An analysis of the effects of internet and mobile usage on migration

Ayra Rowena Reyla and Ana Cecilia Montes

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Introduction

Migration is one of the three main determinants of a country's population development. The other two - the birth and death rate - are generally believed to be easier to forecast [@Castles2014]. However, the literature has associated migration to factors that have classically been seen as drivers for migration between two countries such as (a) conditions in the sending country driving out inhabitants, including political troubles, persecution, conflict and other "push factors"", (b) conditions in the receiving country attracting migrants, such as higher wages, better know as"pull factors", and (c) factors which facilitate or authorize the migration process itself, such as the receiving country's immigration politics.

One driving factor increasingly put forward in recent years is the use of technology. New technology improved and heightened communication, it has also bridged cultural gap between countries as it allows people to easily gathering new information and knowledge about other cultures. This of course has made a large impact on people's perception on other cultures and their worldviews. Overall, technology has changed the landscape for communicating, and gathering knowledge and information. These revolutions that have transformed society are making travel and telecommunications cheaper and easier than ever. Moreover, Technology has enhanced the aspects of interaction as it is transforming the way individuals communicate.

The Research Question

This primary analysis will attempt to answer the following question using empirical methods:

Has the increase use of technologies such as internet and mobile phones affected the flow of emigration?

Methodology

In order to examine the flows of migration, this analysis uses data from the *International Migrant Stock* produced by the United Nations. The data contains information from 232 countries and provides the number of migrants by destination and country of origin for four periods of time; 1990, 2000, 2010, and 2013. Moreover, to account for technology diffusion we will use *World Bank indicators* on the number of Internet users and the number of cellular mobile subscriptions for each country.

The *International Migrant Stock Total* indicates the number of people born in a country other than the country in which they currently reside in, this includes refugees as well. The data set estimates the international migrant stock at a particular time and are mainly collect from population censuses. Also, the data set presents the estimates of : (1) international migrant stock at mid-year; (2) total population at mid-year (thousands); (3) international migrant stock as a percentage of the total population; (4) annual rate of change of migrant stock (percentage); and (5) estimated number of refugees. The estimates are based on official statistics on the foreign-born or the foreign population.

This analysis will focus on the estimates for the years 1990, 2000, 2010 and 2013.

Additionally, in order to conduct a more thorough analysis we will include a number of aggregate data collected from *The World Bank indicators*. There are many other determinants of migration, that is why this analysis chooses to include a wide variety of World Bank indicators. The chosen indicators are used to measure certain push factors.

To measure economic and demographic determinants this analysis includes the *fertility rate* indicator. Indicators such as *poverty* and *unemployment* have been removed from the analysis, as there are many missing values in the data set.

To account for political factors the this analysis used *World Bank Governance indicators*, which includes *government effectiveness*, *regulatory quality*, *rule of law*, and *voice and accountability*. We have omitted *intentional homocides*, *political stability*, and *control of corruption* indicators because there was a lack of observations in the data set to conduct a complete analysis.

Data Gathering

This section of the analysis will go into deep detail on our data gathering methods.

International Migration Stock, Total

The original data was obtained through the United Nations Population Division, and downloaded through our repository as a Microsoft Excel file. The Excel datasheet had a matrix that described the population outflows and inflows for each country and for several time periods. The years 1990, 2000, 2010 and 2013 were selected for this analysis.

We gatherd the data using the **import** command, and afterwards we used a loop to import the file to R Studio. Since we are only interested in analysing migration, we only extracted the Migration column from all the countries in the data set and created a vector. From each matrix, we only selected the years of interest. Furthermore, we transposed the data to transform it into a more usable and readable format and then we declared it as a data frame. Using the command **callnames**, we renamed each column appropriately. We ended the loop by assigning each year to a specific data frame. Using the command **cbind** we combined all the extracted data from above, thus creating combined year in a singular data frame. In order to reshape the new data frame, we used the command **gather**. This takes multiple columns and collapses them into key value pairs -this created two new variables called *emmigration* and *year*. Finally, we included the corresponding year names to the specific year variables.

