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Send correspondence to:
Hatem Jemmali
University of Sousse
hatemjemmali79@gmail.com

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Abstract

This paper analysis the key factors that shape inter-governorates migration in Tunisia, focusing mainly on the role of distance, labor market characteristics, human capital and per capita expenditure in driving migration flows. It uses basic and extended gravity model as well as the Poisson pseudo-maximum-likelihood model for modelling migration data extracted from the 2004 census. The main findings reveal that, as expected, inter-governorate migrations in Tunisia are affected by high population size at the origin and destination, high unemployment rate at the origin, low unemployment rate at the destination. The paper's results suggest as well that migrations flows are affected negatively by high job vacancies availability and per capita expenditure at the origin. However, the contribution of wage and human capital variables in the explanation of migration was not significant.

JEL Classifications: O1, R2

Keywords: Inter-governorates migration, Tunisia, Wages, Human Capital

ملخص

تقوم هذه الورقة بتحليل العوامل الرئيسية التي تشكل الهجرة بين المحافظات في تونس، مع التركيز بشكل أساسي على دور المسافة، وخصائص سوق العمل، رأس المال البشري وإنفاق الفرد في التأثير على تدفقات الهجرة. ويستخدم نموذج الجاذبية الأساسية والموسعة وكذلك بواسون نموذج شبه الأقصى، احتمال لنمذجة بيانات الهجرة المستخرجة من التعداد السكاني عام 2004. تكشف النتائج الرئيسية التي، كما هو متوقع، أن تتأثر الهجرة بين المحافظات في تونس بارتفاع حجم السكان في المنشأ والمقصد، وارتفاع معدل البطالة في الأصل، وانخفاض معدل البطالة في الوجهة. وتشير النتائج كذلك أن تدفقات الهجرات تتأثر سلبا من جراء ارتفاع توافر الوظائف الشاغرة وإنفاق الفرد في الأصل. ومع ذلك، كانت مساهمة المتغيرات كالأجور ورأس المال البشري في تفسير الهجرة ليست بكبيرة.

1. Introduction

Economic growth in diversified economies such as North African countries is intrinsically uneven. In the developing world, capital endowments, whether in the form of industrial plants and installations, natural resources, or complementary investments and infrastructures such as airports, ports, roads and irrigation systems, are typically highly by location. Cumulating and growing inequalities between the more privileged and less privileged regions in these countries have led to a persistent unbalanced development that characterizes most of them. Internal migration appears as an expression of such uneven development. There has been much debate on the linkage between migration and development. But it's easy to conclude, over the literature, that development and internal migration are complements. On the one hand, a growing body of empirical studies claims that development fuels and stimulates migration rather than reduces it, at least in the short and medium run (Lucas 2014). On the other hand, migration is recognized as an important vehicle for boosting development in both origin and destination location (Phan and Coxhead 2010). Such relationship between migration and development remains the focus of attention of a large body of research investigating several empirical questions with normative and policy implications (Bell et al. 2015). In the current study, we look at two such questions using data on internal migration that come from the census conducted in Tunisia in 2004.

Besides, it's well established in the development literature that migration is typically a powerful symbol of large-scale inequality, whether in terms of wages, income, or job market opportunities. A huge number of employees and job seekers move yearly within countries, looking for reducing what they see as the gap between their home location and privileged large cities and towns. In turn, there is growing agreement that migration is a route out of poverty and inequality for people who live a difficult situation in their original residence; it could be considered as an important livelihood diversification policy for them.

Understanding and modeling internal migration flows within countries around the world has been a core area of research during the last three decades (Todaro 1980; Henry et al. 2003; Phan and Coxhead 2010; Beauchemin 2011; Bell et al. 2015). A key topic in these studies is to consider mobility as a social, economic and cultural response to inequality and poverty (see De Haan and Yaqub 2010 for the linkages between migration and poverty and Bell et al. 2015 for migration-inequality relationship). It is therefore unsurprising that the issue of internal migration has a significant effect on political participation and voter turnout (Akarca and Tansel 2015). Various models have been developed to take account of some hidden and unhidden factors that may determine expected gains when migrate. For instance, in the classical Todaro migration model (1969), the anticipated benefits depend basically on the difference in real incomes and job opportunities across locations, and the probability of being employed at each location (Zhu 2002; Chen and Rosenthal 2008; Arntz 2010). Applying his model to rural-urban migration flows, Harris and Todaro (1970) show under some conditions that increased rural-urban migration may lead to a rise of urban unemployment rate as long as the expected wage in urban areas is higher than the rural one. Recent economic migration models have extended the Todaro framework to address many drawbacks in the traditional approach and to explicate why migration sometimes may coexist with no significant expected earnings differentials or, on the contrary, why migration sometimes may occur even when there is not any earnings differential between regions.

Since the mid-1980s, Tunisia has conducted a structural adjustment program characterized by more privatization and economic opening. Tunisia’s diversified economy has experienced rapid growth averaging 5 % per year before the 2011's revolution and has achieved remarkable success in poverty alleviation. However, these achievements have been marred by an unequal growth in the economic performance and the employment opportunities between coastal and interior regions (inland areas). Giving such growing regional disparities, labor market

adjustments and internal migration have become crucial in spreading the benefits of economic reforms and growth from the most advantaged regions to less-advantaged ones. Notwithstanding the obvious importance of internal migration for redistributive of wealth and social policies, there has been, surprisingly, little literature focusing on this population mobility in Tunsia except the work of Jelili and Mzali (1998), Mahjoub (2010) and Mesnard (2004). Jelili and Mzali were the first to model and test individual rural-urban migration decisions in Tunisia and the migration selectivity, taking into account the importance of human capital investment incentives and individual characteristics. Using micro level data from Tunisia's rural areas, they found that by purely statistical assessment, the anticipated monetary gains effect is significantly different from zero, but that by economic considerations it is small. Similarly, to Nakosteen and Zimmer (1980), their findings maintain that "*non-migrants in the rural population choose their status because they fail to perceive more favorable returns elsewhere*".

