WHAT DRIVES EMIGRATION FROM HUNGARY?

EVIDENCE FROM TEACHERS' PATTERNS OF ATTRITION AND EMIGRATION.

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Abstract

The central topic of this thesis is emigration from Hungary. It focuses on teachers, because they tend to earn less as public sector employees than other, similarly skilled workers in the private sector, making them incentivized to leave their profession either in the form of attrition or emigration. Using a comprehensive administrative dataset spanning between 2003 and 2011, I estimate probability models to examine if the age and earnings of teachers have any effect on their propensity to leave their profession. I find no significant effects with respect to age, but highly significant effects with respect to earnings, confirming the association between earnings, attrition and emigration, and encouraging the thorough reconsideration of the structure and system of public sector wages.

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1. Introduction

In this thesis, I aim to identify factors that may increase the probability of emigration from Hungary by estimating probability models. For this purpose, I use a comprehensive administrative dataset, spanning between 2003 and 2011, and restrict my sample to teachers working in the public sector. More specifically, I estimate and compare the probability of attrition[1] and emigration to determine if teachers are willing to face a trade-off between the possibility of earning higher wages and working in a position that may not match their degree specialization and education levels. In both cases, teachers are likely to earn more. The difference between the two cases is that in the former, they stay in Hungary, and in the latter, they move abroad. The prevalence of attrition among teachers is considerable: 37.5% of those who graduate as teachers do not start working as teachers (Veroszta 2012), while teachers under the age of 40 are the most likely to leave the profession, especially if they earn less than others with university education (Varga 2013). Building on this established tendency of teachers quitting their profession, I examine if they are also likely to emigrate. I analyze if the relatively low earnings of teachers are among the factors that make them especially incentivized to seek employment abroad.

An additional importance of this research question is the potential implications of teacher attrition and emigration on the education sector and thus on the human capital of the country. In both cases, the number of teachers per student decreases, which adversely affects student performance. Among the many attempts to improve students' schooling outcomes in the short and long term, providing an adequate number of teachers per student has been shown to be one

[1] Switching to work in a different job position domestically.

of the most effective methods (Rivkin, Hanushek and Kain 2000, Darling-Hammond 1999, Varga 2010). Another way to improve the standards of the education system is by ensuring that the quality of teachers' work is sufficiently high. While the current empirical analysis will not consider measuring the quality of teachers, Varga (2010) and the theoretical examination of the Section 2 suggest that the quality of the pool of teachers is also negatively affected by the process of attrition and emigration. For this reason, policy makers should be mindful of both the quantity and quality of teachers. Some of the policy recommendations in Varga (2010) include the development of a system of incentives that keeps teachers from quitting. In the current analysis I set out to contribute to the development of the appropriate incentive system for teachers, in order to reduce attrition and emigration.

The broad topic of migration has become popular in both public and policy discourse in recent years. Aside from the debates that revolve around the integration and assimilation of immigrants in the host country, it is equally worthwhile to investigate which factors play a role in an individual's emigration decision. The case of Hungary is especially interesting, as Hungary now is struggling with labor shortage at all skill levels. The Financial Times estimates that as of November 2018, 80,000 jobs are unfilled, which is mainly attributed to emigration and the declining population growth rate. This shortage of labor increases wages and decreases the number of available of workers at all skill levels, putting Hungary at the risk of losing its former competitiveness in the international labor market.

Joining the European Union in 2004 gave Hungarians the opportunity to work anywhere in the EU. Gaining work experience abroad is generally assumed to be beneficial for both the individual and the receiving country. It could be beneficial for the sending country, too, if those who have left eventually return to their home countries, enriching the country with better know-

how, labor market experience or even social network capital. However, in order for the home country to enjoy such benefits, the government should strive to explore some of the reasons why the country's workers leave, and how it could motivate some of its emigrants to return. This is especially true for public sector employees, such as teachers, whose wages are set by the government. There are many factors that can influence one's willingness to leave the country, such as individual preferences and ability, that are not within the control of the government. However, public employees' wages and employment conditions, and social, labor and regional development policy in general are among the policy areas that the government can change, and which contribute to an individual's willingness to emigrate, to a certain extent.

