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"A gravity model of migration between ENC and EU"

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Abstract

Due to ageing population and low birth rates, the European Union (EU) will need to import foreign labour in the next decades. In this context, the EU neighbouring countries (ENC) are the main countries of origin and transit of legal and illegal migration towards Europe. Their economic, cultural and historical links also make them an important potential source of labour force. The objective of this paper is to analyse past and future trends in ENC-EU bilateral migration relationships. With this aim, two different empirical analyses are carried out. First, we specify and estimate a gravity model for nearly 200 countries between 1960 and 2010; and, second, we focus on within EU-27 migration flows before and after the enlargement of the EU. Our results show a clear increase in migratory pressures from ENC to the EU in the near future, but South-South migration will also become more relevant.

Keywords: absorptive capacity, inventor mobility, spatial networks, patents, regional innovation

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INTRODUCTION AND OBJECTIVES

The free movement of workers is one of the fundamental principles upon which the European Union was once founded and, somehow, it is also present as a future goal in the bilateral negotiations with most neighbouring countries. As recognised in the Europe 2020 strategy, the European Union (EU) has a clear demographic challenge for the next decades. The EU will need to import foreign labour in response to gloomy demographic forecasts, in the context of ageing populations, low birth-rates, and prospects of a collapsing social security system, but it is also necessary to remain competitive in a global scenario and this means that we have to attract and retain the more skilled migrants.

This also requires improving the current control over migration flows and this is one of the reasons why the European migration policy was integrated into the European Neighbourhood Policy (ENP) from the very beginning. The EU neighbouring countries are the main countries of origin and transit of legal and illegal migration towards Europe. Moreover, their geographical proximity, economic, cultural and historical links make them an important potential source of labour force. In fact, nearly all Action Plans, the main tool of the ENP, contained proposals for actions in areas such as border management and management of migration flows. The EU proposed actions in the field of migration, asylum, visa policies, trafficking and smuggling, illegal migration and police cooperation.

The objective of this paper is to analyse past and future trends in ENC-EU bilateral migration flows. With this aim, two different empirical analyses are carried out. First, we specify and estimate a gravity model for nearly 200 countries between 1960 and 2010 and, next, we use the model to obtain medium-run forecasts of bilateral migration flows from ENC to EU; and, second, and in order to check whether our forecasts are consistent or not with previous evidence, we focus on within EU-27 migration flows before and after the 2003 enlargement of the EU.

The rest of the paper is structured as follows: first, in the next section, main trends in population and migration flows from and to ENC and Russia are described; next, the datasets and gravity models used in the analysis are shown and, last, we conclude with some final remarks.

POPULATION AND MIGRATION TRENDS FROM AND TO ENC

In this section, we provide a brief description of past trends in population growth and migration flows from and to European Neighbourhood Countries (ENC) plus Russia. With this aim, we use statistical data from the World Bank Development Indicators. As it can be seen from table 1, the population of the European Neighbourhood Countries (ENC) plus Russia is nowadays above 400 million people. While in the sixties of last centuries, the population in the ENC-South (Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia) was around sixty million people, a similar figure to the population in ENC-East (Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine), nowadays it is substantially higher: 204 million people vs. 75 million. The Russian population has also experienced a very important growth moving from 250 million people in 1960 to 420 million people in 2010. Population growth has been clearly higher in Russia and the ENC-South than in the EU-27 that has increased its population from 400 million people in 1960 to 500 million people in 2010.

As shown in tables 2 and 3, and according to data from the World Bank Development Indicators, there is a very high heterogeneity regarding migration trends in ENC countries during the last 50 years. While some countries such Israel during the whole period or Russia during the last thirty years have been net receivers of migration flows, other countries such as Belarus, Egypt or Tunisia have clearly lost population due to migration during the considered period. An additional interesting feature of migration from ENC is that it is highly concentrated in some destination countries due to geographical proximity or strong political, economic or colonialist linkages (see table 4). For instance, most migrants from Algeria or Tunisia go to France and most migrants from ENC-East go to Russia. In fact, one interesting result is that European Union countries are not always the main destination of migrants from ENC: for instance, emigrants from Egypt choose as Saudi Arabia as first destination, those from Lebanon prefer to migrate to the United States or those from Syria go to Jordan, Kuwait or Saudi Arabia. Migration flows between ENC has been quite relevant in the more recent period. Nowadays, about 10% of total population in ENC-East has been born abroad while this figure is around 5% in ENC-South and Russia. In the EU-27, the stock of foreign born population is around 10%.