The main paper's contribution to the aforementioned literature is twofold: First, while we use the basic gravity model and its extended version, which assumes that the stream of inter-governorates migrants depend on a set of *push* and *pull* factors such as population size, distance, wage/expenditures differentials and dissimilarities in employment opportunities and education level (Greenwood 1997; Andrienko and Guriev 2004), we employ the Poisson pseudo-maximum-likelihood (PPML) estimation technique to overcome the issues of the traditional models. Second, we attempt to decipher more deeply the relationship between inter-governorates migration and inequality in wage, expenditures, job vacancies and education level by re-estimating all aforementioned models using differential variables. To the best of our knowledge, it's the first time that data on inter-governorates migration are used to study the impact of regional differentials on migration flows in Tunisia.

The remainder of the paper proceeds as follows. Section 2 provides an overview of regional disparities and internal migration in Tunisia. Section 3 presents data and basic descriptive statistics. Section 4 presents the used methodology to investigate determinants of inter-governorates migration pattern. Section 5 presents the results and tests the hypothesis that regional disparities influence migration patterns in Tunisia. Finally, the last section offers some policy recommendations, concluding thoughts and some future research directions.

2. Regional Disparities and Internal Migration Pattern in Tunisia

As for many North African countries, the urban system in Tunisia is composed of a small number of large cities (Greater Tunis, Sfax, Nabeul and Sousse) and by many secondary towns located principally in the coastal zone. In spite of its relatively small size, Tunisia has large environmental diversity and a gradient of rainfall conditions owing to its North-South extent; Its East-West extent is relatively restricted. Disparities in Tunisia, similar to the rest of the Maghreb countries (Algeria, Libya, Mauritania and Morocco), are mainly north-south characterized by sharply decreasing rainfall southward from any point.

Last decades, unemployment and underemployment have become one of the major problems facing working class population and a principal determinant of internal migration in the country added to the uneven economic and social development between regions. Since the outbreak of the revolution of January 14th, 2011, an increase of spatial mobility rates accompanied with an increase in the social and regional disparities were observed, and this in a context where the situation is considerably worse in the inland regions (Figure 1).

Tunisia has recently experienced a growing flow of migrants between governorates, which in terms of annual average, the total of migrants has attained 88,900 in 2004 and in 2009, it rose to 50,900. Between May 2011 and May 2012, the number has attained 160,000 migrants. Of all the concerned regions of the country, only two zones have noted a positive balance: Grand

Tunis and Central East. While Southern, Northern and Central West regions (except Medenine in the South) continued to record substantial negative balances.

The Tunisian population is known to be very mobile compared to those in other African countries. During the colonial and postcolonial period, severe recruitment policies obliged several people to migrate from their villages to work respectively for specific colonial and government interests. Internal migration, less studied compared to international migration, played specifically a main role by shaping the demographic structure of the society and contributing to urban growth in Tunisia. According to the 2004 General Census of Population and Housing, 1,603,326 people, that is 16.2% of the total population, have changed their residence during the period ranging from April 1999 to April 2004. 4.77% of them have left the country to abroad and only 1.78% people came to it from the outside and 26.6% moved from a governorate to another. While the majority of movers, 66.85%, have changed their residence within the borders of the country. In the current study we'll consider as internal migrant, only person who moved from a governorate to another for a predetermined period. [1]

At the governorate level, the largest migratory flows (90116 persons) left Tunis, the capital, during the period 1999-2004, for its neighboring governorates particularly Ariana and Ben Arous (see circular chart in Figure 2). Likewise, Tunis was the most important and common destination of large number of internal migrants; nearly 15% of the total number of migrants have arrived to the capital during the same period. Most of these arrivals were from the North-Western region (see Figure 2). The exchange between Sfax, Sousse and Gabès, and their neighbors respectively Sidi Bouzid, Kairouan and Mednine was also substantial. In fact, 20.70% of the total arrivals to Sfax came from Sidi Bouzid; 25.22% of the total arrivals to Sousse came from Kairouan; 19.25% of the total arrivals to Gabès came from Mednine.

Furthermore, the census statistics show that the capital had the highest emigration rate (9.16%), followed by Siliana (7.12%), El Kef (6.71%), Kairouan (5.51%), Kasserine (5.36%) and Béja (5.08%) (see Table 1). It is notable that in all these governorates, except Tunis, characterized mostly by an economy founded on agriculture and with difficult agro-ecological conditions for some of them, out-migration of the agricultural labor force has led to undesirable economic outcomes.

The five highest immigration rates concerned the Ariana (12.63%), Ben Arous (11.09%), Manouba (6.94%), Sousse (6.41%), Tunis (6.39%) and Monastir (6.10%) governorates. With enormous flows of immigrants, these governorates faced difficulties related to access to job opportunities and basic social infrastructures. Generally, inequalities within the country with regard to migration are substantial. Net migration statistics illustrated in Table 1 show that Tunis lost the greatest number of persons (27,200) followed by Kairouan, Kasserine and Sidi Bouzid that lost respectively 22,984; 16,923 and 14,058 persons between 1999 and 2004. While Ariana, Ben Arous, Sousse, Monastir and Sousse gained respectively 37,896; 36,939; 21,863; 16,954 and 11,392 people through internal migration.

3. Data and Descriptive Statistics

The data on which the analysis below is based come from the General Population and Housing Census microdata (RGPH) for 2004. The 2004 Census is an exhaustive survey taken by the National Institute of Statistic (INS), where the collection of statistical data covered the entire population, households and dwellings in the country. The general population and housing census registered a population of 9 million 910 thousand 872 inhabitants in 2004. The number of male is 4,965.4 thousands, forming 50.1% of the population. The total number of people in urban areas is 6429.5 thousand persons (65%) compared to 3481.4 thousand persons (35%) in

1 In the 2004 Census report, internal migrant is defined as any person who have moved from a delegation to another. We haven't adopted this definition in the current study because of unavailability of data at this scale.

rural areas. The youth population aged less than 15 years old represented relatively 26.27 % of the entire country and solely 9.3 % of people aged 60 and over. The illiteracy rate varied from 16.2% in urban zones (9.8% being male) to 35.5% (46.4% being female) in rural areas. The distribution of the resident population by governorate showed a great disparity. The four governorates of Great Tunis (Tunis, Sfax, Ben Arous, Nabeul and Sousse) are inhabited by 32% of the resident population. Otherwise the southern governorates contain the lowest density of the population. The urban and eastern governorates had the lowest illiteracy rates while the inland ones had the highest rates. The entire inland region differed from the rest of the country with relatively low rates of economic activity, high unemployment rate, high percentage of cultivated area, low urbanization rate and low access to basic services particularly in rural areas.

