage | | | | Gini | | | | IQ-Ratio | | | | Mean log-deviation | | | | Theil T | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | | Obs | CF | diff | |
| BE | 1.043 | 1.052 | -0.008 | * | 0.539 | 0.539 | 0.000 | | 4.034 | 4.062 | -0.028 | | 0.521 | 0.523 | -0.002 | | 0.535 | 0.534 | 0.000 | |
| | | | -0.8% | | | | -0.1% | | | | -0.7% | | | | -0.4% | | | | 0.0% | |
| BF | 0.969 | 0.861 | 0.108 | *** | 0.596 | 0.597 | 0.000 | | 5.357 | 5.000 | 0.357 | *** | 0.687 | 0.678 | 0.009 | ** | 0.651 | 0.663 | -0.012 | *** |
| | | | 11.1% | | | | 0.0% | | | | 6.7% | | | | 1.3% | | | | -1.8% | |
| CI | 1.607 | 1.775 | -0.168 | *** | 0.532 | 0.531 | 0.001 | | 4.571 | 5.051 | -0.479 | *** | 0.533 | 0.537 | -0.005 | | 0.488 | 0.482 | 0.007 | *** |
| | | | -10.5% | | | | 0.2% | | | | -10.5% | | | | -0.9% | | | | 1.4% | |
| MA | 1.108 | 1.066 | 0.042 | *** | 0.532 | 0.530 | 0.003 | | 4.287 | 4.192 | 0.095 | | 0.542 | 0.534 | 0.008 | | 0.506 | 0.501 | 0.005 | |
| | | | 3.8% | | | | 0.5% | | | | 2.2% | | | | 1.5% | | | | 0.9% | |
| NI | 1.197 | 1.158 | 0.039 | *** | 0.549 | 0.551 | -0.001 | | 4.411 | 4.430 | -0.019 | | 0.564 | 0.567 | -0.003 | | 0.539 | 0.544 | -0.005 | |
| | | | 3.3% | | | | -0.3% | | | | -0.4% | | | | -0.5% | | | | -0.9% | |
| SN | 1.453 | 1.400 | 0.054 | *** | 0.508 | 0.503 | 0.005 | | 4.132 | 3.872 | 0.260 | *** | 0.474 | 0.463 | 0.011 | | 0.450 | 0.442 | 0.007 | |
| | | | 3.7% | | | | 1.0% | | | | 6.3% | | | | 2.4% | | | | 1.6% | |
| TG | 0.712 | 0.693 | 0.019 | *** | 0.580 | 0.580 | 0.000 | | 4.329 | 4.393 | -0.064 | | 0.620 | 0.619 | 0.001 | | 0.641 | 0.643 | -0.002 | |
| | | | 2.6% | | | | 0.0% | | | | -1.5% | | | | 0.1% | | | | -0.3% | |
| UEMOA | 1.290 | 1.274 | 0.016 | *** | 0.552 | 0.562 | -0.010 | *** | 4.593 | 4.866 | -0.273 | *** | 0.579 | 0.606 | -0.026 | *** | 0.538 | 0.561 | -0.023 | *** |
| | | | 1.2% | | | | -1.9% | | | | -5.9% | | | | -4.6% | | | | -4.2% | |
| Between | | | | | | | | | | | | | 0.033 | 0.051 | -0.018 | *** | 0.030 | 0.049 | -0.018 | *** |
| | | | | | | | | | | | | | | | -55.1% | | | | -61.1% | |
| Within | | | | | | | | | | | | | 0.546 | 0.555 | -0.008 | *** | 0.508 | 0.512 | -0.004 | * |
| | | | | | | | | | | | | | | | -1.5% | | | | -0.8% | |

Notes: The counterfactual scenario is defined as the *no migration to Abidjan* scenario. p-values calculated from 500 bootstrap replications.
*** : $p < 0.01$ ; ** : $p < 0.05$; * : $p < 0.1$

Table A.3: Changes in inequality accounting for GE - $\beta = -0.4$