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The Extent to Which the Provision of Water and Sanitation Services Affect the Individual's Decision to Migrate: The Case of Egypt

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THE EXTENT TO WHICH THE PROVISION OF WATER AND SANITATION SERVICES AFFECT THE INDIVIDUAL'S DECISION TO MIGRATE: THE CASE OF EGYPT

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Abstract

Determinants of migration, although researched copiously shed little light on the importance of access to sustainable, basic water and sanitation utilities on an individual's decision to migrate. This research reveals that individuals originating from rural Upper Egypt, rural and urban Lower Egypt, and rural and urban Alexandria and Suez Canal regions are more likely to migrate relative to those from the urban Greater Cairo region. Access to water has been deemed as insignificant while access to sanitation is a significant factor in determining migration patterns as do macro-economic differences in origin governorates, gender, educational background before migration, and employment type and status.

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Table of Contents

Table of Figures

List of Tables

List of Appendices

Introduction

Improvement in the access to water and sanitation is a global objective. This access to services and amenities, including among others, water and sanitation, has recently been considered a factor that affects mobility of people within country borders and across borders. Although migrant flows are considered beneficial to the individuals' welfare and likely result in an increase in their social position, personal development, better living conditions, among others (Skeldon, 1997), it can also bring disadvantages at the macro level and micro level. Increased rates of migration can usually result in overcrowding in urban areas, and urban slums. Increased trends of internal migration would also put pressure on certain areas due to overcrowding and this would in turn put both the migrant and the local population at risk of diseases such as COVID-19, Typhoid Fever, or Hepatitis A.

A migrant's decision to relocate is usually shaped by a system of push and pull factors. Push factors- leading the individual to leave their area of origin- including lack of economic opportunities, lack of access to services, or lack of safety. Pull factors on the other hand, attract individuals to migrate and include examples such as increased social stability, fertile land, higher employment rates, and better social amenities namely access to healthcare, electricity, water and sanitation (Lucas, 2015). Other potential barriers such as financial barriers, lack of information, separation from family and close friends, and an increased level of uncertainty, can inhibit potential movement.

Migration Theories

The theory of push and pull factors was first introduced by Everette Lee (1966) to simplify the factors affecting the decision and the process of migration into four categories: (1) factors associated with the area of origin; (2) factors associated with the area of destination; (3) intervening obstacles; and (4) personal factors. All these factors combined will then push the individual to migrate or to remain in their origin area. It should be noted that while this theory of migrant behavior is simple and has been used in literature, Lee (1966), does explain how oversimplifying assumptions, especially those made for migration- a relatively complex phenomenon- is almost impossible to recognize. Other simplifying models explaining migration include the gravity model which states that the volume of migration between any

two interacting centers is the function of both distance between them and also their population size. The "Stouffer hypothesis" , a third migration theory, indicates that the number of migrants from an origin region to a destination region is directly proportional to the amount of benefits available at that destination, and inversely proportional to the number of opportunities available between the origin and the destination (Van Hear, 1998). While the logic of Lee's (1966) theory will be used throughout this research, it is important to note that push and pulls factors only look at those who did migrate, and fail to look at the reasons behind those who chose not to.

What has become increasingly important in both international and national literature is ensuring universal, sustainable, and clean access to water and sanitation. The relationship between access to water and sanitation and migration is not a straightforward one (Wilkinson et al., 2016). Individuals are more likely to migrate from areas that lack sufficient access to basic utilities to other areas with better and more improved access. Relative to the economic, social and institutional factors affecting an individual's decision to migrate, to what extent does access to water and sanitation trigger the movement of people from one area to another? Answering this question can guide investments in access to services and amenities across urban and rural areas.

In an attempt to understand the impact of access to water and sanitation on the decision to migrate within the borders of the country, a nationally representative survey (The Egyptian Labor Market Panel Survey (ELMPS)) is used. Complementing the data obtained from this survey, national level statistics extracted from CAPMAS12 is used to capture governorate economic and non-economic variables. Results show that lack of access to water is insignificant in one's decision to migrate while lack of access to sanitation is significant in defining the probability of being a migrant. I also conclude that unemployed males from areas outside the urban Greater Cairo area are the most likely to migrate compared to those that originate from urban Greater Cairo, and macro-level differences between destination and origin governorates, such as population and GDP per capita, also tend to affect migration habits. Policy recommendations for decreasing spatial inequalities include ensuring the consistent investment into infrastructure and utilities in both urban and rural areas would help prevent the creation of urban slums and overcrowding while in tandem improving citizen health and well-being.

The disparities within a country in access to the basic needs of beings, namely access to water and sanitation can both motivate and prevent a migrant from relocating. Migrants will typically move from one area where their needs are not met to one where they have better welfare. That is why I expect individuals who lack access to water and sanitation facilities to be more likely to leave their governorate of origin. Conversely, an individual's health and economic condition can easily become a barrier to better well-being, thus preventing an individual from migrating.

The paper is organized as follows: the next section reviews the literature on the relationship between migration, socio-economic indicators, water, and sanitation access and presents the data examined. The methodology will then be introduced after and is followed by empirical results. The discussion of policy implications and conclusions summarizing the key findings follows and also examines the ideal applicability of the methodology and suggests what further work could be done.

Internal Migration in the Context of Egypt

Since the onset of the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs) Egypt has been committed to achieving the targets and has since then established the Sustainable Development Strategy: Egyptian Vision 2030. The Millennium Development Goals (MDGs) were launched in 2002 by the United Nations (UN) and were later superseded by the Sustainable Development Goals (SDGs) in 2015. Out of eight goals set under the MDGs, only one sub-goal within the goal number 7 addresses access to water and sanitation.[1] Over the years, the goal itself was revised and the importance of safe and sustainable access to clean water and sanitation came to be more emphasized. Access to water and sanitation was later concluded as a key factor in preventing diseases.

The 2030 Agenda for Sustainable Development was adopted in 2015 by the UN. The SDG's cover 17 different goals and 169 targets. Contrary to the MDGs, the SDGs introduce clean and sustainable access to water and sanitation as a self-standing goal (SDG 6). When it

[1] Goal 7c: halving the number of people without sustainable water and basic sanitation targeted water and sanitation access

comes to access to water and sanitation- a basic human right- there still remains some disparities in access within countries, cities, and villages. In Egypt, especially in rural areas, 8.4 million people lack access to improve sanitation services (UNICEF, 2014). In terms of water access, 7.3 million people are deprived of access to safe water, among which 5.8 million live in rural areas and 1.5 million in urban areas (Ministry of Health and Population, 2014).

The SDGs manage to introduce indicators that are also relevant to migration; and more specifically migrant rights, such as scholarships to study abroad, rights of labor migrants, trafficking, and remittances. While most of these cover issues related to violence and eradicating forced labor, as well as eliminating trafficking and sexual exploitation in young women and girls, others address the health and safety of migrant workers and take the appropriate measures to aid them in a smooth transition between one area and another (Piper, 2017).

Goal 1 in the SDGs looks at targets to eliminate poverty, of which include measures to ensure that the poor and vulnerable have equal rights to economic resources. Providing basic utilities such as water and sanitation services can greatly aid immigrants in ways such as improving health and wellbeing, therefore playing a role in eliminating poverty. SDG 3 focuses on the health of all citizens including eradicating water-borne diseases and eliminating hazardous chemicals from water, which both affect the health of migrants and later spread to areas of destination. This can also prevent migration from happening altogether as health shocks can introduce barriers preventing migrants from leaving their origin area.