All information about internal migration (inter-governorate migration) in five-yearly intervals[2] is obtained from the special migration module that was used in the 2004 population census. This module identified migrants by asking them where they lived five years prior to the census. If the individual has changed his place of residence during that period, the following variables are collected: governorate of origin (in 1999) and the reasons for move. International and intra-governorate migrations were ignored in our case.

By knowing the current governorate of residence in 2004 and that of origin in 1999 for each migrant, we can determine the inter-governorate migration flows that will be used later as being the dependent variable. Each observation represents a pair of governorates, giving 552 (24×23) pairs of flows. Internal migration flows indicate the number of people that, during the five years prior to the census, canceled their official residency in one governorate and registered it in another one inside the country. The 2004 national census used in this study also involved total population, employment population by sector, unemployment rate by governorate, and urban and rural population. In order to test the effect of regional labor market conditions (such as wage differentials between sending and receiving governorates, unemployment and job vacancies) on internal migration, we combine data from the National Business Register (*Répertoire National des Entreprises* or RNE) and the National Agency for Employment and Self-employment (*Agence Nationale pour l'Emploi et le travail indépendant* or ANETI). The RNE, created and managed by the INS, is an annual census containing information on the size, age, wage, activity, … of all private non-agricultural registered firms in Tunisia. According to RNE, there were 15,664 private firms with 6 or more employees in 2004. The ANETI provides information about the number of registered job seekers, job vacancies and job placements by governorate. It is expected that people were considered as rational decision makers, who seek to maximize their utility, move from low to high wage areas. In addition, migration flows are expected to occur from areas with a high unemployment rate to those with a low one, and from those with a low number of vacancies to those with many employment possibilities (Amtz 2010; Gärtner 2016; Liu and Shen 2014; Scott 2010).

The average per capita expenditure by governorate is taken from the 2000 national survey on Households' Budget, Consumption and Standard of Living (EBCNV) conducted by the INS and covering 12,249 households. Migration flows are expected to occur, *ceteris paribus*, from governorates with a low per capita expenditure to those with a high one. The assumption is that the likelihood of migration decreases as the economic welfare in the location of origin increases (Antolin and Bover 1997; Gärtner 2016; Kennan and Walker 2011; Nakajima and Tabuchi 2011; Yazki et al. 2014). This effect is inherent in the neoclassical macro-migration theory developed by Lewis (1954) and later developed by Harris and Todaro (1970) in the rural-urban migration model (Ha et al. 2016).

[2] Migration is measured over the reference period of five years : 1999-2004 for census 2004, 2004-2009 for the mini-census survey of 2009 aimed to update the census database, and 2009-2014 for the census 2014.

Other sources were used to create other variables known to have significant impacts on migration flows. The Tunisia shapefile for the 24 governorates, obtained from the Global Administrative Areas 2015[3], was used to calculate the distance between governorates and contiguity variables. Distance is a standard variable in gravity model, which represents the barriers to, as well as potential costs of, migration. The Euclidean distance between two governorates is defined in our study as the Euclidean between the centroids of the respective governorates[4]. Contiguity variable was used to control for unusually large flows between neighboring governorates. It equals to 1 where governorates have contiguous borders and 0 otherwise. Table 2 provides an overview of the variable descriptions and their sources while Table 3 shows some basic descriptive statistics.

4. Methodology

In analogy with Isaac Newton's Law of gravitation, the spatial interaction models were the first to consider spatial mobility of population as interaction between two territorial units.[5] The idea was that the aggregate groups of people can be compared to a simple system of elementary particles, whose existence and motion follow the rules similar to physical concept. The gravity model builds on this spatial interaction theory by explicitly stating the relationship between migration and the push-pull factors that represent benefits and costs of migration (Garcia et al, 2014). In this model, the flux of migration M_{ij} between two places (countries, regions …) i and j is proportional to their population size, P_i and P_j respectively, (or some other measure of size) and inversely proportional to distance between them (D_{ij}).[6] Our empirical analysis is based on the extended version of the gravity model developed by Lowry (1966) and Lucas (1994), which can be generalized to include all the possible push and pull migration forces as follows (Etzo 2011):

$$M_{ij} = k^{\gamma_0} . \frac{P_i^{\gamma_1} P_j^{\gamma_2}}{D_{ij}^{\gamma_3}} . \prod_{s=1}^{n} \frac{X_{s,j}^{\alpha_s}}{X_{s,i}^{\beta_s}} \quad (1)$$

Where $X_{s,i}$ indicates the possible exogenous variables (push factor for migration) for the origin region i, while $X_{s,j}$ includes all exogenous variables (pull factor for migration) that can attract migrations in the destination region j (Etzo 2011; Andrienko and Guriev 2004). In equation (1), k is a constant.

The exogenous variables in equation (1), other the standard gravity variables (population and distance), are added to the gravity model in multiplicative forms representing ratios of variables in destination and origin regions. By expressing equation (1) in logarithmic form, we get an expanded double logarithmic equation in which M_{ij} of equation (1) is in logarithms, and there are terms added to the right hand side giving push and pull factors of regions i and j, the following linear equation is obtained (Etzo 2011):

$$\ln(M_{ij}) = \gamma_0 \ln k + \gamma_1 \ln P_i + \gamma_2 \ln P_j - \gamma_3 \ln D_{ij} + \sum_{s=1}^{n} (\ln X_{s,j}^{\alpha_s} - \ln X_{s,i}^{\beta_s}) + \varepsilon_{ij} \quad (2)$$

The error term ε_{ij} is assumed to be an independent random variable which is normally distributed with zero mean and identical variance σ^2. The γ's are now estimable and may take

[3] www.gadm.org.