Table 1. Population trends in ENC + Russia

	1960	1970	1980	1990	2000	2010
Armenia	1,867,396	2,518,408	3,096,298	3,544,695	3,076,098	3,092,072
Azerbaijan	3,894,492	5,171,999	6,166,000	7,159,000	8,048,535	9,047,932
Belarus	8,198,000	9,040,000	9,643,000	10,189,000	10,005,000	9,490,500
Georgia	3,645,600	3,967,800	4,467,700	4,802,000	4,418,300	4,452,800
Moldova	2,544,000	3,045,000	3,397,000	3,696,000	3,639,588	3,562,062
Ukraine	42,783,010	47,316,501	50,043,550	51,892,000	49,175,848	45,870,700
Total ENC- East	*62,932,498*	*71,059,708*	*76,813,548*	*81,282,695*	*78,363,368*	*75,516,066*
Algeria	10,799,997	13,746,185	18,811,199	25,299,182	30,533,827	35,468,208
Egypt	27,903,093	35,923,283	44,952,497	56,843,275	67,648,419	81,121,077
Israel	2,114,020	2,974,000	3,878,000	4,660,000	6,289,000	7,624,600
Jordan	844,000	1,508,000	2,181,000	3,170,000	4,797,500	6,047,000
Lebanon	1,907,573	2,464,286	2,794,638	2,948,372	3,742,329	4,227,597
Libya	1,349,004	1,994,000	3,063,000	4,334,459	5,231,189	6,355,112
Morocco	11,625,999	15,309,995	19,566,920	24,781,105	28,793,236	31,951,412
Syria	4,566,822	6,368,017	8,906,543	12,324,116	15,988,534	20,446,609
Tunisia	4,220,701	5,127,000	6,384,000	8,154,400	9,563,500	10,549,100
Total ENC-South	*65,331,209*	*85,414,766*	*110,537,797*	*142,514,909*	*172,587,534*	*203,790,715*
Total ENC	*128,263,707*	*156,474,474*	*187,351,345*	*223,797,604*	*250,950,902*	*279,306,781*
Russia	119,897,000	130,404,000	139,010,000	148,292,000	146,303,000	141,750,000
Total ENC + Russia	*248,160,707*	*286,878,474*	*326,361,345*	*372,089,604*	*397,253,902*	*421,056,781*

Note: Palestinian territory is not considered due to the lack of data

Source: Own elaboration from World Bank Development Indicators.

Table 2. Accumulated net migration by decades in ENC + Russia

	1960	1970	1980	1990	2000	2010
Armenia	80,879	142,430	97,262	-114,499	-725,000	-175,000
Azerbaijan	35,979	-65,536	-85,359	-258,668	-243,237	106,528
Belarus	-174,866	-220,098	-72,286	-21,799	*-25,905*	-30,010
Georgia	87,231	-36,371	-143,479	-85,941	-934,105	-459,021
Moldova	182,250	217,003	84,650	-89,430	-373,256	-491,748
Ukraine	-285,919	594,986	247,971	27,378	-446,638	-212,835
Total ENC- East	*-74,446*	*632,414*	*128,759*	*-542,959*	*-2,748,141*	*-1,262,086*
Algeria	-433,115	-838,090	-147,566	13,306	-190,000	-280,000
Egypt	-50,100	-289,800	-1,475,236	-1,348,419	-2,054,942	-717,702
Israel	167,565	281,199	228,425	68,022	702,257	376,570
Jordan	119,245	290,067	-110,464	199,855	213,210	109,022
Lebanon	40,000	-15,000	-296,001	-440,002	230,000	87,500
Libya	46,023	121,206	209,411	165,260	-40,600	-40,600
Morocco	-12,967	-423,104	-614,593	-300,000	-950,000	-1,289,000
Syria	-15,000	-32,000	-243,173	-233,502	-200,000	492,385
Tunisia	-172,625	-368,048	-145,463	-49,196	-98,872	-100,599
Total ENC-South	*-310,974*	*-1,273,570*	*-2,594,660*	*-1,924,676*	*-2,388,947*	*-1,362,424*
Total ENC	*-385,420*	*-641,156*	*-2,465,901*	*-2,467,635*	*-5,137,088*	*-2,624,510*
Russia	-973,612	-938,489	315,615	2,013,615	4,427,937	2,700,163
Total ENC + Russia	*-1,359,032*	*-1,579,645*	*-2,150,286*	*-454,020*	*-709,151*	*75,653*

Note: Palestinian territory is not considered due to the lack of data

Source: Own elaboration from World Bank Development Indicators.