The goal relating to water and sanitation in specific, SDG 6, looks at the contribution of the limited access to water and sanitation to pollution of surface and groundwaters. Large and abrupt flows of migrants can increase competition where water resources are scarce. However, this becomes problematic only in contexts of pre-existing challenges in water governance. Lastly, goal 11 seeks to ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums. This would greatly improve spatial inequalities that would then likely strengthen social cohesion as migrants can easily integrate within the community.

Egypt has performed well in terms of achieving the annual targets under the SDG's, however, it still lags behind in targets relating to migration, and water and sanitation access within governorates (Sustainable Development Report, 2020). This can potentially widen the gap in spatial inequalities especially in access to water and sanitation. For this reason, I believe can likely trigger the relocation of individuals from one areas within Egypt to another.

Migration Trends, Determinants, and Egyptian Overview

The history of population growth in Egypt can be categorized into two distinct phases. The first of which Egypt reached a peak of population growth of 2.08 percent at the onset of the 1960's (World Bank). This was the decade in which Egypt entered the North Yemen Civil War (1962-1967), Sand War (1963), and the Six-day War (1967) which in turn led Egypt down a path of economic decline. Since then, population growth in Egypt has steadily decreased to 1.08 percent in 2019 (MPED, 2019). Currently with a total population of 101 million people (CAPMAS, 2021) , the majority of the population resides in both urban and rural areas along the Nile River and over a quarter of the population reside in Cairo. The population dynamic, driven by fertility and mortality rates, is also subject to change between governorates due to individual mobility.

Given this population distribution, the identified trends of migration within Egypt are more likely to be a move towards urban areas-namely to Cairo and Alexandria. Past research on migration in Egypt has identified that the movement of an individual is more likely a move towards urban areas- namely to Cairo and Alexandria. Herrera and Badr (2012) have calculated that on average 86.5 percent of Egyptian internal migrants move from one urban area to another, while 81.7 percent move from a rural area to an urban one. These percentages drastically decrease when taking the movements to rural areas, whether rural to rural or urban to rural, reaching 18.3 percent and 13.5 percent respectively of total internal migrants (Herrera, 2012).

Over the past decade, internal migration in Egypt has fluctuated between three to ten percent from 2007-2012 (Wahba, 2009, Herrera and Badr, 2012). Internal migration rates are very low relative to the global average, with internal migration at 20 percent in Brazil and 32 percent in Morocco. Herrera and Badr (2012) link the low internal migration rate over the

past to low educational levels, which also link to the low migration levels in agriculture-based governorates. Globally, internal migration moves in tandem with educational attainment, and as educational attainment would increase, internal migration would increase simultaneously. Since, in Egypt educational attainment is low, Herrera and Badr (2012) conclude that for this reason, internal migration is low as well. Those working in agriculture are less likely to be migrants as they are usually tied down to the land they own. Agriculture is usually characterized as a low productivity area of work and as such, agriculture-based work tends to pay a lower wage than industry and manufacturing. Another reason mentioned is that individuals working in agriculture likely lack the skills and background necessary for work in other governorates.

Rural-to-rural migration is a relatively newer stream of migration where individuals move from rural areas in Upper and Lower Egypt to more advanced rural provinces such as from Upper to Lower Egypt, particularly from Aswan to *Kafr El-Sheikh, Beheira, and Ismailiaya* (Nagi, 1974). A series of migration streams are outlined in the literature. This would include: the rural-metropolitan migration, mainly to Cairo, Alexandria, but also to other large metropolitan hubs; the rural-urban movement of students and laborers from villages to urban centers; the rural-industrial relocation, from villages to major industrial centers in Aswan, Giza, Beheira, etc. A very recent move from Lower to Upper Egypt (particularly to Aswan, where labor was demanded for a wide variety of industrial complexes.

This, although a small percentage of total migrants, depicts a couple things such as how individuals originating from rural areas might lack the skills and specializations required to find a job or a source of income in the more technologically advanced, urban areas. It also shows that migrants can often relocate to look for better service provision and improved infrastructure. One of the strongest reason's migrants choose to move from one area to another is their hope to find better job opportunities and move out of poverty (Ayman Zohry, 2009, Haidar, 2010). For this reason, Zohry (2019) concluded in his analysis of internal migration that "migration is more of a survival tactic than it is a method of development."

Literature Review

Migration is a relatively broad concept. According to Beijeer (1969), migration is "the movement of a person involving a permanent change of residence." For the purpose of this research, an internal migrant is defined as "an individual who changed his governorate of residence compared to his governorate of birth" or "an individual who was living in an urban area at birth and moved to a rural area (or vice versa)" (Anda David, 2019).

Internal migration can be a permanent or semi-permanent shift from one location to another across country lines, or within the country's boundaries. It in itself (rural-rural, rural-urban, urban-rural, urban-urban) is globally researched. Rural-urban migration in particular is largely researched in literature and is usually regarded as one of the main elements of economic transformation. However, internal migration is one of the reasons leading to the rise of urban slums and urbanization. Urbanization is an indispensable part of the process of modernization. Though according to government statistics Egypt remains a largely rural country, many villages have expanded, some to over 100,000 inhabitants, but have not been reclassified as towns (Zinkina & Korotayev, 2011).

Conceptual Framework

For many years, individuals have been concerned with the changing distributions of human societies, but only recently have those changes been subject to extensive research.
The amount of migration studies undertaken out over the past thirty years demonstrates that migration has been and continues to be one of the most prominent, and perhaps important studies.

To date, two key approaches to the study of mobility behavior have essentially been adopted. The first uses macro level characteristics such the socioeconomic and physical environments (wages, unemployment, and climate). This literature is deeply embedded in the framework of neoclassical economics. The second, or the micro approach, attempts to explain migration in the sense of individual decision making and is usually concerned with how individuals choose between different options. The choice of potential destinations, and concepts such as place utility, are assumed within the general framework of choice behavior developed by psychologists (Cadwallader, 1989).

An individuals' overarching objective of migration is to increase one's social position and overall development of social and economic conditions (Chowdhury et al., 2012). These conditions include factors such as household income, savings, land possession, expenditure, non-productive assets, housing status, water, sanitation facilities, and poverty. These preidentified conditions are expected to improve in comparison to their pre-migration levels (Lucas, 2015).

Determinants of Migration

Research has been done on how education affects migration, however, they offer conflicting viewpoints. While most researchers (including Aude Bernard, 2018, Deshingkar, 2006, Gould, 1982) agree that increased education increases the probability of migration, others have proven the opposite (Amoyaw, 2015, Gould, 1982). One can note that the higher the education of the individual the better their chances of finding a job opportunity elsewhere and usually has better access to information. The opposite is also true. Educated individuals are more likely than not to have a job before moving and may keep them from moving as it would be more uncertain. Increased education alters other variables that determine the decision to migrate such as income; a highly educated individual has the chance to get a higher paying job in their origin location or elsewhere. These indirect effects cannot be qualified with ease. Achah and Medvedev (date) concluded that migration likelihood is higher for those who are younger and more educated and overall leads to better welfare for the whole household.