[4] Other alternative measures of distance were used in the empirical studies such as the road distance, the travel time and the population weighted centroids. Some of them concludes that there are no significant differences between these measures (Garcia et al. 2014).

[5] Models that describe and predict the numbers of migrations between two regions as a function of attributes of the locations of origin, the attributes of the locations of destination and the friction of distance between them are often called spatial interaction models (Rogers 2015, p.8).

[6] The gravity model as originally formulated (naive gravity model) expresses migration from i to j (M_{ij}) as: $M_{ij} = \frac{\alpha P_i P_j}{D_{ij}}$, where α is a constant.

any number of values, but the coefficients on γ_1 and γ_2 are expected to be positive whereas that associated with $\gamma_3$should be negative. The log-linear gravity model in equation (2) can be estimated by employing ordinary least squares (OLS). The term in square brackets reflects regional differentials or regional inequalities such as regional differences in job opportunities or job vacancies, in income or expenditure, in wage, in poverty, in unemployment rate, and in education.

The use of the log-linear gravity model to estimate the inter-regional migration flows may lead to several problems (Congdon 1992; Liu and Shen 2014). First, the logarithmic transformation of inter-regional migration flows can result in an enormous difference between the total number of expected and actual movers. Second, the error term ε_{ij} does not necessarily follow a normal distribution with zero mean because the migration flows must be a discrete random variable. Third, the OLS is based on the assumption that all error terms have the same variance. In addition, when a large proportion of cases are very small flows, the logarithmic transformation of variables may result in substantial differences between the estimated and observed flows (Shen 1999).

The use of Poisson models can solve the abovementioned problems. Several empirical works have demonstrated that the Poisson models outperform the log-linear models in terms of goodness of fit (Liu and Shen 2014, Congdon 1992). Formally, the inter-regional migration flow M_{ij} between i and j can be assumed to follow a Poisson distribution as:

$$p(M_{ij}) = \frac{\exp(-u_{ij})u_{ij}^{M_{ij}}}{M_{ij}!}, \quad (M_{ij} = 0, 1 \dots) \tag{3}$$

The conditional mean (u_{ij}) is linked to an exponential function of a set of exploratory variables as:

$$u_{ij} = \exp(\gamma_0 \ln k + \gamma_1 \ln P_i + \gamma_2 \ln P_j - \gamma_3 \ln D_{ij} + \sum_{s=1}^{n}(\ln X_{s,j}^{\alpha_s} - \ln X_{s,i}^{\beta_s})) \tag{4}$$

In order to estimate gravity equations in the presence of over-dispersion, Santos Silva and Tenreyro (2006) recommend using Poisson pseudo-maximum-likelihood (PPML) estimation techniques, which does not assume equi-dispersion. PPML is optimal when the conditional variance is proportional (though not necessarily equal) to the conditional mean, and even if the two are not proportional, the PPML will still be consistent (consistent with over-dispersion). PPML has an additional property which makes it more preferable. PPML is the only estimator that automatically satisfied the adding-up constraints on the sum of flows for each source region and each destination (which is not the case for the other estimators such as the OLS and the Gamma-pseudo-maximum-likelihood). Accordingly, we implement Poisson regressions as our preferred specification. For more details, see Fally (2015) and Santos Silva and Tenreyro (2011).

5. Results and Discussion

Table 4 presents the main results for the basic gravity model. In column 1 we run the log-linear specification of equation (M1) with only population and distance as independent variables. In column 2, we added the contiguity variable to test if migration was generally higher between adjacent governorates. Columns 3 and 4 present the results from the PPML model (M2) without and with the contiguity variable, respectively. All estimated gravity variables have the expected sign and they are all statistically significant at the 1% level. The traditional gravity model (M1) explains 55% of the observed variation in the depended variable inter-governorate migration, and 59% when the contiguity variable is added to M1. For the PPML model (M2 and M2 with contiguity variable), the pseudo R-squared (pseudo R^2) is computed as the square of the correlation between inter-governorate migration and fitted values and it is about 59% and 60% respectively.

The results of different models are quite similar. The coefficient of $\ln(P_i)$ is positive and significant, which is consistent with the conventional thesis that populous regions are more likely to have a large out-migration. The coefficient of $\ln(P_j)$ is also positive and significant and it has a higher effect than the coefficient of the origin population (1.119 versus 0.668 for the log-linear model and 1.065 versus 0.919 for the Poisson model). This result shows that the destination population clustering higher than the origin population and it is in line with the hypothesis that migrant move based on their expectation of increased benefits in the destination region and the relative gains compared to the origin region (Todaro, 1980). Additionally, the level of migration flows is negatively related to the geographical distance between sending and receiving region, as in Liu and Shen (2014), Phan and Coxhead (2010) and Etzo (2011), confirming the validity of gravity factors. The effect of contiguity variable on migration flows is positive and significant at 1 per cent level, which indicates that migration was generally higher between adjacent governorates than predicted simply by the friction of distance. In fact, the absolute value of distance elasticity was dramatically decreased when the contiguity variable was added (from 0.803 to 0.478).

The intra and inter-regional migration flows in Table A1 in the appendix confirm also this finding. As we can see, most of the migrants (22%) who move out from their governorate of residence move within the Greater Tunis area formed by four adjacent governorates (Tunis, Ariana, Manouba and Ben Arous). This result is in line with many previous findings focusing on the inter-regional migration flows (e.g. Henry et al. 2003; Garcia et al. 2014; Biagi et al. 2011). Biagi et al. (2011) investigated the differences between long distance and short distance migration within Italy. They showed that economic and labor market variables, more specifically poverty and unemployment, determine the long distance migration flows. They added that, in case of long distance movements, people tend to migrate to provinces with higher GDP per capita (highly correlated with higher wages) and lower unemployment. Contrary to long distance movements, they showed that economic variables do not play a dominant role for the case of short distance movements. Moreover, they argued that short distance movements are more related to natural amenities such as being close to the coast and having a better quality of life.