Table 3. Immigrant stock as a percentage of population in ENC + Russia

	1960	1970	1980	1990	2000	2010
Armenia				18.6%	18.7%	10.5%
Azerbaijan				5.0%	4.3%	2.9%
Belarus				12.3%	11.2%	11.5%
Georgia				7.0%	4.9%	3.8%
Moldova				15.7%	13.0%	11.5%
Ukraine				13.3%	11.2%	11.5%
Total ENC- East				12.4%	10.5%	9.9%
Algeria	4.0%	1.2%	1.0%	1.1%	0.8%	0.7%
Egypt	0.8%	0.6%	0.4%	0.3%	0.3%	0.3%
Israel	56.1%	47.4%	36.9%	35.0%	35.9%	38.6%
Jordan	45.7%	35.3%	37.2%	36.2%	40.2%	49.2%
Lebanon	7.9%	7.7%	8.6%	17.8%	18.5%	17.9%
Libya	3.6%	6.1%	10.1%	10.6%	10.7%	10.7%
Morocco	3.4%	0.8%	0.4%	0.2%	0.2%	0.2%
Syria	6.0%	5.8%	5.6%	5.6%	5.8%	10.8%
Tunisia	4.0%	1.0%	0.6%	0.5%	0.4%	0.3%
Total ENC-South	5.0%	3.7%	3.4%	3.5%	4.0%	5.0%
Total ENC				6.7%	6.0%	6.3%
Russia				7.8%	8.1%	8.7%
Total ENC + Russia				7.1%	6.8%	7.1%

Note: Palestinian territory is not considered due to the lack of data

Source: Own elaboration from World Bank Development Indicators.

Table 4. Main destination countries of emigrants from ENC + Russia in 2010

Source country	Main destination countries (Percentage of total migrant stocks in 2010)
Armenia	Russia (56.7%), United States (8.9%), Ukraine (6.1%), Azerbaijan (4.9%)
Azerbaijan	Russia (60.5%), Armenia (11.5%), Ukraine (6.5%)
Belarus	Russia (54.3%), Poland (6.4%) Ukraine (15.6%)
Georgia	Russia (60.9%), Armenia (7.2%), Ukraine (6.8%), Greece (4.0%)
Moldova	Russia (36.9%), Ukraine (21.9%), Italy (11.6%), Romania (5.0%)
Ukraine	Russia (55.9%), Poland (5.1%), United States (5.1%)
Algeria	France (75.5%), Spain (5.2%)
Egypt	Saudi Arabia (26.9%), Jordan (22.8%), Libya (10.6%), Kuwait (8.5%)
Israel	West Bank and Gaza (64.3%), United States (14.6%)
Jordan	West Bank and Gaza (50.3%), Saudi Arabia (23.5%)
Lebanon	United States (19.6%), Australia (14.4%), Canada (13.2%), Germany (9.3%) Saudi Arabia (8.8%), France (6.8%)
Libya	Israel (25.9%), United Kingdom (11.0%), Chad (10.1%), United States (9.8%) Jordan (7.3%), Egypt (6.6%)
Morocco	France (27.9%), Spain (25.8%), Italy (15.8%), Israel (8,1%), Belgium (5.7%), Netherlands (5.5%)
Syria	Jordan (30.6%), Kuwait (13.0%), Saudi Arabia (11.8%), United States (7.1%)
Tunisia	France (46.4%), Italy (18.7%), Libya (13.0%), Germany (5.7%)
Russia	Ukraine (33.4%), Kazakhstan (20.2%), Israel (6.5%), Belarus (6.2%)

Note: Palestinian territory is not considered due to the lack of data.

Source: Own elaboration from World Bank Bilateral Migration Matrix 2010.

DATA SOURCES

It is a difficult task to collect data on homogeneous international migration for a large number of countries (Fertig and Schmidt, 2000; Crespo-Cuaresma et al, 2013). There are problems of data availability and difficulties in getting comparable statistical information across countries. From a comparative analysis of currently available datasets, the most complete source of bilateral migration flows seems to be World Bank Bilateral Migration Database 1960-2000 completed with the World Bank Bilateral Migration Matrix 2010 (Özden et al, 2011). It includes data for more than 200 countries for a long time period starting in 1960 and ending in 2010 and it provides information on bilateral migration stocks for every 10 years: 1960, 1970, 1980, 1990, 2000 and 2010. Over one thousand census and population register records are combined to construct decennial matrices corresponding to the last five completed census rounds. Immigrants are identified using the foreign-born criteria. The only problem with this dataset is that it provides information on stocks rather than on flows. However, migration stocks data have already been used by several studies such as Ortega and Peri (2009), Brücker and Siliverstovs (2006) or Grogger and Hanson (2011) among others. Moreover, as highlighted by Brücker and Siliverstovs (2006), the analysis of stocks can be interpreted as a representation of a long-term equilibrium and, as data on immigration stocks are based on national censuses, they are probably of higher quality than those that report annual immigrant flows, as censuses deal with unambiguous net permanent moves and reduce the undercounting of undocumented immigrants.