As large proportions of highly educated individuals move together from one area to another, it will skew the origin education level downwards while inflating the destination education levels (Abdulloev, 2019). This should raise concern for policy makers as internal brain drain can lead to underdeveloped areas within a country. As the youth move from one area to another in search for better job opportunities or education, the origin state is left out as a loser and the destination state as a winner of the individual's increased level of human capital.

Spatial income inequalities between origin and destination areas are widely looked at under the scope of internal migration determinants. Chowdhury et al. (2012) discusses the relationship between an individual's socio-economic status and their migration and concludes

that internal migration contributes positively to the development of lower-income groups. In other words, internal migration (specifically rural to urban) contributes to the improvement of the socio- economic status of the migrants. Potential income differences between origin and destination areas are also more likely to skew decisions on migration. An individual will migrate if they expect income in their destination area to be higher than income in their origin area.

Very little research was done on the effects of improved access to water and sanitation on migration. Ackah and Medvedev (2012) concluded that households with better water and sanitation access are more likely to produce less migrants. Research usually maps the determinants of having access to water and sanitation rather than whether they affect an individual's decision to relocate. Tiwari and Nayak (2013) found that education and literacy rates are significant predictors of water and sanitation access. Lucas (2015) states that very little evidence exists on the effects of amenities on migration outcomes in the developing world.

Individuals coming from an area that is worse off, in terms of access to utilities and infrastructure, are more likely to migrate to an area with better access to services, proving that inequalities within villages are likely pushing citizens away and this leads to the widening of spatial inequalities by pushing more educated, and wealthier individuals to urban areas. Bhat (2013) looks at a more extreme approach and concludes that globally, a permanent lack of water and sanitation services caused by continuous droughts or insistent flooding can be considered a determinant of migration (Bhat et al., 2013; Opitz-Stapleton et al., 2017). In Egypt, Herrera and Badr (2012) concluded that there is a significant premium in wages in urban areas compared to rural ones, and that migrants are more likely to be employed than non-migrants living in the origin governorate, unless migrants carry a low educational level .

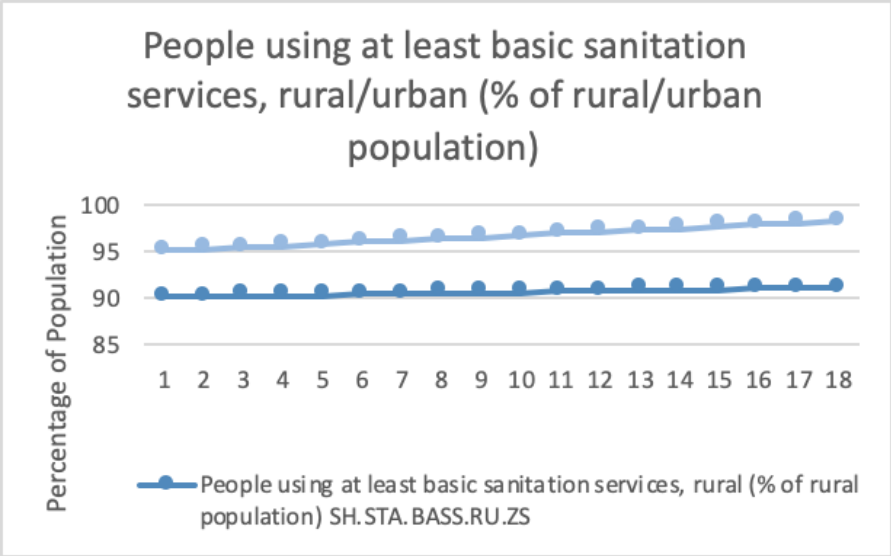
According to the previous coverage of the existent research on the determinants of migration, and more specifically internal migration in Egypt, this research determines how unequal distribution of infrastructure and access to amenities could affect an individual's probability of being an internal migrant across governorates. It looks at the magnitude other micro level factors, such as education, unemployment, and gender, have on migration. The major contribution of this research to the current literature is to determine to what extent does

the impact of infrastructure elements, more specifically water and sanitation access, act as push factors for internal migrants, from the start of the 21st century to present day.

Current Utility Inequalities in Egypt

From the data acquired from the World Development Indicators it is obvious that there remains a gap between rural and urban areas with people using at least basic sanitation services. The percentage of people using at least basic sanitation services, that is, improved sanitation facilities that are not shared with other households. This indicator encompasses both people using basic sanitation services as well as those using safely managed sanitation services. (WDI, 2019) The overall gap has been increasing with an average of 5 percent difference between rural and urban areas. As of 2018, urban areas have a 98 percent access to basic sanitation services while the rural areas remain at 91 percent.

Figure 1: Urban/ Rural Access to Basic Sanitation



Source: Authors' calculations using WDI

Table 1 below further shows the correlation between people using at least basic sanitation services, in rural areas and both poverty headcount ratio at $1.90 a day accounting for 2011 Purchasing Power Parity (PPP). The poverty headcount ratio adjusts for differences in the purchasing power of the currency and makes it easily comparable. It also does the same for people using at least basic sanitation services, in urban areas and both poverty headcount

ratio at $1.90 a day (2011 PPP). It can be observed that both rural and urban areas have almost a perfect negative correlation with the poverty headcount ratio and a perfect positive correlation with the poverty headcount against national poverty lines.

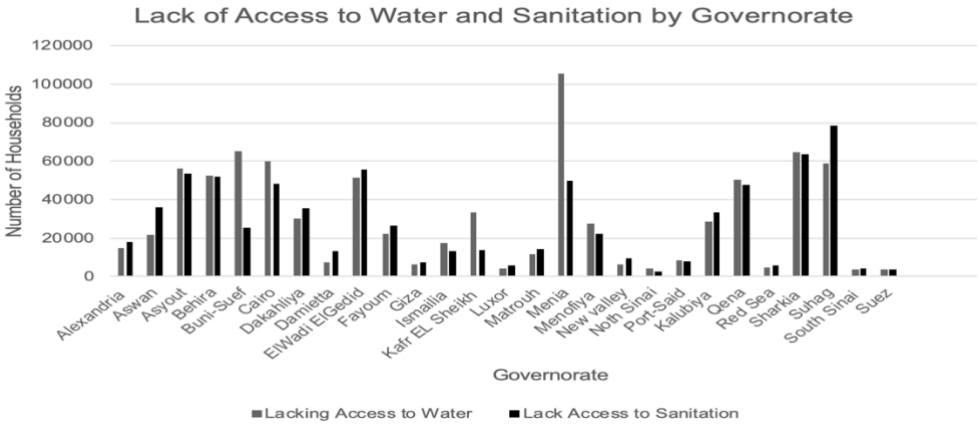
Table 1: Correlation Between Poverty and Basic Sanitation

	Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population)	Poverty headcount ratio at national poverty lines (% of population)
People using at least basic sanitation services, rural (% of rural population)	-0.920947761	0.973401145
People using at least basic sanitation services, urban (% of urban population)	-0.921299784	0.973286278

Source: Authors own calculations using WDI.

One can immediately conclude that utility access (or lack thereof) correlates highly within governorates. Figure 2 shows lack of water access and lack of sanitation access by governorate. When governorates lack access to electricity, they usually have issues with sanitation as well (and vice versa). One can also note that lack of access to these utilities relate to governorate in Upper and Lower Egypt.