The attrition and emigration patterns of medical doctors has already been analyzed by Varga (2016, 2017). The employment conditions of medical doctors and teachers share some similarities: for example, as they are also public employees, they are subject to a similar wage system as teachers and their profession plays a similarly important role in society. Their employers are unlikely to misreport the status of their employment and their wages, while medical doctors and teachers are also unlikely to switch to work in the black economy, making them especially easy to identify from administrative data. Medical doctors' employment chances abroad are more straightforward than that of teachers', due to the direct transferability of their skills and the high demand for them. On the other hand, Hungarian teachers are less likely to continue working as teachers abroad because of the lower transferability of their skills and higher transaction costs (additional examinations may be required in the host country to be able to teach there), thus their decision to emigrate includes the trade-off of earning higher wages against the possibility of working in a lower-skilled position.

My empirical investigation below can be a complement to the number of recent surveys conducted in Hungary, which aimed to uncover the factors that increase the probability of emigration. My contribution to this strand of literature is that I focus on one distinct professional group as opposed to investigating a sample containing people with varying skill levels and labor market experience. While narrowing the analysis down to one distinct group can yield a clearer picture of how one segment of society is affected by emigration, teachers' emigration patterns may not be representative of the larger population. My main result, the relationship between wages and the probability of attrition and emigration, may inform policy making in the sense that it may be used to restructure the system of wages and incentives used in the education sector.

The thesis is structured as follows: in Section 2, I provide an overview of the relevant theoretical models on self-selection, the empirical literature on the patterns of migration globally and within the European Union, and the literature on wages in the Hungarian public sector. In Section 3, I describe the dataset, the process of sample restriction and the definitions of the key variables I used for the analysis and provide some findings from exploratory data analysis. In Section 4, I explain the methodology I used. In Section 5, I discuss the results of my analysis. Section 6 offers policy recommendations and concludes the thesis. The Appendix contains all tables and regression outputs.

2. Literature Review

Understanding who migrates and why, and what happens to them upon their arrival in the short and long term has puzzled economists for decades. In this chapter, I first introduce the self-selection model developed by Roy (1951), because it applies directly to the question of analyzing migration decisions, as was done by Borjas (1987). I then turn to the empirical findings of the literature on the self-selection to migration, both in the global and the European context. I use these findings to identify the key push and pull factors of migration, i.e. the factors that affect migrants' tendency to leave their home countries and that may attract them to a specific receiving country. In the last two sections of this chapter, I cite evidence on emigration from Hungary and focus on the wages of teachers, where my main argument is that they earn relatively less than similarly educated and skilled workers.

2.1. Roy's Model on Self-Selection and Its Application to Migration

Roy (1951) was among the first economists to capture the process of self-selection of workers into certain occupations. In his paper, he describes a model consisting of two professions and individuals who choose between these professions by maximizing their expected wages. Each individual is allotted with sector-specific skills, which determine their earnings potential in a given sector as compared to others. Roy argues that the allocation of the population will depend on (i) the distribution of sector-specific skills in the population, (ii) the correlation between these skills and (iii) consumer tastes, which determine the demand for the output of various sectors (Roy 1951, Autor 2003). This model sheds light on the fact that differences in earnings

may be attributable to differences in skills, and if one worker earns high wages in one occupation, it does not necessarily follow that this worker will earn similarly high wages in another occupation. This is due to the lack of skills necessary for that sector.

Borjas (1987) uses this approach to formally describe immigration decisions to the United States. He argues that migrants are also a self-selected group of rational optimizers, who, before making their decision, compare their current earnings in their home countries and their potential earnings in the target country. As opposed to sector-specific skills, Borjas emphasizes the differences in skill premium between various countries. Using formal notation, this argument may be written as:

$$w_0 = \mu_0 + \varepsilon_0 \quad (1);$$
$$w_1 = \mu_1 + \varepsilon_1 \quad (2).$$

In Equations (1) and (2), w_0 and w_1 represent the logarithm of an individual's potential wages in Country 0 (Home) and 1 (Foreign), μ_0 and μ_1 are the average log wages in the two countries, and ε_0 and ε_1 stand for the individuals' *demeaned* compensation for their skills in the two countries. Average log wages are assumed to be constant and are the results of observable socio-economic characteristics. The terms ε_0 and ε_1 refer to unobservable characteristics and are assumed to be distributed normally with mean zero, variance σ_0 and σ_1, and correlation ρ. Borjas also assumes the existence of an exogenous cost to emigration, π. In his model, individuals emigrate if

$$(\mu_1 - \mu_0 - \pi) + (\varepsilon_1 - \varepsilon_0) > 0 \quad (3).$$

Continuing the derivation, he arrives at the following hypotheses regarding the emigration rate: emigration of home country workers is more likely (i) the lower are mean earnings in the home

country, (ii) the higher are mean earnings in the target country and (iii) the lower is the costs of mobility.