Table 5 shows the results of the extended gravity model with both push factors (characteristics of the governorate of origin) and pull factors (characteristics of the governorate of destination) for both specifications (traditional gravity model and PPML model). The discussion of the results starts from the gravity variables, which have all the expected signs and statistically significant coefficients. The positive sign of population size for both origin and destination governorate suggests that an increase in population size leads more people to emigrate but also attracts more immigrants. These results are similar with the previous work such as Etzo (2011) and Garcia et al. (2014). Geographical distance is always negative and significant, but it is smaller in absolute value under PPML model compared with OLS. This result is typical of Poisson gravity models, and largely reflects the impact of heteroskedasticity on the original OLS estimates (Santos Silva and Tenreyro 2006). The average of the log-distance between governorate is 5.159 (about 213 km) with a standard deviation of 0.676 km. For a one standard deviation increase (approximately 0.7 km) in the log-distance, the expected number of migration flows would decrease by a factor of 0.697 ($(e^{-0.534\times0.676}-1)\times100=-30.32\%$), holding all other variables constant. The coefficient on the contiguity variable for the PPML model (0.669) suggests that flows between border governorates are 95 percent ($(e^{0.669}-1)\times100$) larger than other flows. These results confirm again that distance is an important determinant of internal migration in Tunisia that cannot be omitted.

In the extended PPML model, economic opportunities were measured by the unemployment rate, the average monthly wage, and the number of job vacancies. As expected, the coefficients on the unemployment rate indicate that higher unemployment triggers out-migration at the

origin (1.531) and dampens in-migration at the destination (-0.531). The estimated coefficients suggest that a one standard deviation increase in log unemployment rate (about 10%) induces 50 percent ($(e^{1.531\times0.266}-1)\times100=50.27\%$) increase in migrant departures at the origin and 13 percent ($(e^{-0.531\times0.266}-1)\times100=-13.17\%$) decrease in migrant arrivals at the destination governorate. Thus, the effect of the unemployment rate on internal migration (other things equal) appears to be stronger in the sending governorate (as a push factor) than in the destination governorate (50% versus 13%). This result shows that if the unemployment rate differentials are high enough, people still willing to migrate from regions with high unemployment to low-unemployment ones in search of better job opportunities. This is the case of Tunisia where the unemployment differentials between the non-coastal and the coastal areas are high and persistent.

Similarly to the unemployment rate variable, the job vacancies variable as an alternative indicator of local labor market conditions is a highly relevant factor in motivating migration. Harris and Todaro (1970) determine that migrants follow jobs and hence, low vacancy rates should act as 'push' factors of migration. Looking to the coefficient of the job vacancies for the PPML model, it is clear that out-migration is sensitive to the fluctuations in vacancy stock in the governorate of origin (the coefficient for job vacancies in governorate j is insignificant). This vacancy effect has to be interpreted cautiously, since there are only job vacancies reported to official job centers and that only 12% were registered by the National Agency for Employment and Self-employment (Amara et al, 2013). In addition, most vacancies in Tunisia are filled informally without the involvement of the official job centers.

In addition to unemployment rate and job vacancies variables, we tested the effect of the average annual wage on migration flows. Whereas the results for unemployment and vacancies are largely in line with the literature, the results for wage are not. Contrary to our expectations, the average annual wage in both the destination and origin governorates has no significant effect, and does not support the idea that labor migrates from areas with lower wages to areas with higher wages. One possible explanation for these results is the observation that the wage differential between sending and receiving governorates is not important enough to stimulate internal migration in Tunisia between 1999 and 2004. Indeed, the coefficient of variation of the average annual wage in Tunisia is 0.24 while that of job vacancies and unemployment rate are 0.83 and 0.27, respectively. Our results are in line with the findings of Heibron (1998) and Westerlund (1998) which both claim that the labor market has a significant effect on the internal migration in Sweden, but that regional unemployment differences seem to be more important than wage differences. Knapp and Graves (1989) and Mueser and Graves (1995) gave an alternative view of why interregional wage differentials cannot explain the interregional move of people. They argued that migration is a result of the change in demand for location-specific amenities such as low crime rates and favorable public services rather than interregional wage differentials. In this view, regional variation in wages is assumed to reflect compensation for spatial variations in amenities.

The results for urbanization rate confirm a negative (push) effect in the sending governorate but no significant effect in the destination governorate. Higher level of urbanization reduces the risks of out-migration. According to the rural-to-urban model developed by Harris and Todaro (1970) the link between urbanization and migration is assumed to work as follows: a considerable increase in labor demand from the big industries, mostly located in the urban areas, triggered the migration of people from the rural areas. Urbanization in Tunisia increased in fifty years (1964-2014) from 39.3 to 67%[7] and rural-urban migration continues to be an important pathway for rural migrants, especially young men. Until the 1980s, almost 40% of migrants headed for the capital Tunis which has 50% of industrial employment in the 1960s.

[7] World Development Indicators.

The pace of urbanization, however, declined since the mid-1970s following the decentralization process and economic liberalization, which explains the insignificant coefficient for the urbanization rate in the governorate of destination. Recently, spatial movements have changed from rural-urban migration to urban-urban migration flows. More specifically, the intra-metropolitan migration, particularly within Greater Tunis from the center to the periphery, has gained significance and increasingly part of internal migration in Tunisia.

The obtained estimates of the extended PPML model in Table (5) show also that an increase in per capita expenditure as a proxy for welfare levels induces lower out migration, which may indicates that people with higher expenditure are less likely to be willing to leave, since other governorates are less attractive to them. Our results are consistent with findings that high per capita expenditure and income are clearly conducive to migration (see among others Bell et al., 2015). From the standpoint of regional human capital reallocation, the effect of the level of education (as a proxy of skills) on internal migration is of special interest. Two variables were used to try to account for regional human capital in our analysis: the percentage of people with higher education level and the percentage of people with no education level. Our results show that areas with higher level of education failed to attract migrants (the coefficient of $\ln(educ4_j)$ is statistically insignificant), but their people are less likely to be willing to leave and appear to be discouraged to move to regions with low concentrations of human capital (the coefficient of $\ln(educ4_i)$ is negative and significant at a 0.01 level). Surprisingly, we find the same results for areas with higher proportion of no education people. This ambiguous result may be explained by the fact that we do not distinguish between skilled and unskilled migrants, as they have starkly different migration patterns. In fact, the data that we have do not permit this plausible argument to be tested. Interesting results have recently funded by empirical studies focused on the effects of regional human capital agglomeration on inter-regional migration, more specifically on the labor migration flows. Fu and Gabriel (2012) show, for example, that migrants in the top education stratum are strongly attracted to regions with high human capital concentration, in contrast to those with no education who appear to be discouraged from migrating to high human capital regions.