Figure 2: Utility Access at the Governorate Level



Source: Authors' own calculations using CAPMAS12

Overall, based on the initial findings it is apparent that inequality in access to services driven by the unequal distribution of infrastructure, along with the improper government planning is a solid basis for potential relocation of individuals.

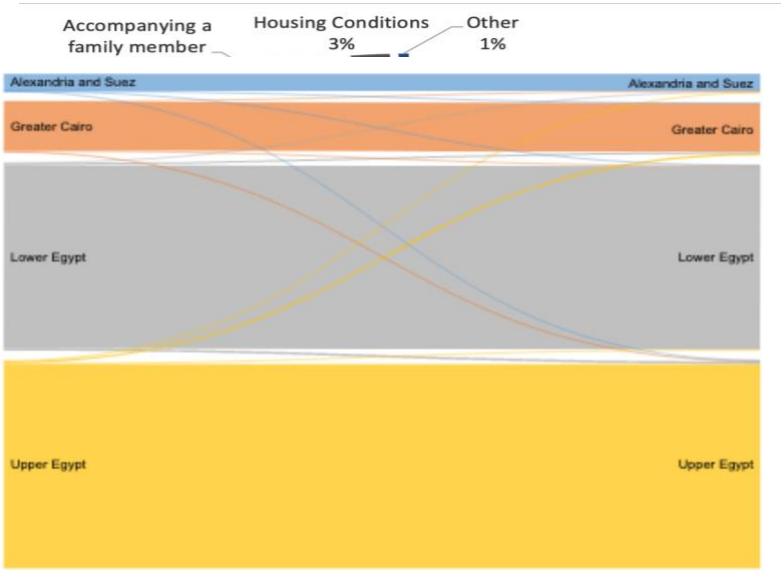
Data and Descriptive Statistics

Data Sources

In this research, data from the 2018 Egypt Labor Market Panel Survey (ELMPS18) and the 2012 Egypt Labor Market Panel Survey (ELMPS12) is used to examine the determinants of migration in Egypt. The ELMPS18 is a longitudinal survey by the Economic Research Forum (ERF) and the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS). The ELMPS18 follows individuals interviewed in the 1998, 2006, and 2012 surveys, and provides an in-depth nationally representative analysis of an Egyptian citizens' dynamic. The ELMPS18 follows those interviews in the 2012 round and even some that were interviewed in the 2006 and 1998 round, but it mostly includes a "refresher sample" of households that were added in 2018.

The ELMPS18 interviews 61,231 individuals who belong to 15,746 households. The final model however, will account for the missing values by removing observations that contain a missing value for any of the variables. Due to this, the final Sample size includes 37,720 individuals. Individuals were asked over 1000 questions under three different categories of surveys: household level, individual level, and migration, remittances, non-agricultural and agricultural enterprises are all areas encompassed in the third survey. For the purpose of this research, questions covering migration (from the mobility module), education, access to services, and employment background are used. In addition to using ELMPS18, governorate level data extracted from the Egyptian annual data reports produced by CAPMAS (2012), as well as data from the Ministry of Planning and Economic Development and the World Bank are used.

Figure 3: Reasons for Migration



Source: Authors' own calculations using ELMPS18

Individuals who had migrated within Egypt were asked what the major reason why they decided to leave their birth governorate and travel to another governorate. This question, under the mobility module, is only concerned with those who migrated internally.[2] The top two reasons representing 84 percent of the whole sample stated that they have moved due to work or marriage at 43 percent and 41 percent respectively. Housing conditions represented 3 percent of the reason's individuals chose to migrate including access to electricity, flooding, and access to water and sanitation. "Other" holding the remaining 1 percent of answers includes health conditions, family circumstances, prison, and army related reasons.

Descriptive Analysis of Migration at the Regional and Governorate Level

Figure 4: Migration by Region

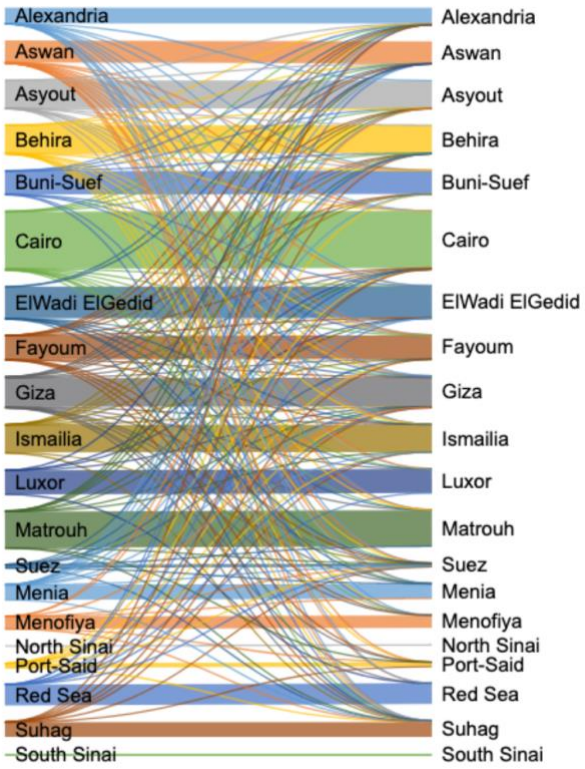
To gain a better and more comprehensive view of individual movement within Egypt, figures 4 and 5 show the movement of individuals within all the governorates of Egypt. As depicted in Figure 4, those originating from Upper Egypt usually end up moving to Greater Cairo and Alexandria and Suez Canal regions, and like the model findings, individuals originating from Upper Egypt, Lower Egypt, and Alexandria and Suez Canal regions are more

[2] Individuals who travelled internationally did not answer this specific question in the survey and have a dedicated question regarding international migration.

likely than the Greater Cairo region to be a migrant. It is important to note that the nodes depicting the movement of individuals are not individual moves, but rather a movement of the percentage of the origin region. The same can be seen in more depth in Figure 5 which shows the movement from origin governorate to destination governorate. Those originating from Upper Egypt namely Aswan, Asyout, Beni Suef, and El Wadi ElGedid have a high percentage of their population traveling to other destinations, whether inside Upper Egypt itself or elsewhere.

The summary statistics (Annex 2) show that approximately 10 percent of our sample has migrated within Egypt at least once. This is consistent with the previous literature of Herrera and Badr (2012), and Wahba (2002) proving that indeed, Egyptian migration is low.