He then turns to the selection process. He distinguishes between three types of selection: (i) positive hierarchical sorting, (ii) negative hierarchical sorting and (iii) refugee sorting (I will not deal with the third one in detail). Positive selection happens if $\frac{\sigma_1}{\sigma_0} > 1$ and $\rho > \frac{\sigma_0}{\sigma_1}$. The first inequality means that in the foreign country, skillful workers, on average, are compensated more highly for their skills than they would be in the home country. The second inequality ensures that skills in the home country are sufficiently adaptable to the foreign market (i.e. individuals who receive above average pay in one country are likely to receive an above average wage also in the other, with a sufficiently high probability). **In this case, it will be primarily the skilled individuals of the home country who decide to emigrate**, in the hope of a higher compensation for their skills in the foreign country.

In the case of negative selection, which happens when $\frac{\sigma_0}{\sigma_1} > 1$ and $\rho > \frac{\sigma_1}{\sigma_0}$, **the opposite is true.** Here, low-skilled workers are not so worse off than the average worker in the foreign country than they are in the home country, and as a result, they will be the primary group to emigrate. Their skills are adaptable to foreign countries to a sufficiently high extent.

The Roy and Borjas model may be applied both to the question of teachers' attrition and emigration. For this, we need to know how the average wages for teachers compare to the average wages in the targeted home and foreign markets, teachers' ability to adapt their talents to various sectors, and we also have to know the returns to skill in these sectors. We can form three hypotheses:

- **Hypothesis 1:** Mean effects: The higher the average earnings in the target countries compared to Hungarian teachers' wages are, the more likely teachers will switch jobs or emigrate.

- **Hypothesis 2:** Cost effect: The lower the costs of exiting the home country, the more likely will teachers do so.

- **Hypothesis 3:** Selection: If we find that the variation in wages is lower for teachers than in target sectors, and the necessary skills are sufficiently compatible, we would expect teachers with higher pay to leave (a case of positive selection).

2.2. Empirical Tests of Roy's Model

The empirical literature on the self-selection to migration studies one's decision to leave one's home country, building primarily on Roy's model and Borjas' application to immigration to the United States. Although the papers I cite work with data from different countries, they all offer insights into the application of Roy's model. These findings are summarized below.

Ambrosini et. al. (2011) test whether Romanian migrants after 1990 are positively or negatively selected, and whether there are any returnees. They find that selectivity differs based on the target country: more highly educated and older individuals are the most likely to migrate to the United States; migrants to Austria do not seem to deviate from the average with respect to education and age; whereas migrants to Spain are the most likely to consist of less educated and younger individuals. They also check whether return-migration occurs. They find that returnees seem to be more positively selected than non-migrants as they tend to earn higher

wages, implying that the international experience could be rewarded in the home country upon return.

Kaestner and Malamud (2014) test the selectivity of Mexican male migrants to the United States in a similar way. Their main finding is that Mexican migrants tend to come from the middle of the distribution of education levels, be young and come from rural areas. They are more likely to migrate to a country like the United States where the variance of wages is higher in the hope of higher earnings. The results of Chiquiar and Hanson (2005) complement the evidence on the selectivity of Mexican migrants, as they also study female migrants. They find evidence for positive selection for Mexican-born women.

Abramitzky (2008) examines who is likely to leave an Israeli kibbutz for work in an Israeli city. Although migration in this case is within the same country, a kibbutz and a city differ in many aspects, such as the tightness of the community and the prevalence of redistribution of goods in a kibbutz, and this provides a context that is suitable to examine the self-selection process, thus the findings of this paper can also be relevant for understanding the push and pull factors of migration. He finds evidence that redistribution attracts workers who were less productive in the city (observed as lower wages and skills), compared to similar individuals who do not enter a kibbutz. One the other hand, a less educated kibbutz leaver also earns more in the city than an average worker with similar education levels who always worked in the city, providing further evidence of positive selection.