World Bank Indicators

To import the indicators we used **install.packages ('WDI)**, afterwards we imported it into our library using **library("WDI")**. Then, we specified which indicators we wanted to include in our analysis by using the specific codes available on the metadata set of the World Bank. We then properly renamed the variables using the **rename** command. Once the data was loaded, we used **Merged <- merge(emigrationtotal, WDI_indi, by = c('iso2c','year'))** to combine the WDI indicators with the International Migration Stock.

Final Data Gathering

After importing and merging all the data into a singular data frame, a lot of missing values (NAs) we noticed that the dataframe had a lot of missing values (NAs). To properly clean the data and omit the NAs we used the **is.na**.However, in this process a total of ten countries were committed from the data frame, due to the lack of relevant information in our control variables.

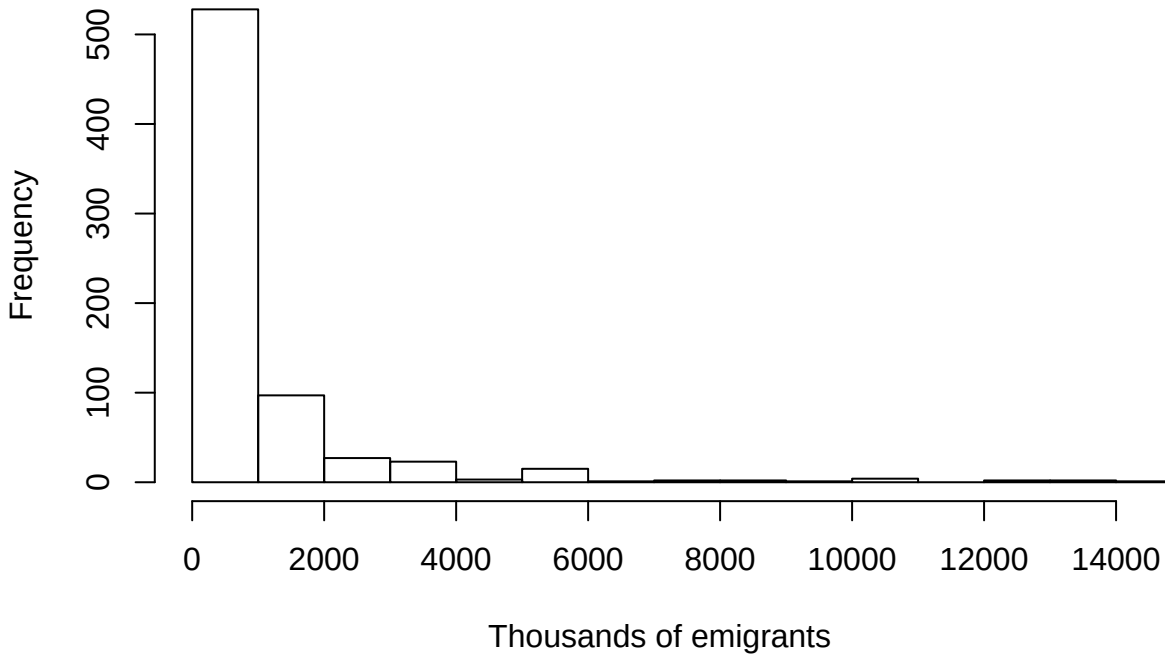
Descriptive Statistics

Dependent Variables

Our dependent variable is the total migrant stock at mid-year by country of origin, which we retrieved from the United Nations Population division.

Figure 1 below shows the distribution of the dependent variable. Since the statistics accounts for the number of emigrants, it can be considered as count data. It is also very rightly skewed, because there is a large amount countries that both have low emigration and low population.