Besides immigration stocks, an additional number of traditional variables related to pull and push factors of migration have been considered in order to explain migration flows and stocks. Table 5 summarises the different push and pull factors identified in the literature. The different determinants of migration are related to demographic, geographic, social, cultural, economical and political characteristics of both origin and destination countries. As our objective is not to explore the influence of the different push and pull factors on migration but to predict future movements, we only focus on a subset of these factors. In particular, and following a similar approach to Kim and Cohen (2010), we investigate the role of demographic, geographic, historical variables and relative differences in GDP per capita. Data for these additional variables have been collected from the CEPII Geodist dyadic dataset (Head et al., 2010) and the CEPII gravity dataset (Head and Mayer, 2013). Geographical distance has been defined as the distance between the two capital cities of immigrants' origin and destination countries using the great circle formula for cities' latitude and longitude. The area in km squared of the origin and destination countries are also considered. Dummy variables indicating whether the two countries are contiguous, share a common language, have had a common colonizer after 1945, have ever had a colonial link, have

had a colonial relationship after 1945 or are currently in a colonial relationship have been included. There are two common languages dummies, the first one based on the fact that two countries share a common official language, and the other one set to one if a language is spoken by at least 9% of the population in both countries.

GDP and population data from the CEPII's gravity dataset have been updated using data from the World Bank Development Indicators and the same definitions as in the original source. Forecasts for GDP and population for 2018 have been obtained from the International Monetary Fund World Economic Outlook database (April 2013 edition).

After some adjustments related to missing country codes and equivalences between the different datasets our potential sample of bilateral migration stocks will include 199836 origin-destination from 183 countries and 6 time periods (183*183-183=33,306*6=199,836). However, due to missing values of bilateral migration stocks for 2010, our final sample includes 181,888 observations. However, when GDP differences between destination and origin countries are considered the sample further reduces down to 141,112 observations.

Table 5. Migration pull and push factors

	Pull factors	Push factors
Demographic	○ Population growth ○ High fertility rates	
Geographic	○ Distance ○ Common border	
Social, historical and cultural	○ Human rights abuses ○ Discrimination based on ethnicity, gender and religion	○ Family reunification ○ Diaspora migration ○ Freedom from discrimination ○ Common language ○ Colonial relationship
Economic	○ Poverty ○ Unemployment ○ Low wages ○ Lack of basic health and education	○ Prospects of higher wages ○ Potential for improved standard of living ○ Personal or professional development
Political	○ Conflict, insecurity, violence ○ Poor governance ○ Corruption	○ Safety and security ○ Political freedom

Source: Adapted from Praussello (2011)

As previously mentioned, while the main aim of our analysis is to analyse the potential role of ENP, it is also interesting to analyse the effect of recent EU enlargements on migration flows from the new members to the EU. In particular, we use data from the EUROSTAT project

"Migration Modelling for Statistical Analyses (Mimosa)" providing annual information of intra-EU migration flows between 2002 and 2007. It currently includes 5580 observations (bilateral relationships between 31 countries and 6 time periods). In our empirical analysis, however, we do not consider migration flows from and to Switzerland, Iceland and Norway and we focus on the period 2002-2006 as the accession of Bulgaria and Romania during the last year of the sample does not permit to consider the potential effect of EU membership on migration flows. Taking this into account, our analysis of intra-EU flows addresses the potential impact of EU accession by the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia and the Slovak Republic in 2003. As we have a short time-span, just before and after the EU accession, the results will provide evidence on the short run dynamics of migration flows that permit us to check the consistency of the previous analysis for ENC.

EMPIRICAL ANALYSIS

There are many theoretical hypotheses and models concerning the determinants of migration. Gravity models were initially based on Newton's gravity law, but recent contributions have also provided the microfoundations in the context of migration analysis (Grogger and Hanson, 2011). These models have been widely used in the empirical analysis of migration due to their relatively good forecasting performance (Fertig and Schmid, 2000; Karemera et al, 2000 or Kim and Cohen, 2010; among others). In particular, migration stocks or flows between two countries are supposed to increase with their size and decay with the distance between the two countries. Usually, the most representative variable of the size of countries is population. Therefore, it is expected that migration be a positive function of population size of the host and home country and a negative function of distance (which controls for migration costs). As Santos-Silva and Tenreyro (2006) and Martinez-Zarzoso (2013) highlight, the most common practice in empirical applications has been to transform the multiplicative gravity model by taking natural logarithms and to estimate the obtained loglinear model using Ordinary Least Squares. One problem with this approach is how to deal with the potential presence of zero bilateral migrant stocks. As argued by Llull (2013), based on the law of large numbers, theory predicts that all bilateral stocks will be positive, though some may be very small. In finite populations, however, zero migration stocks may occur, if bilateral migration probabilities are small. In fact, in our sample, and due to the high number of considered countries, the presence of zeros is relevant accounting for around 55% of total bilateral observations. In order to estimate the log-linearized version of the gravity model, we have replaced the 0 values by a very small value (1) and then transform the variable into logarithms.

Usually gravity models are enlarged with additional variables related to different pull and push factors briefly discussed in the previous section (see, among others, Volger and Rotte, 2000; Hatton and Williamson, 2002; Gallardo-Sejas et al., 2006; Mayda, 2010; or Ortega and Peri, 2013). We also include in our specification year fixed effects, to control for common time shocks, and origin and destination country fixed effects to account for time-invariant unobserved heterogeneity. The importance of adding country fixed effects in the gravity model specification is noted by Bertoli and Fernandez-Huertas Moraga (2013), who argue that specifications without fixed effects may suffer biases due to the Multilateral Resistance to Migration.