Figure 5: Migration by Governorate

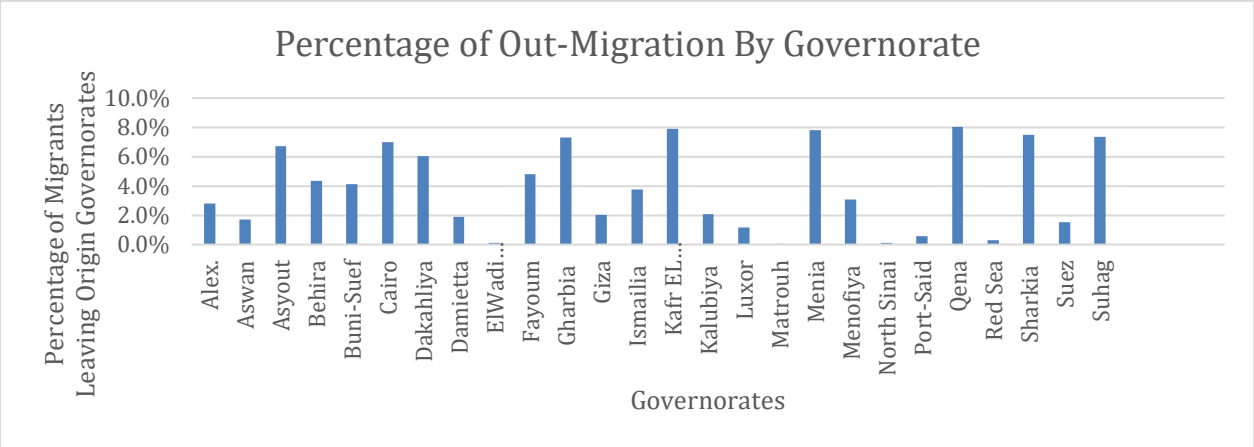


Source: Authors' own calculation using ELMPS

Figure 6: Pull Governorates

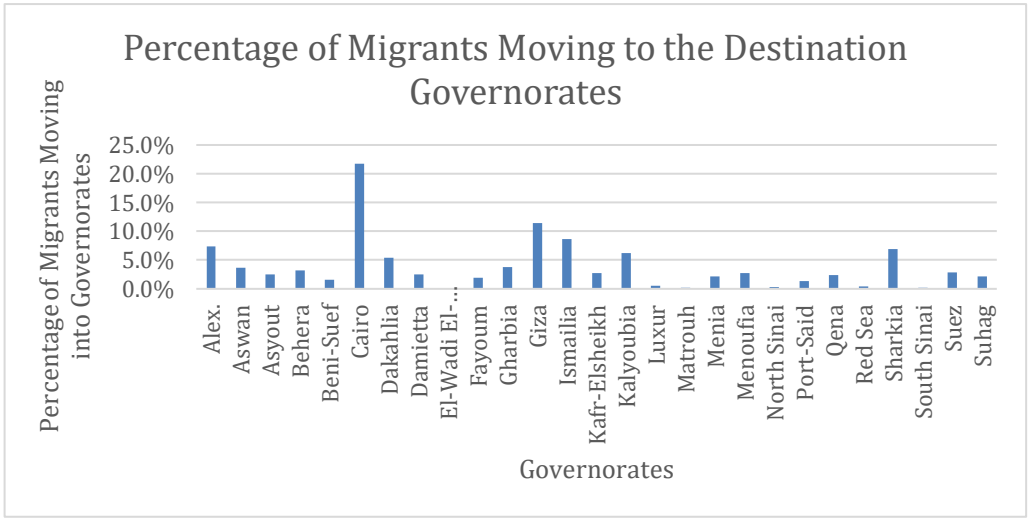
Source: Authors' own calculations using ELMPS18

Figure 7: Push Governorates



Source: Authors' own calculations using ELMPS18

Figures 6 and 7 aim to look at the main pull and push governorates. The main push governorates include Qena, Kafr ElSheikh, Menia, and Sharkiya. The main pull governorates,



or the main destination governorates include Cairo, Giza, Alexandria, and Ismailia. Aligned with the past research on areas of migration, pull governorates are mostly comprised of urban metropolitan centers and industrial hubs. Push governorates on the other hand are mostly comprised of Upper and Lower Egypt which more likely than not, suffer from infrastructure related issues (Ministry of Health and Population, 2014). Cairo stands the highest in terms of inward-migration accepting 21.7 percent of the total migrants. Giza comes in second with 11.4 percent. Overall, this is consistent with the work of Nagi (1974), by showing that the top two

major governorates of destination are Cairo and Giza. Nagi's (1974) work is also consistent with the origin governorates or the outward-migration governorate. A total of 8 percent of all migrates originate from Qena (Upper Egypt), and 7.9 percent from Kafr El Sheikh (Lower Egypt).

Scope of the Analysis

The model sample size is 32,720 individuals, encompassing all the individuals that managed to answer all the questions within the module. The model had to account for those missing observations and only chose those with a full set of information available, missing values mostly came from the difference in data on lack of access to water and sanitation as it can from ELMPS12. The ELMPS18, as mentioned before, although it includes some of the individuals from the 2012 ELMPS round, introduces a refresher sample of new individuals. Of the sample size, those who have migrated make up approximately 11 percent or about 3,859 individuals. This only includes those who have migrated after the turn of the 21st century to 2018.

Age is a continuous variable and is taken at the time of migration showing an average age of 48.6 years of age. For the purpose of this research, age is restricted to 18 to 80 years of age to avoid accounting for young ones as migrants when in actuality they could have moved with their parents or other family members, in other words it was not an individual decision driven by economic push and pull factors. Males make up 49 percent of the sample. Education level was computed at the time of migration using a comparison between the year the individuals have received their respective degrees and the year of migration. If the degree was completed before the time of migration then they are considered holders of that degree, and if after then the last degree completed before that time is used for that purpose. The education level is divided into four categories: illiterate, less than secondary, secondary, and post-secondary, university and above making up 35.5 percent, 23.8 percent, 23.6 percent, and 17.1 percent of the sample respectively. The same was done for employment before migration. If an individual has a job before migration they were considered employed, and if not then they are recorded as unemployed. This along with the type of sector they are working in is combined to provide a fuller image of the individual employment by sector. Unemployment before migration was also gathered and represents about 3.4 percent of the overall sample.

Recently there have been many improvements in infrastructure projects in Egypt. Infrastructure projects are usually long term. Prior to the revolution Egyptians suffered from inadequate distribution of infrastructure. Major sectors infrastructure development plans that had been delayed by the political and economic instability that began in 2011 have since then slowly started to move forward (IMEP,2017). For this reason, the access to water and sanitation at the time of the ELMPS12 will be used. The year post-revolution came with a total amount of 11 billion Egyptian Pounds worth of projects relating to three new projects offered are a 980 million Egyptian Pounds wastewater treatment plant at Sixth of October City, a LE5.5 billion treatment plant at Abu Rawash and a LE4.5 billion road from Sixth of October while the last project related to hospitals in Alexandria (Ahram, 2012).

Lack of access to water and sanitation were calculated at the household level from the ELMPS12 to take into account the access to amenities in the place of origin as a proxy to this level of access at a time prior to the time of migration. Anything less than a connection to a water source or sanitation pipeline was considered a lack of water or sanitation respectively. Origin areas composed a big part of the variables under the model. This first of which is a dummy variable for the area of origin and is equal to one if the individual is from an urban area and zero if rural. Individuals were also categorized under the regions they were born in; Greater Cairo, Alexandria and Suez Canal, Upper Egypt, and Lower Egypt. Both the rural/urban dummy variable, along with the region of origin was combined to create 8 categorical variables: urban Greater Cairo, rural Greater Cairo, urban Alexandria and Suez Canal, rural Alexandria and Suez Canal, urban Upper Egypt, rural Upper Egypt, urban Lower Egypt, and rural Lower Egypt.

Differences in per capita GDP were collected from CAPMAS12 and were used to measure whether or not individuals moved into a more income-generating, human-productive, governorate. Another variable was also introduced which focuses on whether individuals likely moved to a region of higher population compared to their origin governorate. Governorate of origin level data was subtracted from destination level data. Both variables hold a value of 1 if the destination minus origin data is 0 or less and a value of 0 if the difference is positive.