In order to test the robustness of our results and to overcome some ambiguities that appear when interpreting the results (for example the negative and significant effect of the percentage of people with no education level on out-migration flows), we re-estimate the extended log-linear gravity and PPML models by using differential variables. For the independent variables (except distance and contiguity), the differences are calculated as the destination value (in logarithmic form) minus the origin value (in logarithmic form) of the variables. The estimation results for both models based on differential variables are reported in Table 6. Our estimation PPML model provided strong evidence of several important factors influencing inter-governorate migration flows in Tunisia. More specifically, internal migration flows are determined primarily by distance, unemployment inequalities between governorates, per capita expenditure differentials (welfare level), and less influenced by job vacancies. Tunisian migrants were found to be more attracted to governorates with low unemployment rate and high per capita expenditure. So out-migration flows are largely directed from lower income, depressed and high unemployment western interior areas to higher income and advanced east coast areas.

The absence of any significant effect of wage on internal migration is in line with the mixed performance of regional wage and unemployment variables in the literature (see Greenwood, 1993 for more details). Numerous papers hypothesize that migrant will be influenced by expected income at alternative locations, and consequently the values of alternative wage rates will enter the potential migrant's decision calculus. This wage hypothesis is not supported in our case. One possible explanation for this was that in Tunisia, characterized by high unemployment rate (about 15%, over 20% among university graduates and reached 60% in

some sections such as literature or human sciences graduates) the probability of achieving a higher wage is intrinsically related to the probability of finding a job. The high unemployment rate among university graduates can also explain the absence of any significant effect of education on internal migration.

6. Conclusions and Policy Implications

In this paper, we undertake analyses of inter-governorates migration in Tunisia during the period from 1999 to 2004. That period was characterized by liberalization of labor markets, good macroeconomic performances, and accelerating urbanization. Nonetheless, there is still much to be done in terms of fighting unemployment and regional disparities across Tunisian governorates. We focus mainly on the role of distance, wage/expenditure differentials and dissimilarities in employment opportunities and human capital in determination of internal migration patterns. Research findings indicate that Tunisian migrants were found to be more attracted to governorates with low unemployment rate and high per capita expenditure. Out-migration flows are largely directed from lower income, depressed and high unemployment western interior areas to higher income and privileged east coast ones. Moreover, migration is found to be affected by distance; most migrants move only short distance.

Our first recommendation from the current study after analyzing the internal migration patterns in Tunisia is that any policy or strategy linked to migration should be founded on a better comprehension of the conditions, needs, priorities and a reason to migrate of the particular migrant group targeted as one size does not fit all. In technical and practical terms, all stakeholders from small civil associations to different departments and other institutions currently responsible for one or other aspect of migration should be involved in a closer coordination and cooperation. Moreover, greater attention should be given to longitudinal, causality, retrospective and prospective studies in order to enhance current knowledge on migration and its linkage with poverty and inequality in Tunisia, and investigate the main drivers of migration and its impact on economic development and inequality.

According to potential results, we shall recommend also a special focus on the contribution of migrants to home areas. Thus, the government should recognize the main requirements for support and, on this basis, develop and promote relevant initiatives such as, facilitate transfer of remittances, and omit categorizing regulation, provide more interesting information on local investment opportunities, offers programs of training and practical sustain to return migrants and/or their families, etc. This requires further research on the socioeconomic cost and benefits of migration, for the low-income migrants and non-migrants and for whole the society. In fact, rising pressure on infrastructure and services in the receiving cities are in certain cases problematic and generates a lot of social troubles for the society. To alleviate the magnitude of the negative effect of migration in great cities such as the pressure on infrastructure government policies could support more equilibrate and equitable regional development throughout public investment in infrastructure and services in small towns and intermediate urban centers.

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Figure 1: Spatial Distribution of Poverty, Unemployment and Literacy Rates in Tunisia

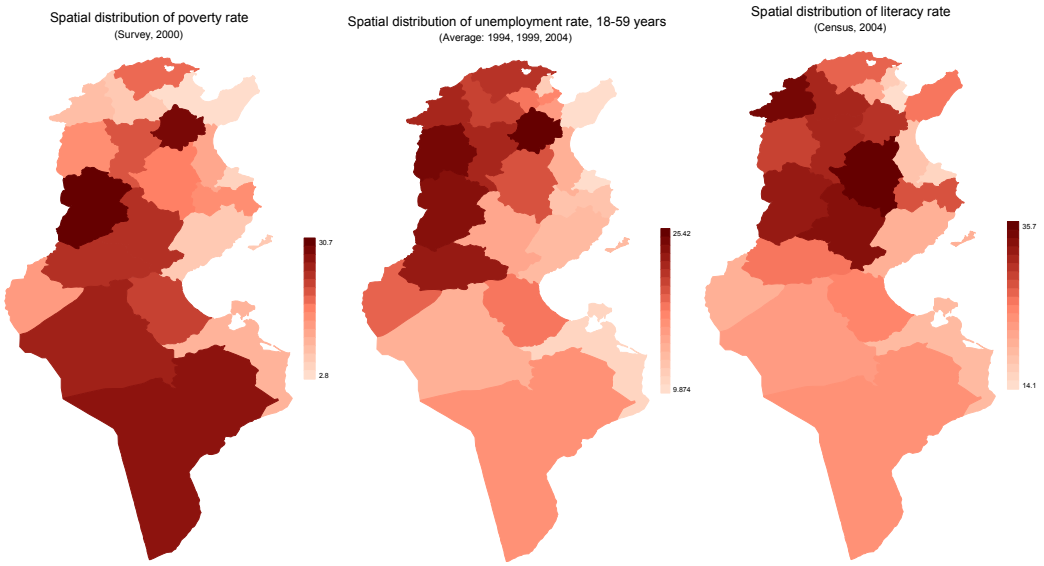

Figure 2: Migration Flows (Circular Chart)