Taking all this into account, our model specification is as follows:

$$\begin{aligned}\log M_{ijt} = {} & \beta_1 \cdot \log Pop_{it} + \beta_2 \cdot \log Pop_{jt} + \beta_3 \cdot \log Dist_{ij} + \beta_4 \cdot \log Area_i + \beta_5 \\ & \cdot \log Area_j + \beta_6 \cdot \text{contiguity}_{ij} + \beta_7 \cdot comlangoff_{ij} + \beta_8 \cdot conlangethno_{ij} \\ & + \beta_9 \cdot colony_{ij} + \beta_{10} \cdot comcol_{ij} + \beta_{11} \cdot col45_{ij} + \beta_{12} \cdot \log \frac{GDPpc_{jt}}{GDPpc_{it}} \\ & + fixed\ effects + u_{ijt}\end{aligned}$$

where $log(M_{ijt})$ denotes the logarithm of the stock of immigrants from country *i* (origin) in country *j* (destination) at time *t*. $Log(Pop_{it})$ and $Log\ (Pop_{jt})$ denote, respectively, the logarithm of the population in the origin (*i*) and destination (*j*) countries at time *t*. $Log(Dist_{ij})$ is the logarithm of geographical distance between capital cities of countries *i* and *j*. $Log(Area_i)$ and $Log(Area_j)$ denote, respectively, the logarithm of the area of origin (*i*) and destination (*j*) countries. The rest of variables are dummies indicating whether the two countries are contiguous (*contiguity*), share a common official language (*comlangoff*), share a language spoken by at least 9% of the population in both countries (*comlangethno*), have ever had a colonial link (*colony*), have had a common colonizer after 1945 (*comcol*) and have had a colonial relationship after 1945 (*col45*). Log $\frac{GDPpc_{jt}}{GDPpc_{it}}$ represents relative differences in GDP per capita between the destination and the origin country at time *t*. As previously mentioned, time fixed effects and origin and destination country fixed effects are also included in the model. Last, u_{ijt} denotes a random error term.

The model has been estimated with standard errors clustered for each origin and destination country combination to take into account for potential heteroscedasticity and autocorrelation. The results of estimating the gravity model are shown in table 6. The first column shows the results of estimating a model where demographic, geographic and social/historical determinants of bilateral migration stocks are included but GDP differences between origin and destination are not considered. As we can see from this column, all coefficients are statistically significant at the usual levels and have the expected sign. Population in origin countries have positive and significant effects on immigrant stocks, while population in destination countries has

a negative sign that is usually interpreted as limitations to migration due to capacity constraints. Immigrant stock decreases with distance and contiguity is clearly relevant. Regarding other geographical variables, ceteris paribus, a higher area in origin and destination countries increases migration. Having a common language or a colonial relationship increases importantly the stock of immigrants, with the only exception of common colonizer post 1945 that has a negative effect. In sum, our results are in line with those found by previous literature and very similar to those obtained by recent studies such as Mayda (2010), Kim and Cohen (2010) Grogger and Hanson (2011), Ortega and Peri (2013) and Llull (2013). The coefficients associated to the year dummies also provide some interesting results. In particular, after controlling for the effect of demographic, geographical and social/historical characteristics, migration stocks have significantly increased when compared to the 1960s, similar results to those found by Massey (1999) and Kim and Cohen (2010). However, the economic crisis has deeply affected international migrations (Tilly, 2011): the value of the coefficient associated to the 2010 dummy is positive and significant but its value is similar to the one estimated for the 1980 dummy.

In model (2) of table 6, GDP per capita differences between origin and destination countries[1]. While the results for nearly all of the previous controls are quite similar to the ones shown in (1), the stock of migrants is positively associated with relative differences in GDP per capita. This result shows that better economic opportunities positively affect migration.

In order to have a better description of migration patterns from and to ENC countries, in model (3) of table 6 origin and destination country fixed effects are replaced by dummies representing different groups of countries. In particular, origin and destination countries are grouped into five categories: EU, ENC-East, ENC-South, Russia and the rest of the world that will be used as the reference category. The results show that the EU has received and sent more immigrants in the considered period than the rest of the world even after controlling for demographic, geographical, cultural/historical and economical variables. ENC-East, ENC-South and Russia have also sent more immigrants than the rest of the world, but they have received significantly less. In Table 7, the same specification of the model is re-estimated but now looking at specific destination. While model (1) in table 7 reproduces model (3) in table 6, model (2) shows the result of looking only at immigrants stocks at the EU countries, model (3) at ENC-East countries, model (4) at ENC-South and, last, model (5) at Russia. From these different models, first, we can see that EU destinations are clearly preferred for immigrants from ENC-South, ENC-East and Russia; second, that South-South migration flows are also significantly higher than it

[1] To check for multicollinearity among some independent variables, we calculated variance inflation factors (VIFs) for all the independent variables in model (2) of table 6. The mean VIF for all variables in the model was 2.20 with a maximum of 2.79 for the common language dummy and a minimum of 1.02 for GDP differences between destination and origin.

should be according to the factors included in the gravity equation[2]; and, third, that the links between ENC-East and Russia are particularly strong.