2.3. Migration within the European Union

Kahanec and Zimmermann (2009) extensively analyze the effects of the enlargement of the European Union on the labor market outcomes of individuals and countries. Migration in the European context differs from immigration to the United States from the aspect of transaction costs, as there is little bureaucratic and legal hindrance to migration for the citizens of the member states, which can mean that workers at all skill levels have more freedom to move around. This legal flexibility granted by Article 39 in the Treaty establishing the European Community also allows seasonal work. Furthermore, given the geography of the EU, it is also possible that workers reside in the country in which they are citizens, but commute to another country for work. This is especially relevant for Hungary, given its proximity to Austria. They also note that the enlargement of the European Union in 2004 and in 2007 has brought about mainly East-West migration, i.e. the target countries are usually the old, richer member states. The findings of Zaiceva and Zimmermann (2008) find a few factors that tend to decrease the willingness to emigrate: having children and owning property tend to increase the transaction costs of moving.

Lastly, the results of De Giorgi and Pellizzari (2006) and Bonin et. al. (2008) suggest that the decision to migrate is motivated more by the prospects of finding a more suitable job with higher wages, as opposed to by the prospect of receiving benefits, testing whether the prospect of receiving benefits in the host country (often called “welfare tourism”) may be a strong pull factor.

2.4. Emigration from Hungary

The 2015 and 2016 volumes of Munkaerőpiaci Tükör ("Mirror on the Labor Market") focus on the question of migration to and from Hungary. Examining the factors that lead to emigration, Sik and Szeitl (2015) designed and distributed questionnaires to a random and representative sample of Hungarians above the age of 18, asking if the respondent intends to leave Hungary, and if they do, what the intended duration of migration would be, along with several individual characteristics. The findings show that the type of settlement and the region the respondent lives in (capital, town or village), political affiliation, living in an own or rented apartment, and dissatisfaction with earnings significantly influence the willingness to emigrate. Young males living in the capital city or a town in a rented apartment who are skeptical of the current government and are dissatisfied with their current earnings but are optimistic regarding future earnings (i.e. they believe they have the power to change their situation) are especially likely to decide to migrate. However, there is considerable variation in the intended duration of the migration.

Hárs and Simon (2016) use the Hungarian Central Statistical Office's (KSH) quarterly Labor Market Survey to study those Hungarians who work at a firm's subsidiary abroad. They show that the most popular target countries are Austria, Germany and the United Kingdom. Austria and Germany may be popular because of their proximity and common cultural and historic roots, whereas the United Kingdom has a relatively flexible labor market which became immediately open to newly joined countries in 2004; and English and German are commonly spoken foreign languages by Hungarians (also in Galgóczi et. al. 2011). In addition to the region where the migrant worker is from, age, education levels and the sector where the worker has job experience in seem to be significantly influential factors in one's decision to work abroad.

They also find that about 50% of those who have left return to Hungary within a few years, especially blue-collar workers. However, they make an important note that for more precise estimates, the databases of the sending and the target countries containing data on migrants' characteristics and the evolution of labor market outcomes should be linked to be able to follow the same individuals. Galgóczi et. al. (2011) raise another concern related to estimating migration flows precisely: they claim that seasonal work is unlikely to appear in survey or administrative data because seasonal workers are often not required to register with the public authorities.

2.5. Teacher Attrition and Wages in the Public Sector

This section aims to explore the relationship between wages in the public sector and teachers' patterns of attrition and emigration.

The wages of workers employed in the Hungarian public sector are set by the government in the form of a wage table. In general, the average earnings gap between low and high skilled workers tends to be smaller than in the private sector. Thus, compared to the private sector, in the public sector low-skilled workers are better off, while high-skilled workers are worse off. Another feature of the wage table is that wages reflect performance in the specific positions to a lesser extent. This is because the factors that increase wages are the degree specialization and years spent in the position. This way, lower performing and higher performing teachers tend to receive the same wages. The Hungarian government in 2002 decided to raise wages in the public sector uniformly by 50%.

Even during the Communist era, teachers in Hungary earned about 70% of the wages of other workers with similar education levels, a difference that remained after Hungary had transitioned to a market economy. The largest gap was in 1999-2000, when teachers earned about 40% of the wages of workers with university degrees (Varga 2013).

Varga (2013) extensively analyzed the patterns of teacher attrition with respect to the 2002 raise in public sector wages. She notes that before the change in wages, the age group that was the most likely to seek employment outside the education sector is the young generation of teachers, ages between 25 and 40. She finds that the 50% pay raise for public sector employees was only temporarily successful in keeping young teachers in their profession. This effect faded away 1-2 years after, when their relative wage positions started to worsen again. The probability of teacher attrition among the age group 25-40 essentially did not change before and after the change in wages. The probability of teacher attrition among those aged above 40 slightly decreased after the change. It is important to note that the change in the wage table also included the abolishment of several wage supplements, such as additional wages paid after overwork or substituting other teachers, thus the extent of the wage increase is hard to estimate, while the abolishment of wage supplements is not likely to have decreased attrition considerably.