Although one would've hoped to gain a full picture of an individual before migration and compare it to after migration, due to the data restrictions some variables will be used before time of migration and others will depict levels after migration.

Methodology

Econometric Methodology

Herrera and Badr (2012) use the same econometric method to define the determinants of migration in Egypt, while they do not look at how migration is affected by provision of utilities, they do find a relationship between migrants and their educational attainment as well as their employment field (agricultural, manufacturing, etc.). Abdulloev et al. (2019) utilize a probit regression in determining how education and employment affect migration rates in Tajikistan. The results conclude that because Tajikistan has very high rates of migration, they suffer from brain drain and "forsaken schooling" where individual's forgo schooling because of opportunities to migrate to high paying low-skilled jobs which leads to reduced educational investment.

Castaldo et al. (2005) look at how community level indicators and environmental factors, such as access to water, stagnant water sources, and crime affect the individual decision to migrate. Using a probit model stagnant water in the commune was deemed as significant but water availability, measured by whether the residence contains an internal water closet is significant only at the ten percent level.

Based on the previous review highlighting the common methodology in the literature I will be using a probit model. Our dependent variable, internal migration, is a binary outcome variable holding the value of one if an individual has migrated within Egypt and 0 otherwise. Individuals were asked if and when they moved (ranged from one move to a maximum of 20). The variable "migrant" holds a value of one if the individual has moved at least one of the twenty possible times and zero if they did not move at all. Given this binary nature of the dependent variable, a probit model is used.

$$Pr[Migrant = 1] = \Phi(X`\beta)$$

where Φ(.) is the Cumulative Density Function (CDF) operator, X is a vector of explanatory variables, and β is a vector of unknown parameters.

The independent variables used in my model cover both the individual relating variables, economic variables, and amenities/access to service variables over twelve main categories: age, gender, region and area of origin, education status before migration, employment status before migration, water access, sanitation access, differences in per capita GDP by governorate, differences in total population under each governorate, the number of schools, and interaction terms between schools and lack of access to water and lack of access to sanitation. The former seven categories provide an in-depth look at the individual's own factors, while the latter provide a more comprehensive, macro-level analysis of the origin governorates.

Age is a continuous variable holding a value between eighteen and eighty years of age. The education status is taken at the time of migration and is divided into four main categories, illiterate, less than secondary, general or vocational secondary, and university and above. Individual employment status is also taken at the time of migration and accounts for whether the individual is employed or unemployed, along with the sector of employment. Individual locations are divided into region of origin and area or origin and have been combined into eight categorical variables. The region of origin divided the governorates of Egypt into four regions: Greater Cairo, Alexandria and Suez, Upper Egypt, and Lower Egypt. Area of origin indicated if the individual was born in an urban or rural area.

The remaining variables look at macro level indicators. The difference in GDP per capita looks at the difference in per capita GDP between destination and origin values. The variable holds a value of zero if the difference is positive, and a one if negative or equal to zero. The same holds for population differences between destination governorate and origin governorate.

Lastly, variables on the amenities and the quality of life are introduced. The number of schools by governorates aims to show the availability of educational institutions. The major

variables of concern look at the log lack of availability of water and sanitation by governorate. Two other interaction terms are included to visualize the relationship between schools and water and schools and sanitation.

Statistical Analysis

The results of the probit regression and the average marginal effects are presented in table 2 below.[3]

Table 2: Probit Regression Results

Variable Name	Coefficient	Average Marginal Effects
	(st. error)	(st. error)
Demographic Variables		
Age at Migration	0.0026006	0.0003523
	(0.0056551)	(0.0007661)
Age Squared	-0.0003923***	-0.0000531***
	(0.0000738)	(0.00001)
Gender		
Male	0.1904814***	0.0258033***
	(0.0283798)	(0.0038422)
Education levels (ref. category: Illiterate)		
Less than Secondary	2.931469***	0.3971079***
	(0.3201826)	(0.0433027)
Secondary	-2.073254***	-0.2808509***
	(0.3200984)	(0.0433124)
Post-Secondary, University and above	0.2222876***	0.0301119***
	(0.0307918)	(0.0041793)
Employment Status (ref. category: Out of Labor Force)		
Public Employment	0.2666385***	0.0361199***
	(0.051184)	(0.0069329)

[3] The model interpretation depends on the analysis of the marginal values and not the actual coefficients of the probit model.

Private Formal Employment	-0.0529106	-0.0071675
	(0.0507207)	(0.0068701)
Private Informal Employment	-0.0177563	-0.0024053
	(0.0310328)	(0.0042037)
Unemployment before Migration	0.7061168***	0.0956533***
	(0.0345834)	(0.0046604)
Region of Origin (ref. category: Urban Greater Cairo)		
Rural Greater Cairo	-0.6889079***	-0.0933221***
	(0.1020307)	(0.013828)
Urban Alexandria and Suez Canal	-0.3001602***	-0.0406608***
	(0.0597394)	(0.0080913)
Rural Alexandria and Suez Canal	1.297297*	0.1757368*
	(0.695735)	(0.0942314)
Urban Upper Egypt	0.0667383*	0.0090406*
	(0.0394795)	(0.0053486)
Rural Upper Egypt	0.2374102***	0.0321605***
	(0.031829)	(0.0043116)
Urban Lower Egypt	0.1823934***	0.0247077***
	(0.0519331)	(0.0070351)
Rural Lower Egypt	0.1686699***	0.0228487***
	(0.03921)	(0.0053103)
Economic Variables		
Difference in GDP per Capita by Governorate (Destination-Origin)	-0.9070122***	-0.1228673***
	(0.0605648)	(0.0081956)
Population Difference between Governorates (Destination-Origin)	-3.400933***	-0.4607033***
	(0.1523997)	(0.0204622)
Amenity/Quality of Life		
Lack Access to Water	-0.1501149	-0.0203351
	(0.1372046)	(0.0185863)
Lack Access to Sanitation	-0.6981505***	-0.0945741***
	(0.0706831)	(0.0095723)
Number of Schools	-0.0002202***	-0.0000298***

	(0.0000149)	(2.02e-06)
Interaction Term (Schools and Water)	0.0000311	4.21e-06
	(0.0000544)	(7.37e-06)
Interaction Term (Schools and Sanitation)	0.0002201***	0.0000298***
	(0.0000298)	(4.03e-06)
Constant	3.321091***	
	(0.2059117)	
Pseudo R2	0.2473	
N	37,720	37,720
LR Chi2	Chi(24)= 5327.95***	

Note: *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' own calculations using ELMPS18 and ELMPS12