Table 8 reproduces the same structure than table 7 with the only change that time fixed effects have been replaced by a linear time trend. The inclusion of a trend is justified for two reason: first, because past years cannot give any guidance about the coefficients of future year dummy variables, time fixed effects are not appropriate for projecting future international migration, our ultimate objective; and, second, because it will permit to test whether the patterns observed in table 7 have been stable or not across time. Model (1) in table 8 shows that after controlling for demographic, geographical, cultural/historical and economical variables, the EU has sent more immigrants than the rest of the world at the beginning of the period, but there is a clear downward trend. The opposite has happened when we looked at the EU as a migration destination: the EU has become much more attractive than it was at the beginning of the period. ENC-East, ENC-South and Russia have sent more immigrants than the rest of the world, but the trend is negative. However, as destination countries, the trend for ENC-East and Russia is positive and not different from the rest of the world for ENC-South. When we look at models (2) to (5) in table 8 where different destinations are considered, no significant differences are observed when compared to the same models in table 7, so the previous results are stable across time and can be interpreted as evidence of the stability of the model in order to obtain bilateral migration forecasts.

In table 9 we present the results of a forecasting exercise using model (2) of table 1 but replacing the time fixed effects with a linear trend interacted with the origin and destination country fixed effects[3]. Future values for time-varying exogenous variables (population and GDP) are obtained from the IMF World Economic Outlook database (April 2013). The results of the forecasting exercise for bilateral migration stocks in 2018 is a 183x183-183 matrix that is available from the authors on request. In table 9 we only reproduce the forecasted values of immigrants from ENC to the EU in 2018 together with historical values for 2000 and 2010. The values for the scenarios on population and GDP for the considered countries are shown in annex 2. From this table, we can see that migration from ENC countries to the EU will increase in more than 675,000 migrants (9%) with higher increases from ENC-South and Russia. It is worth mentioning that there is a high heterogeneity in the forecast, but also that the share of emigrants from ENC to the EU will fall from 23.6% in 2010 to 21.7% in 2018, a figure that reinforces the increase in South-South migration in the next years.

[2] Russian immigrants in ENC-South are also higher than expected but this is explained due to the bilateral relationship between Russia and Israel.

[3] The ex-post forecasting performance of the model has been assessed for all origin-destination pairs for the different time periods considered. The 1-period ahead Mean Absolute Percentage Error (MAPE) is 4.53 on average (with a minimum value 2.47 in 1970 and a maximum value of 6.18 in 2010). These values indicate a good forecasting performance of the model.

Table 6. Gravity model estimates (I)

Log of migrants stock from origin to destination	(1)	(2)	(3)
Log population (origin)	0.245***	0.485***	0.450***
Log population (destination)	-0.675***	-1.224***	0.303***
Log distance	-1.305***	-1.384***	-0.970***
Log land area (origin)	0.148***	-0.015	-0.049***
Log land area (destination)	0.634***	1.040***	0.110***
Contiguity	3.355***	3.166***	3.536***
Common official of primary language	0.348***	0.457***	0.408***
Language is spoken by at least 9% of the population in both countries	0.386***	0.322***	1.092***
Colonial relationship	1.651***	1.616***	2.474***
Common colonizer post 1945	0.637***	0.655***	0.003
Colonial relationship post 1945	1.416***	1.275***	1.087***
Difference in GDP per capita (destination – origin)		0.133***	0.210***
European Union country as origin			1.163***
ENC-South as origin			0.388***
ENC-East as origin			0.391***
Russia as origin			1.328***
European Union country as destination			0.855***
ENC-South as destination			-0.844***
ENC-East as destination			-1.165***
Russia as destination			-2.852***
Year – 1970	0.269***	0.349***	0.063***
Year – 1980	0.515***	0.696***	0.154***
Year – 1990	0.833***	1.050***	0.065***
Year – 2000	1.166***	1.455***	0.223***
Year – 2010	0.491***	0.801***	-0.655***
Observations	181888	142112	142112
R2	0.612	0.634	0.438

Robust cluster estimates at the origin-destination country pair. Models (1) and (2) also include origin and destination countries fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7. Gravity model estimates (II)