Figure 1. Histogram for Emigration

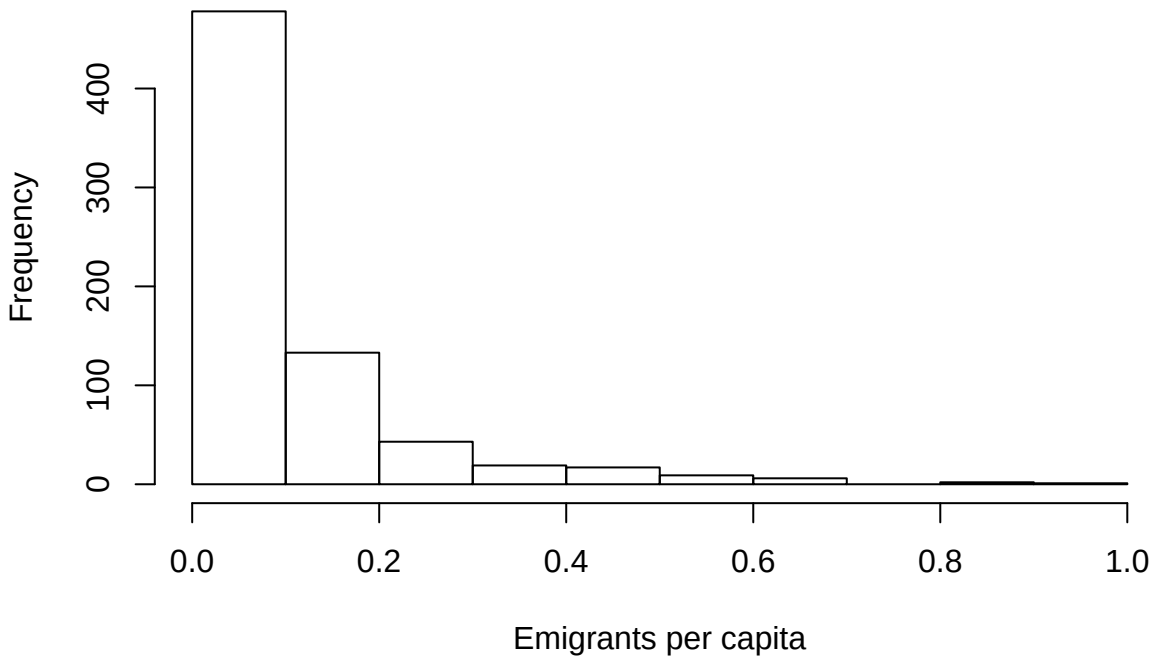



```
   Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
  1.242   131.300   437.700  1001.000  1021.000 14170.000
```

Figure 2 expresses emigration in per capita terms in order to account for population differences between countries. The shape of the distribution has not as not made a strong visual change, which means that emigration is quite low in a large number of countries.

Among all the years, the country with the largest emigration per capita is the West Bank and Gaza. One can infer that the conflict in this region over time has affected the population movements drastically. The country with the lowest emigration per capita is Western Sahara. Even though there is a strong conflict in the region, free mobility in and out of the country is heavily guarded and limited by a 2,700 kilometer sand wall, also known as the Moroccan Wall. This can account for the lack of emigration throughout the region.

Figure 2. Histogram for Emigrants per capita




```
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
0.0001053 0.0282700 0.0557800 0.1051000 0.1233000 0.9202000
```

Patterns of Emmigration

The following figures illustrate the evolution of the per capita emigration stock totals for each country in the years 1990, 2000, 2010 and 2013.