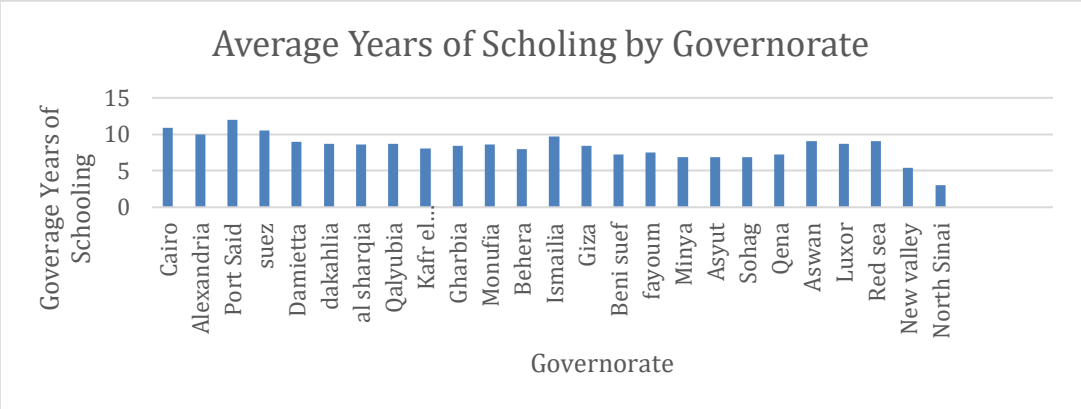
The probit model shows that as age increases individuals are more likely to become a migrant within Egypt. Unemployed individuals are 9.5 percent more likely to migrate compared to those out of the labor force. In terms of employment, those employed in the public sector are 3.6 percent more likely to migrate compared to those out of the labor force. Both private formal and informal are deemed as insignificant. One possibility is that, in a rationed market for skills, only the most talented candidates manage to access a formal job. Those remaining unemployed, or employed in informal jobs, have an incentive to migrate (David, 2016).

When it comes to education level at the time of migration, it shows that compared to the reference group of illiterate individuals, those with a higher level of education are more likely to migrate which, like the previous literature on the matter, shows that those with a higher level of education are more likely to find better jobs elsewhere. It is important to note that those with a secondary education are less likely to migrate. This could be due to the fact that they already have a job, or still plan to finish their schooling (Nagi, 1974).

Based on Figure 8, individuals in Greater Cairo governorates and Alexandria and Suez Canal (predominantly urban area governorates), tend to have a higher average of years in schooling. This could be due to the inflow of migrants coming to continue their education on

leading to the potential internal brain drain of origin governorates and brain gain in the destination governorates.

Figure 8: Average Years of Schooling by Governorate



Source: Authors' own calculations using CAPMAS

Access to water and sanitation is an important part of human health and wellbeing. Access to water is particularly related to sound health condition of the respondents' family and respective residential areas as well (Islam 2008). Data was available on the lack of water and sanitation within households using the ELMPS12 data. Based on this information we can conclude that while you are less likely to migrate if you lack access to sanitation, lack of water access is deemed insignificant. revise these two sentences together

The following test shows that the lack of water and sanitation in the origin governorate is a likely factor in the deciding to migrate

Test: (Lack of access to water) (Lack of access to Sanitation)

(1) [migrate] Lack of access to water= 0
(2) [migrate] Lack of access to Sanitation = 0

chi2(2) = 113.87
Prob > chi2 = 0.0000

The overall effect of lack of access to water and sanitation is significant in this model. This tests that all coefficient of lack of access to water and lack of access to sanitation are jointly zero.

Upper Egypt has been widely regarded as the region lagging behind with access to basic utilities, of which include water and sanitation. The model shows that those originating from rural Upper Egypt are 3.2 percent more likely to become migrants than the reference region of urban Greater Cairo. Individuals are more likely to migrate if they originate from any of the rural regions. Urban and Rural Lower Egypt are 2.4 percent and 2.7 percent respectively more likely to migrate in comparison to those originating in the urban region of Greater Cairo.

Tabulating the number of individuals originating in rural Upper Egypt with those who lack access to water, I find that 71.3 percent of individuals from rural Upper Egypt lack the access to water. When I further cross tabulated those originating from rural Upper Egypt and those who migrated I find that only 10 percent of them have migrated within Egypt. This observation could be one of the reasons water was deemed insignificant in the model as the lack of water access is concentrated in an area with relative inelastic migration. The work of Herrera and Badr (2012) aligns with this theory as mentions that those originating from Upper Egypt contain a large proportion of agriculture-based work and could potentially find it difficult to relocate.

The table of results (Table 2) shows that if an individual lacks access to sanitation, they will be less likely to migrate. I also managed to introduce an interaction term between the number of schools within the governorate and the lack of access to water and sanitation. It can be further concluded that the number of schools available in the area is a significant indication of migration potential. It shows that an individual is less likely to migrate is there are more schools available within their governorate of origin. The interaction terms however are considered insignificant for lack of access to water and individuals are more likely to migrate if they lack access to water, even if there are schools available.

The Chi-squared is significant to the 1 percent level proving that this model there is a significant improvement in fit of this model compared to the null (intercept only) model. Unlike the interpretation of the R-squared under a normal regression the pseudo-R-squared is at 24.73

percent which was the highest of all possible models run indicating a good goodness of fit. To further test the goodness of fit for the model a Pearson test was conducted[4], showing a Pearson Chi-squared of 33310.23 and a p-value of 0.000 showing a high significance level of the model. Lastly, tabulating the number of correctly classified[5] individuals we find that approximately 91.38 percent is classified correctly in the model, representing a very robust model.

Conclusion

Given Egypt's economic growth and the spatial disparity in living standards, I would expect high levels of internal migration and labor mobility to equalize returns on economic benefits. However, since internal migration is low, it makes sense that the course of equilibrium has not been met. The results show that unemployed, educated males originating from Upper Egypt are most likely to be migrants. We can also conclude that a lack in access to sanitation is less likely to produce migrants, while lack of access in water is insignificant. The model also introduced two interaction terms linking the number of schools by governorate to the access to water and access to sanitation respectively and the findings show that individuals who have access to schools within the governorate but lack access to sanitation are more likely to be migrants. This leads me to believe that comparing water access, schooling, and sanitation access, individuals will prioritize schools over sanitation and will prioritize both over water.

Based on the results, it is recommended that policy makers should aid water and sanitation related service providers as they would need to cover the growing demand for water and sanitation services in urban cities with a positive inflow of people as well as help build better access to services in rural areas in attempt to prevent overcrowding and urban slums in urban destination areas. Governments should aim to create synergies between water and sanitation access and migration by providing better water governance in terms of infrastructure, monitoring, and planning of water and sanitation related projects (Guy Jobbins, 2018) (Greenwood, 1969).

[4] The Pearson Test results show a Chi-squared of 33310.23***
[5] Percent of correctly classified individuals has a 91.38 percent success rate.

Policy makers should also be weary of the income inequalities that increase internal migration might cause. It is apparent that internal migration is more likely to increase a household income (especially to an urban migrant from a household that is rural based). In an effort to help decrease internal migration governments must be able and willing to intervene (Deshingkar, 2006). This concern is also relevant when talk about internal brain drain. Policy makers should also be weary of the movement of more educated citizens from rural areas to more urban areas.

The role of Private Public Partnerships (PPPs) should also be looked at as citizens are more incentivized to move from rural to urban to look for better job opportunities. This decreases the need for governments to provide services in rural areas. This incentivizes PPPs to invest more in urban areas which will ultimately create a bigger gap in spatial inequality between urban and rural areas as PPPs are less incentivized to provide services in any utilities sector as the cost per capita has increased.