	(1) All destinations	(2) EU destinations	(3) ENC-South destination	(4) ENC-East destination	(5) Russia as destination
European Union country as origin	1.163***	1.765***	0.705***	-0.127	0.099
ENC-South as origin	0.388***	0.744***	2.132***	-0.330*	0.112
ENC-East as origin	0.391***	1.271***	0.437	3.776***	3.555**
Russia as origin	1.328***	2.527***	2.747***	6.519***	
European Union country as destination	0.855***				
ENC-South as destination	-0.844***				
ENC-East as destination	-1.165***				
Russia as destination	-2.852***				
Observations	142112	22545	7722	3066	914
R2	0.438	0.531	0.434	0.626	0.763

Robust cluster estimates at the origin-destination country pair. All models include the same explanatory variables as model (2) in table 6.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8. Gravity model estimates (III)

	(1) All destinations	(2) EU destinations	(3) ENC-South destination	(4) ENC-East destination	(5) Russia as destination
European Union country as origin	1.764***	2.410***	1.293***	0.551	0.352
European Union country as origin x time trend	-0.157***	-0.167***	-0.167***	-0.135	-0.069
ENC-South as origin	0.739***	0.516**	2.570***	-1.783***	0.090
ENC-South as origin x time trend	-0.093***	0.063	-0.128	0.291**	0.008
ENC-East as origin	0.911***	0.875*	-0.452	9.707***	2.552*
ENC-East as origin x time trend	-0.110***	0.075	0.174	-1.185***	0.194*
Russia as origin	1.634***	2.832***	2.313***	7.460***	
Russia as origin x time trend	-0.084*	-0.082	0.129	-0.189**	
European Union country as destination	-0.623***				
European Union country as destination x time trend	0.380***				
ENC-South as destination	-0.889***				
ENC-South as destination x time trend	0.006				
ENC-East as destination	-2.284***				
ENC-East as destination x time trend	0.237***				
Russia as destination	-4.642***				
Russia as destination x time trend	0.482***				
Observations	142112	22545	7722	3066	914
R2	0.445	0.532	0.435	0.630	0.763

Robust cluster estimates at the origin-destination country pair. All models include the same explanatory variables as model (2) in table 6, except time fixed effects.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9. Forecasting exercise: Stock of emigrants to EU destinations

Country of origin	2010	2018	2010-2018
Armenia	65,899	66,471	0.9%
Azerbaijan	36,103	36,357	0.7%
Belarus	218,604	226,271	3.5%
Georgia	95,997	96,234	0.2%
Moldova	187,310	201,456	7.6%
Ukraine	1,030,697	1,039,489	0.9%
Total ENC- East	1,634,611	1,666,279	1.9%
Algeria	1,078,191	1,204,618	11.7%
Egypt	219,253	241,545	10.2%
Israel	63,193	82,685	30.8%
Jordan	34,407	50,045	45.5%
Lebanon	195,117	203,949	4.5%
Libya	27,836	32,626	17.2%
Morocco	2,575,993	2,668,403	3.6%
Syria	129,390	144,114	11.4%
Tunisia	492,597	521,670	5.9%
Total ENC-South	4,815,977	5,149,655	6.9%
Total ENC	6,450,588	6,815,934	5.7%
Russia	1,096,687	1,406,863	28.3%
Total ENC + Russia	7,547,275	8,222,796	9.0%

Are these forecasts reasonable? Do they provide a medium-run scenario compatible with EU previous enlargements? Although the ENP does not provide the same level of integration than accession, it is interesting to estimate the effect of EU accession on migration from new to old member states using a similar modelling framework. Model (1) of table 10 shows the result of estimating model (2) in table 6 but using data of intra-EU migration flows between 2002 and 2006. As we can see from these results, most relevant variables in this gravity equation are distance, contiguity and GDP differences. In model (2) of table 10, we have added two dummy variables that try to quantify the short-run impact of EU accession by the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia and the Slovak Republic in 2003 on migration flows both as origin and as a destination. We can see that coefficients associated to both variables are positive and significant. Regarding emigration from new members to other EU countries, flows increased by nearly 9% while immigration to new members from other EU countries increased by nearly 20%. This result is in line with previous studies such as Marques

(2010), Raymer et al. (2011) or DeWaard et al. (2012) and it is also consistent with our previous forecast regarding ENC countries.