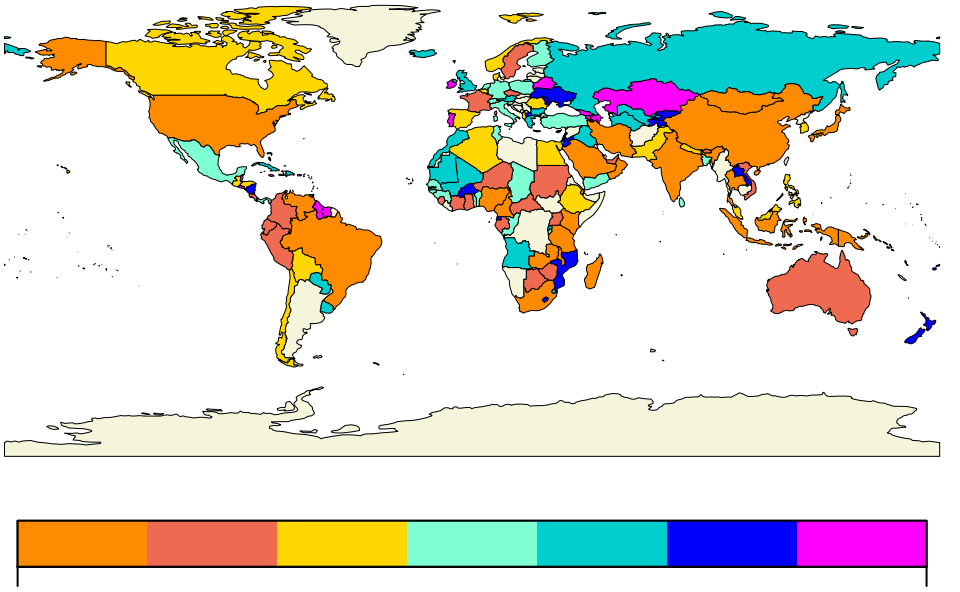
Observing the figures indicates the important population movements, particularly in Africa. For example, between the years of 1990-2000, Mozambique and Burkina Faso has reduced the number of people exiting the country. Also, Chad has experienced similar pasterns, but not the the extent to which the previous examples faced. When comparing 2010 and 2013, there is not a visually observable difference. This can possibly be attributed to the stabilization of migration patterns.

While Africa has experienced a decrease in emigration, Latin America has the opposite pattern. For example, countries such as Mexico, Colombia, Educator, Peru, Bolivia, and Guatemala have experience a large increase in total emigration during the last decade.

In Europe, the situation is quite mixed since many factors, such as the creation of European Union (EU) and the enlargement of EU over the years could have played a large role the heterogeneity of the migration patterns in the past decade. There is migration movement, but there is no overall pattern of movements within the EU region.

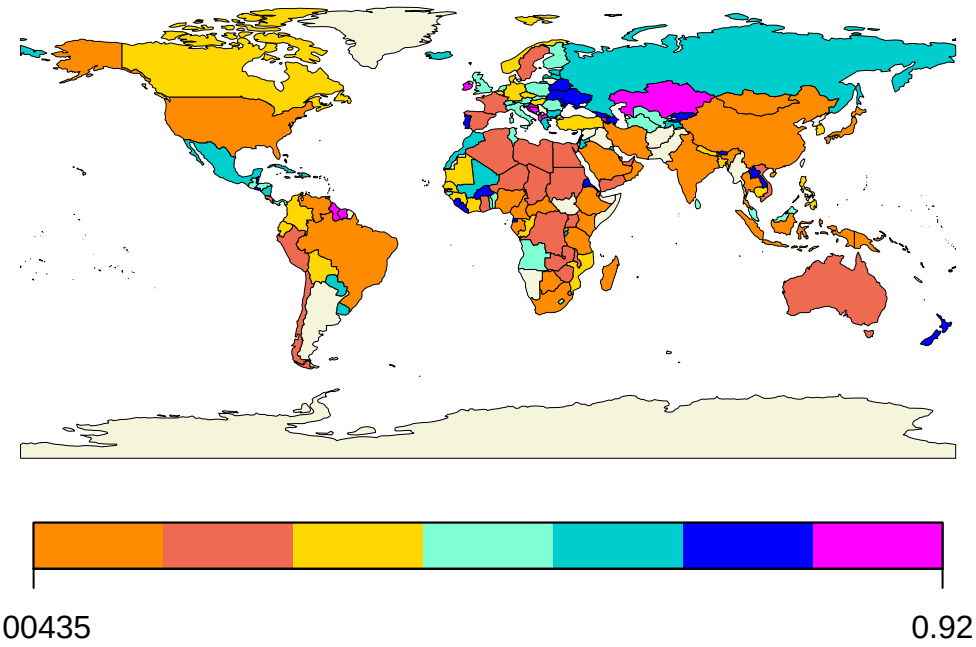
```
Note: 156 codes from your data successfully matched countries in the map
Note: 4 codes from your data failed to match with a country code in the map
Note: 87 codes from the map weren't represented in your data
```