The limitations of this research include the potential endogeneity of the explanatory variables. An issue with our regression analysis is the potential endogeneity of the schooling variables. It is possible that decisions on schooling are taken simultaneously with the migration decision (Abdulloev, Epstein, & Gang, 2019). Secondly, reverse causality is always an issue when researching migration. Another potential endogeneity issue arises from the employment variable. Here, there also lies a possibility that individual's make the decision on employment and migration simultaneously. To address this issue, I tried to look at the variables at the point before migration. However, some variables were not available prior to the time of migration. Future research will need to utilize different tools and instruments to mitigate this issue. Given the fact that full data on each individual was not available before and after the time of migration, future studies should use more comprehensive panel data that would give the research the ability to match the variables before and after migration to be able to fully comprehend the key determinants affecting their decision to migrate.

While Egypt shows a growing economy, regional disparities still lie within. Future research should also look at both internal and international migration in Egypt. Examining the relationship between the two should provide a more well-rounded view of how these two systems work together. It would be interesting to look at if individuals who left for the reason

of education or employment later returned to their home governorate or if they chose to continue their life in the destination governorate. If individuals ended up continuing in the destination governorates, there could pose a risk of intra-governorate brain drain which would require the intervention of policy makers. While migration is a strategy to alleviate one's own poverty it is considered a driver of growth and offers significant benefits to the migrants' well-being and welfare.

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APPENDIX A: SDGS AND MIGRATION, WATER AND SANITATION RELATIONSHIPS

Table 1.1: SDGs, Migration, Water, and Sanitation

Relevant SDGs and Targets	Link to Migration, Water, and Sanitation
Goal 1: No Poverty	
By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of 13 property, inheritance, natural resources, appropriate new technology and financial services, including micro-finance.	Sustainable water resources management and the provision of Water, Sanitation, and Hygiene WASH services can enable successful migration, which plays an important role in reducing poverty.
Goal 3: Ensure healthy lives and promote well-being for all at all ages	
By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases	In origin communities, poor WASH services can contribute to health shocks that inhibit successful migration. However, remittances from migrants can contribute to WASH provision and health outcomes.
By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	Failure to meet the WASH needs of migrants can contribute to public problems, particularly when large numbers of people are concentrated in temporary, informal or dilapidated areas.
Goal 6: Clean water and Sanitation	

By 2030, achieve universal and equitable access to safe and affordable drinking water for all By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	While there is evidence that water resources shocks and long term stresses contribute to seasonal, temporary and permanent migration, there is limited evidence that WASH services are a significant driver of migration. Achieving universal access for all requires addressing the needs of migrants. Migrants can face significant barriers in accessing WASH services, particularly when they are in transit or undocumented. Large and abrupt flows of migrants, particularly refugees, can pose specific problems to the coping capacity of service providers. Monitoring is a challenge, especially for disaggregation by migratory status. Monitoring methods for WASH targets are likely to exclude undocumented and transitory migrants, and localized and temporary needs.
By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	Where refugee and migrant populations are not served with safely managed sanitation, open defecation, untreated wastewater discharge, and unsafe disposal of fecal sludge can contribute to pollution of surface and groundwaters.
By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and	Large and abrupt flows of migrants can increase competition where water resources are scarce. However, this becomes problematic only in contexts of

substantially reduce the number of people suffering from water scarcity	pre-existing challenges in water governance. There is limited evidence that economic out-migration reduces water competition in origin communities.
By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programs, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	Providing developing countries with the technology and tools aiding in providing safe water and sanitation access can increase the welfare of citizens' as well as provide them with job opportunities.
Support and strengthen the participation of local communities in improving water and sanitation management	
Goal 11: Sustainable Cities and Communities	
By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	Providing WASH services to slum and informal areas helps reduce spatial inequality and strengthen social cohesion.

APPENDIX B: SUMMARY OF DATA VARIABLES

Table 2.1: Summary of Variables Used

Variable Name	Description	Mean (St. deviation)
Migrate	=1 if individual has ever migrated internally, =0 otherwise	0.1018643
Age	A continuous variable reflecting the age at the time of migration of the individual	36.95798 (14.96091)
Male	=1 if the individual is a male, =0 otherwise	0.4865831
Public Sector Employment	=1 if individual works in the public sector, =0 otherwise	.1099027
Private Formal Employment	=1 if individual works in formal private sector, =0 otherwise	.1525978
Private Informal Employment	=1 if individual works in the private informal sector, =0 otherwise	.3022311
Unemployment before Migration	=1 if individual was unemployed before the year of migration, =0 otherwise	0.0746944
Illiterate	=1 if the individual has no education, =0 otherwise (used as reference)	0.2654064
Less than Secondary	=1 if the individual has had less than a secondary degree before migration, =0 otherwise	0.2367359
Secondary	=1 if the individual has a general or vocational secondary degree before migration, =0 otherwise	0.2367359
Post-Secondary, University, and above	=1 if the individual has anything above a secondary degree before migration, =0 otherwise	0.1718521
Access to Water	Lack of tap water availability inside the dwelling	.0615831
Access to Sanitation	Lack of a connection to a public network inside house	.4658924

Urban Greater Cairo	= 1 if individual was born in the Urban Greater Cairo region, =0 otherwise. (used as reference)	.0727097
Rural Greater Cairo	= 1 if individual was born in the Rural Greater Cairo region,=0 otherwise.	0.0277506
Urban Alexandria and Suez Canal	= 1 if individual was born in Urban Alexandria or Suez Canal region, =0 otherwise	0.0429095
Rural Alexandria and Suez Canal	= 1 if individual was born in Rural Alexandria or Suez Canal region, =0 otherwise	0.0002751
Urban Upper Egypt	= 1 if individual was born in the Urban Upper Egypt region, =0 otherwise	0.1099027
Rural Upper Egypt	= 1 if individual was born in the Rural Upper Egypt region, =0 otherwise	0.2988692
Urban Lower Egypt	= 1 if individual was born in the Urban Lower Egypt region, =0 otherwise	.0503362
Rural Lower Egypt	= 1 if individual was born in the Rural Lower Egypt region, =0 otherwise	.1104829
Difference in GDP per Capita by Governorate (D-O)	=1 if difference between destination and origin governorate GDP per capita is zero or negative, =0 otherwise	0.9296455
Population Difference between Governorates	=1 if difference between destination and origin governorate population is zero or negative, =0 if positive	0.9894866
Number of Schools by Governorate	Number of schools by governorate	2427.289 (1145.258)
interaction Term	Interaction term between the number of schools and the lack of access to water	145.9459 (608.566)
Interaction Term	Interaction term between the number of schools and the lack of access to sanitation	998.8548 (1157.526)
N		32,720

Note: Standard deviations are reported in brackets for only the non-binary variables in the dataset.

APPENDIX C: GOVERNORATES AND RESPECTIVE REGIONS

The Greater Cairo region includes Cairo, Kalubya and the urban area of Giza.

Some consider Giza to be fully part of the Greater Cairo region (EU, 2012, Osman 2016) while others divide Giza into the Greater Cairo urban area and the Upper Egypt rural area (Wahba, 2019).

Upper Egypt also includes Beni-Suef, Fayoum, Menia, Asyout, Suhag, Qena, Aswan, Luxor, Red Sea, and El-Wadi El-Gedied.

Alexandria and Suez Canal governorates include Alexandria, Suez, and Port-Said.

Lastly, Lower Egypt is comprised of Damietta, Dakahliya, Sharkia, Kafr El-Sheikh, Gharbiya, Menofeya, Beheira, Ismailiaya, Matrouh, North Sinai, and South Sinai.