The central research question of Varga (2016) is the probability of emigration of Hungarian medical doctors and other highly skilled healthcare professionals since the EU accession. As mentioned in the Introduction, I argue that medical doctors and teachers share a number of similarities, such as (i) the fact that both groups are subject to the same system of wages, (ii) their relative wage position is worse compared to similarly skilled workers in the private sector, which arises from the system of their wages, (iii) data on their employment status and wages is easily identifiable from administrative data, and (iv) both professions fulfill an exceptionally

important role in the country's human capital, thus whether or not they leave their profession is an important question from a policy point of view as well. However, due to the transferability of their skills and the higher demand for them, medical doctors are more likely to find employment abroad in their own profession. She finds that between 2003 and 2011, 12% of medical doctors left Hungary to work abroad, and 17% of them switched to a different position domestically (attrition). Her findings also suggest that men are much more likely to emigrate (the probability is 22% higher) and a 1% increase in earnings decreases the probability of emigration by 6%. This probability is roughly equal among those who are below 30 and between 31 and 40. Somewhat surprisingly, 14% of doctors who are between 51 and 60 years old also left. The difference between the younger and older generation of doctors lies in the timing of their emigration: the older ones left immediately at the accession to the EU, while younger ones left around 2010, when Austria and Germany lifted the former restrictions on worker inflow.

One important thing these results suggest is that the 50% increase in public sector wages in 2002 did not manage to keep doctors and teachers in their profession. Altwicker-Hámori and Lovász (2013) evaluated the long-term effects of the 2002 increase in wages with special focus on whether the wage position of public sector workers improved relative to workers in the private sector. They found that immediately after the raise, it did at all income quintiles, but the positive effects seemed to have faded by 2008, leaving high skilled workers in the public sector in an unchanged position relative to similarly educated workers in the private sector. This was exacerbated by the 2008 global financial crisis and subsequent recession, which brought about the withdrawal of the thirteenth-month salary and freezing the increase in wages.

Applying the Blinder-Oaxaca decomposition technique (1973) to these results can make better sense of them. This method can shed light on the potential origins of the differences in earnings by separating mean differences in pay to observable and unobservable differences. Decomposing the earnings of people who have similar skill and education levels, Altwicker-Hámori and Lovász (2013) find that the unobservable differences in pay are likely to be attributed to the different pay regimes in the public and private sector. They further find that at the 10^{th} wage percentile, the difference between wages earned in the public and private sector is -10 percent in 2002 and 2 percent in 2008; at the 90^{th} wage percentile it is -75 percent in 2002 and -65 percent in 2008. A similar comparison was calculated for German wages by Melly (2005), which yielded the following results: at the 10^{th} wage percentile, the difference between wages earned in the public and private sector is 5%, and at the 90^{th} wage percentile, it is -17 percent. These differences are constant between 1984 and 2001. These comparisons suggest that at the right tail of the earnings distribution, Hungarian wages in the public sector are lower than in Germany in the absolute term, and lower than in the private sector in the relative term. This poses the risk of brain drain, amplified by open labor markets.

3. Data

This chapter describes the data, the sample and the key variables used for estimating the likelihood of teachers' attrition and emigration, and provides some descriptive statistics, too.

3.1. Database

The database I use for the purposes of this thesis has been created by linking the administrative dataset of several Hungarian authorities, resulting in an extremely detailed dataset covering many aspects of an individual's life. The sources and owners of the linked dataset are the Central Administration of National Pension Insurance, the National Health Insurance Fund Administration, the Educational Authority, the National Tax and Customs Administration, the National Labour Office, and the Pension Payment Directorate. The data was processed by the Institute of Economics, Centre for Economic and Regional Studies of the Hungarian Academy of Sciences.

The anonymized dataset covers a random half of the 5 – 74 – year – old population in January 2003, who were tracked until December 2011. It includes data on labor market characteristics, such as occupation code, monthly wage, type of employment contract, in addition to the region where the individual resided in 2003, the type of transfers and benefits the individual receives, an ID of the firm where the individual is employed, and the date of death for the deceased. Each observation is available on a monthly basis until December 2011, or exit from the social security

system either because of death, emigration or working in the informal economy. Thus, the maximum possible number of observations for an individual is 108.