Table 10. Gravity model for intra-EU migrations flows

Log of migrants flows from origin to destination	(1)	(2)
Log population (origin)	1.171	2.295*
Log population (destination)	1.678	3.754***
Log distance	-1.052***	-1.051***
Log land area (origin)	-0.077	-0.683
Log land area (destination)	-0.445	-1.542**
Contiguity	0.413**	0.413**
Common official of primary language	0.049	0.052
Language is spoken by at least 9% of the population in both countries	0.086	0.084
Colonial relationship	0.501*	0.501*
Common colonizer post 1945	0.076	0.079
Colonial relationship post 1945	1.750***	1.741***
Difference in GDP per capita (destination – origin)	0.440***	0.400***
EU new member states as origin after accession		0.087**
EU new member states as destination after accession		0.199***
Observations	3356	3356
R Squared	0.834	0.834

Robust cluster estimates at the origin-destination country pair. All models include country and time fixed effects. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

FINAL REMARKS

The objective of this paper was to analyse past and future trends in ENC-EU bilateral migration flows. With this aim, we have provided some empirical evidence on population and migration trends in ENC and, next, two different empirical analyses are carried out. First, we have specified and estimated a gravity model covering around 200 countries and used the model to obtain medium-run forecasts of bilateral migration flows from ENC to EU; and, second, and in order to check whether our forecasts are consistent or not with previous evidence, we have focused on within EU-27 migration flows before and after the 2003 enlargement of the EU.

The descriptive analysis of population and migration trends in ENC countries has shown some interesting results. First, the population of the ENC has increased in 170 million people between 1960 and 2010 while the EU-27 has increased its population only in 100 million. Second, there is a very high heterogeneity regarding migration trends in ENC countries during the last 50 years. While some countries such Israel during the whole period or Russia during the last thirty

years have been net receivers of migration flows, other countries such as Belarus, Egypt or Tunisia have clearly lost population due to migration. Third, migration from ENC countries is highly concentrated in some destination countries due to geographical proximity or strong political, economic or colonialist linkages.

Our analysis of the long-run determinants of bilateral migration stocks has permitted us to conclude that demographic, geographical, social/historical and economic factors are relevant both to explain and to forecast migration patterns. Our results have shown that once these different pull and push factors are controlled, migration flows from ENC countries to the rest of the world are higher than they should be according to the model. When we concentrate on flows from ECN to the EU, this "surplus" in migration is even higher. This result shows the strong ties between these countries and the EU and how the ENC could clearly increase migratory pressure from these countries in the future. In fact, our medium-run forecasts show an increase in migration from ENC countries to the EU will increase in more than 675,000 migrants (9%) with higher increases from ENC-South and Russia. It is worth mentioning that there is a high heterogeneity in the forecast, but also that the share of emigrants from ENC to the EU will fall from 23.6% in 2010 to 21.7% in 2018, a figure that reinforces the increase in South-South migration in the next years. The analysis of the short-run impact of EU accession by the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia and the Slovak Republic in 2003 on migration flows both as origin and as a destination have provided a benchmark that is also consistent with our forecast regarding ENC countries.

Regarding future directions for research, the availability of the compiled data set on bilateral migration stocks and several determinants can serve as a starting point to enlarge our benchmark specification with other variables that are potentially interesting in the context of the ENP. For instance, indicators on quality of governance or other institutional determinants could be included as additional explanatory variables and different scenarios regarding institutional convergence with the EU could be considered in order to assess the future evolution of migration from and to ENC.

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Annex 1. Datasets description

Data set	Countries and periods	Description
World Bank Bilateral Migration Database 1960-2000 World Bank Bilateral Migration Matrix 2010	226 countries 1960, 1970, 1980, 1990, 2000, 2010	Bilateral migration stocks http://data.worldbank.org/data-catalog/global-bilateral-migration-database http://go.worldbank.org/JITC7NYTT0
CEPII Geodist dataset and gravity data	225 countries 1960-2006	GeoDist 's provides several geographical variables, in particular bilateral distances measured using city-level data to assess the geographic distribution of population inside each nation. The dyadic file includes a set of different distance and common dummy variables used in gravity equations to identify particular links between countries such as colonial past, common languages or contiguity. The gravity dataset also includes information on additional time-varying variables usually included in gravity models such as GDP. http://www.cepii.fr/anglaisgraph/bdd/distances.htm http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp
Migration Modelling for Statistical Analyses (Mimosa)	31 countries 2002-2007	Annual data of intra-European migration flows http://mimosa.gedap.be

Annex 2. Scenarios on population and GDP growth for ENC

Average annual growth rates 2010-2018	Population	GDPpc
Armenia	1.0%	3.84%
Azerbaijan	1.0%	16.45%
Belarus	-0.5%	9.14%
Georgia	0.1%	13.53%
Moldova	-0.1%	13.05%
Ukraine	-0.5%	13.24%
Total ENC- East	-0.2%	12.91%
Algeria	1.6%	3.85%
Egypt	2.4%	5.53%
Israel	2.4%	3.53%
Jordan	2.5%	6.56%
Lebanon	1.4%	5.47%
Libya	1.5%	6.12%
Morocco	1.0%	7.20%
Syria	1.7%	5.05%
Tunisia	1.3%	3.55%
Total ENC-South	1.9%	4.93%
Total ENC	1.3%	6.66%
Russia	-0.4%	14.32%
Total ENC + Russia	0.7%	10.06%

Source: IMF World Economic Outlook Database April 2013
http://www.imf.org/external/pubs/ft/weo/2013/01/weodata/index.aspx

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