Figure 3. Number of emigrants per capita 1990




```
Note: 172 codes from your data successfully matched countries in the map
Note: 4 codes from your data failed to match with a country code in the map
Note: 70 codes from the map weren't represented in your data
```

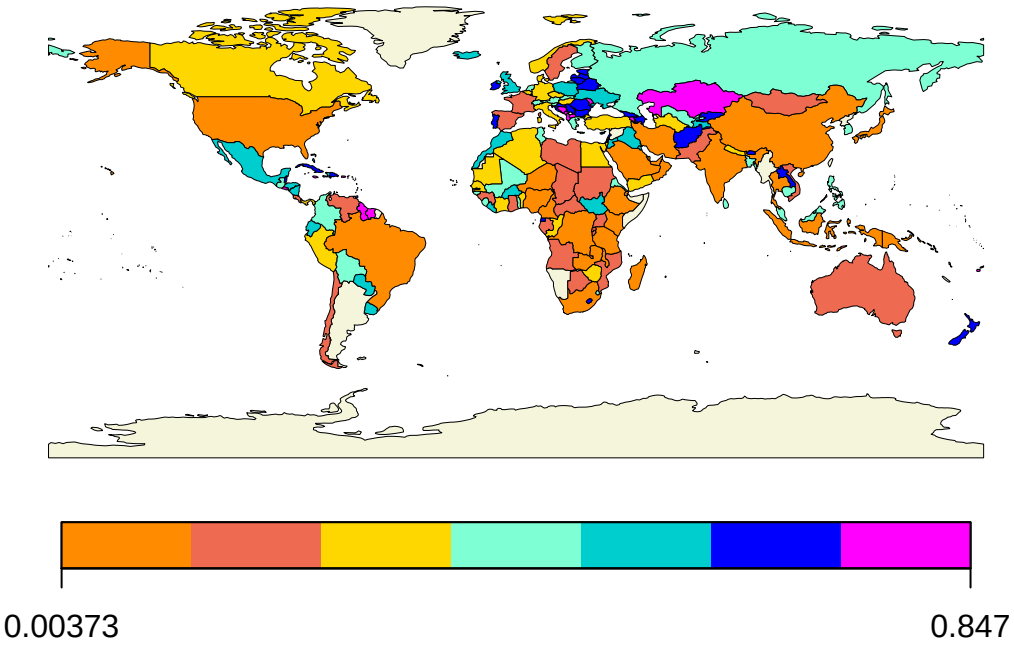
Figure 4 Number of emigrants per capita 2000




```
Note: 182 codes from your data successfully matched countries in the map
```