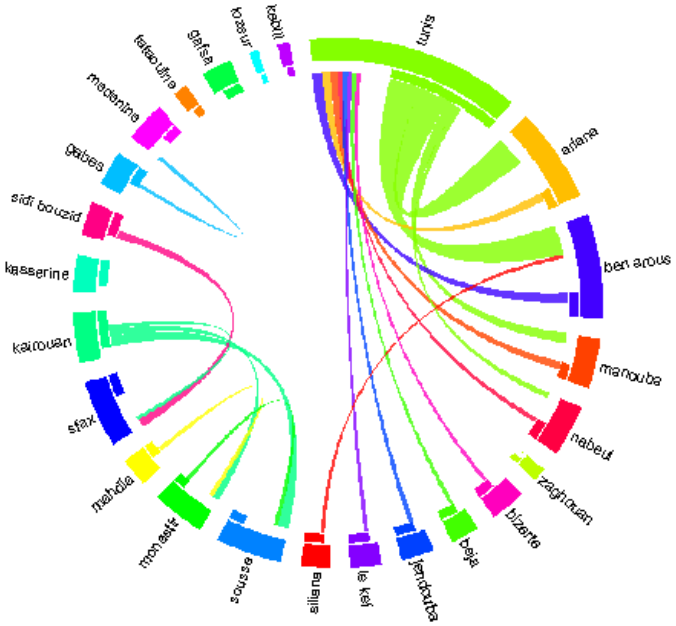

Table 1: Departures, Arrivals, Net Migration, Immigration and Emigration Rates for The 24 Governorates

	Population In thousand	Departures In thousand	Arrivals In thousand	Net migration	Immigration Rate (%)	Emigration Rate (%)
Tunis	983.9 (9.93)	90.1 (21.13)	62.9 (14.75)	-27200	06.395	9.159
Ariana	422.2 (4.26)	15.4 (3.62)	53.3 (12.50)	37896	12.627	3.652
Ben Arous	505.8 (5.10)	19.2 (4.49)	56.1 (13.15)	36939	11.090	3.787
Manouba	335.9 (3.39)	13.6 (3.19)	23.3 (5.46)	9721	06.939	4.045
Nabeul	693.9 (7.00)	15.5 (3.63)	22.5 (5.28)	7055	03.247	2.231
Zaghouan	161.0 (1.62)	05.6 (1.32)	04.8 (1.14)	-785	03.011	3.498
Bizerte	524.1 (5.29)	14.5 (3.39)	11.6 (2.73)	-2823	02.221	2.760
Beja	304.5 (3.07)	15.5 (3.63)	05.9 (1.38)	-9601	01.927	5.080
Jendouba	416.6 (4.20)	17.3 (4.05)	07.3 (1.72)	-9936	01.761	4.146
El Kef	258.8 (2.61)	17.4 (4.07)	06.2 (1.46)	-11155	02.399	6.709
Siliana	234.0 (2.36)	16.7 (3.91)	05.0 (1.17)	-11692	02.124	7.121
Sousse	544.4 (5.49)	13.1 (3.06)	34.9 (8.19)	21863	06.414	2.398
Monastir	455.6 (4.60)	10.8 (2.54)	27.8 (6.51)	16954	06.098	2.377
Mahdia	377.9 (3.81)	11.7 (2.75)	09.3 (2.18)	-2452	02.459	3.108
Sfax	855.3 (8.63)	18.7 (4.38)	30.1 (7.05)	11392	03.518	2.186
Kairouan	546.2 (5.51)	30.1 (7.06)	07.1 (1.67)	-22984	01.307	5.515
Kasserine	412.3 (4.16)	22.1 (5.19)	05.2 (1.22)	-16923	01.262	5.366
Sidi Bouzid	395.5 (3.99)	19.6 (4.60)	05.6 (1.30)	-14058	01.407	4.962
Gabes	342.6 (3.46)	14.3 (3.36)	12.0 (2.81)	-2367	03.495	4.186
Medenine	432.5 (4.36)	13.4 (3.13)	16.1 (3.76)	2696	03.712	3.089
Tataouine	143.5 (1.45)	07.0 (1.64)	04.5 (1.06)	-2455	03.165	4.875
Gafsa	323.7 (3.27)	15.0 (3.52)	07.2 (1.70)	-7783	02.235	4.640
Tozeur	097.5 (0.98)	04.3 (1.01)	03.7 (0.87)	-586	03.811	4.412
Kebili	143.2 (1.45)	05.7 (1.33)	04.0 (0.93)	-1716	02.775	3.973
Tunisia	9910.9	426.5	426.5	0	04.304	04.304

Note: Number in parentheses indicates the percentage.

Table 2: Variable Definitions

Variable	Description	Source
Gravity variables		
Migrant volume (M_{ij}) 1999-2004	The number of people moving from governorate i to governorate j from 1999 to 2004	RGPH, 2004
Migrant volume (M_{ij}) 1987-1994	The number of people moving from governorate i to governorate j from 1999 to 2004	RGPH, 2004
Population (P_i/P_j)	Total population at i and j	RGPH, 2004
Distance (D_{ij})	Euclidean distance between geometric centroids of i and j (km)	GADM, 2015
Contiguity ($contig_{ij}$)	Equals to 1 where governorates i and j have contiguous borders and 0 otherwise	GADM, 2015
Social, Economic and Demographic variables		
Wage ($wage_i/wage_j$)	Average annual wage in 2004 for private firms with six or more employees (TND)	RNE, 2004
Unemployment ($unemp_i/unemp_j$)	Annual average Unemployment rate from 1999 to 2004 at i and j	INS and RGPH, 2004
job vacancies (job_i/job_j)	Number of job vacancies at i and j	ANETI
Educational level ($educ_i/educ_j$)	Level of education : none (1), primary (2), secondary (3) And university level (4) at i and j	RGPH, 2004
Expenditure (exp_i/exp_j)	Average annual per capita expenditure at i and j in 2000 (TND)	EBCNV, 2000
Urbanization (urb_i/urb_j)	Urbanization rate at i and j	RGPH, 2004