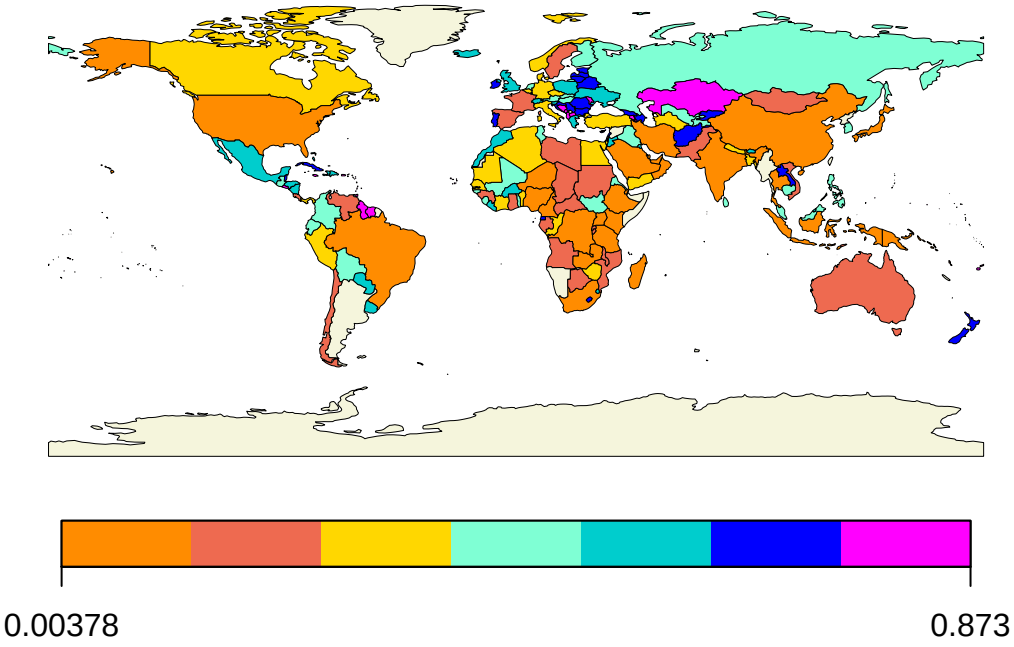
```
Note: 4 codes from your data failed to match with a country code in the map
Note: 60 codes from the map weren't represented in your data
```

Figure 5. Number of emigrants per capita 2010




```
Note: 182 codes from your data successfully matched countries in the map
Note: 4 codes from your data failed to match with a country code in the map
Note: 60 codes from the map weren't represented in your data
```

Figure 6. Number of emigrants per capita 2013



Independent Variables

This analysis makes use of many variables, to control for determinates that effect the dependent variable.

Cellphone Users

```
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
  0.0000   0.4623  41.8500  54.6300 102.3000 304.1000
```

Internet Users

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
 0.0000  0.1331  7.0000 21.2200 38.0500 96.5500
```

GDP Per Capita

```
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
   302.8   2360.0   6631.0  13610.0  18280.0 140600.0
```

Total Population

```
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
6.183e+04 2.070e+06 7.186e+06 4.310e+07 2.314e+07 1.357e+09
```

Fertility Rate

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  0.939   1.848   2.672   3.260   4.633   8.667
```

Correlation between independent variables

```
    Pearson's product-moment correlation

data:  Merged$InternetUsers and Merged$CellphoneUsers
t = 33.829, df = 706, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.7565806 0.8129957
sample estimates:
      cor
0.7864226
```

Since a high correlation between internet users and cellphone users can be observed from the correlation test above, this analysis used the variables seperately.

Results

Panel regression using within estimators and separate random effect estimators are used when analyzing the research question at hand.

Table 1 illustrates the regression results of a *panel regression*. The results show that cellphone usage is significant to explain the change in immigration inside a country. Additionally, the within estimations indicates that cellphone users do not explain the migration pattern across countries.

Furthermore, the comparison between the same countries within the same year indicate that the more cellphone users in a country, the more migration occurs. Coincidentally, when comparing between countries, there is no effect on the cellphone users.

It's the effect within the country and the year that is significant. The more technology is introduced in the country, the more it will incentive or "push" immigration in the country. This suggests that the differences across the countries are not a relevant factor to explain immigration across countries.

Limitations and Further Research

The next step to this analysis will be to estimate our dependent variable using a *Poisson* distribution. We intend to combine combine panel data techniques with count data.