Table 3: Descriptive Statistics

Variables	Mean	Std. Deviation	Minimum	Maximum
M_{ij} (1999-2004)	773	1813	12	24760
P_i/P_j (thousand)	406	202	97	967
D_{ij} (km)	213	128	17	589
$contig_{ij}$	0.181	0.385	0	1
$wage_i/wage_j$	3239	777	1994	5782
$unemp_i/unemp_j$ (%)	16.6	4.5	9.9	25.4
job_i/job_j	5930	4903	829	15510
Educational level (%)				
None ($educ1_i/educ1_j$)	24.1	6.8	14.1	35.7
Primary ($educ2_i/educ2_j$)	37.4	2.9	31.1	42.6
Secondary ($educ3_i/educ3_j$)	31.2	4.6	22.6	40.4
University ($educ4_i/educ4_j$)	6.90	3.2	4.10	15.3
Expenditure (exp_i/exp_j)	912	242	614	1388
Urbanization (urb_i/urb_j) (%)	60.96	22.46	24.69	100

Table 4: Estimation results (Gravity Model)

Variables	log-linear model		Poisson model	
	Traditional Gravity model (M1)	M1 + Contiguity	PPML model (M2)	M2 + Contiguity
$\ln(P_i)$	0.668***	0.766***	0.919***	0.997***
	(0.072)	(0.071)	(0.154)	(0.161)
$\ln(P_j)$	1.119***	1.216***	1.065***	1.145***
	(0.072)	(0.071)	(0.108)	(0.106)
$\ln(D_{ij})$	-0.803***	-0.478***	-0.943***	-0.745***
	(0.059)	(0.075)	(0.108)	(0.127)
$contig_{ij}$		0.834***		0.440***
		(0.126)		(0.148)
Constant	-0.657	-3.627***	-0.758	-2.803**
	(0.775)	(0.870)	(0.911)	(1.188)
Observations	552	552	552	552
Adj R^2	0.553	0.586		
Pseudo R^2			0.587	0.599

Note: ***, **, * denote statistical significant at 1%, 5% and 10% level respectively.

Table 5: Estimation Results (Extended Gravity Model)

Variables	Extended Gravity Model	t-Student	Extended PPML model	Z
$\ln(P_i)$	1.401***	(11.47)	1.776***	(9.29)
$\ln(P_j)$	0.899***	(7.37)	0.603***	(2.92)
$\ln(D_{ij})$	-0.768***	(-11.95)	-0.534***	(-7.26)
$contig_{ij}$	0.656***	(7.04)	0.669***	(5.64)
$\ln(unemp_i)$	0.997***	(6.09)	1.531***	(7.04)
$\ln(unemp_j)$	-0.147	(-0.46)	-0.531**	(-2.40)
$\ln(wage_i)$	-0.039	(-0.21)	0.187	(0.62)
$\ln(wage_j)$	0.593***	(3.19)	0.358	(1.26)
$\ln(job_i)$	-0.061	(-1.14)	-0.277***	(-3.52)
$\ln(job_j)$	-0.061	(-1.14)	-0.019	(-0.22)
$\ln(urb_i)$	-0.458**	(-2.05)	-0.759**	(-2.01)
$\ln(urb_j)$	0.098	(0.44)	0.195	(0.57)
$\ln(exp_i)$	-1.320***	(-7.17)	-0.803**	(-2.51)
$\ln(exp_j)$	0.286	(1.55)	0.093	(0.41)
$\ln(educ1_i)$	-2.800***	(-4.90)	-2.471***	(-2.63)
$\ln(educ1_j)$	-1.765***	(-3.09)	-1.263	(-1.48)
$\ln(educ4_i)$	-0.942***	(-3.55)	-0.784**	(-1.98)
$\ln(educ4_j)$	-0.299	(-1.13)	0.092	(0.24)
Constant	-0.539	(0.22)	7.370	(1.27)
Observations	552		552	
Adj R^2	0.816			
Pseudo R^2			0.861	

Note: ***, **, * denote statistical significant at 1%, 5% and 10% level respectively.

Table 6: Estimation Results (Extended Gravity Model Using Differential Variables)

	Extended Gravity model		Extended PPML model	
Variables	**Coefficient**	**t-Student**	**Coefficient**	**Z**
$\ln(D_{ij})$	-1.036***	(-12.97)	-1.315***	(-8.30)
$contiguity_{ij}$	0.189	(1.35)	-0.091	(-0.62)
diff_ln$(population)_{ij}$	-0.251*	(-1.71)	-0.625***	(-3.01)
diff_ln$(unemployment)_{ij}$	-0.572***	(-2.91)	-0.837***	(-3.42)
diff_ln$(wage)_{ij}$	0.316	(1.41)	0.114	(0.33)
diff_ln$(job)_{ij}$	-0 .001	(-0.00)	0.139*	(1.72)
diff_ln$(urbanization)_{ij}$	0.278	(1.04)	0.214	(0.57)
diff_ln$(expenditure)_{ij}$	0.803***	(3.78)	0.694***	(2.61)
diff_ln$(education1)_{ij}$	0.517	(0.76)	0.676	(0.64)
diff_ln$(education4)_{ij}$	0.321	(1.02)	0.600	(1.20)
Constant	11.011***	(25.57)	12.897***	(16.44)
Observations	552	552	552	552
Adj R^2	0.444			
Pseudo R^2			0.552	

Note: ***, **, * denote statistical significant at 1%, 5% and 10% level respectively.

Appendix

Table A1: Intra and Inter-Regional Migration in % (2004 census)

	Greater Tunis	North-East	North-West	Center-East	Center-West	South-East	South-West
Greater Tunis	21.78	3.16	1.87	3.11	0.65	1.36	0.50
North-East	4.54	0.68	0.79	1.52	0.30	0.35	0.15
North-West	9.22	2.00	1.50	2.06	0.47	0.29	0.11
Center-East	3.61	1.06	0.43	4.90	1.11	1.18	0.45
Center-West	3.24	1.49	0.73	8.86	0.79	0.89	0.85
South-East	2.33	0.45	0.23	1.72	0.38	2.44	0.60
South-West	1.15	0.31	0.17	1.78	0.50	1.13	0.83