The dataset contains all this information about 4,600,000 people, of which about 50% is male and 50% is female. The time period of the dataset includes several noteworthy events in Hungary, such as the accession to the European Union in 2004, the global financial crisis in 2008, or the political changes in 2010: electing the rightwing Fidesz-KDNP with a two-third majority after 8 years of socialist MSZP rule (although the effects of this sort of change in government and policy cannot be felt immediately).

3.2. Sample

To obtain the sample that I use to estimate probability models, I first drew a random sample containing 500,000 men. In the current analysis, I do not focus on women for two reasons: teacher attrition is higher among male teachers because the earnings gap between the public and private sector for them is higher (Varga 2013), and because the emigration decisions of women are often driven by their husbands' success in finding a job abroad.

After the random sample was drawn, I filtered the dataset with respect to age. I only consider men whose age is between 25 and 50, as younger individuals are the most likely to enjoy the long-term benefits of migration, while the longer labor market experience older individuals may have increased their probability of finding a suitable job abroad. Furthermore, this age group is not likely to be permanently ill or disabled, which would prevent them from leaving. Teachers above 50 are likely to become inactive (Varga 2013). This age restriction excludes university

students studying either in Hungary or abroad. Studying the behavior of fresh graduates in the labor market in light of the free flow of labor would be an interesting research question, but for the current analysis, I focus on those who definitely have some years of job experience in Hungary already. Having already worked for some years in a certain work environment and then migrating is a different decision than gaining some experience sporadically (across countries, sectors and positions) before deciding to settle down somewhere.

3.3. Key Variables

In the absence of an explicit emigration dummy in the database, I created one that identifies potential migrants. The **'exit' dummy** is assigned to those who are not deceased, and the following information are missing for at least 6 months: monthly wage, firm ID, occupation code, type of employment contract, government transfers and benefits, and who are not registered as unemployed. This way, it is unlikely that I mistake them with individuals with a short-term employment abroad (members of this group are not considered to be migrants), those who are taking a long holiday, or those who are unemployed and are waiting to start receiving benefits (usually, about 3 months pass between registering as unemployed and starting to receive benefits. During this period, we would obviously not observe wages, firm ID, occupation code and the type of employment contract). A considerable limitation of identifying migrants using this definition is that people switching to work in the black economy are naturally unobserved in the database, their information is recorded as missing and thus they might be misidentified as emigrants. Furthermore, I disregard seasonal workers, i.e. those that work for less than 6 months abroad. As current addresses are not observed in the database, only the region where the individual resided in 2003, I cannot distinguish between commuters and

those who migrate further away, although the 2011 Hungarian Census suggests that 2.1% of the working age population tends to commute to a neighboring country for work. The implications of many commuting workers would include partial consumption in Hungary and partial consumption in the country where they work, paying taxes in the country where they work, and possibly using some services of the healthcare system in Hungary (or even the education system if they have children).

'Teacher' dummies are assigned by occupation code (20) and employment contract type (203). This includes teachers and pedagogues in primary and secondary education who work in the public sector and excludes professors working in the tertiary education. I define teacher attrition as (i) either changing jobs but remaining in the public sector (domestically); (ii) or continuing to work as teachers in the private sector (domestically); (iii) or taking up a non-teaching job in the private sector (domestically). These scenarios are observed as a change in the occupation code and the type of employment contract. Following this definition, I created a **'non-teacher' dummy**, which equals 1 if (i) the occupation code is not 20 and is not missing, (ii) or the employment contract type is not of public servants' (is not equal to 203), and if the individual's 'exit' dummy is not equal to 1. This change should last for at least 6 months so that temporary changes in jobs are not misidentified as attrition.

Occupation codes are collapsed in a way that they form four categories so that we can differentiate between skill levels across jobs: 1 (managerial occupations), 2 (occupations requiring high skills), 3 (occupations requiring medium skills), 4 (occupations requiring low skills). Using these categories, I could also impute an individual's **experience** on the labor market in years, following the definition commonly used in the Mincer equation (Mincer 1974): *experience = age – years spent in education – 6.* Years spent in

education is most likely to be 17 for people with university degrees (occupation code 2), 15 for people with college degrees (occupation code 3), and 12 for people with high school degrees (occupation code 4). 6 is deduced because it is the usual age of starting primary school.

The **monthly wages** in the original database were nominal. In order to be able to work with real wages, I obtained a monthly deflator from the website of the Hungarian Central Statistical Office (KSH), set January 2003 as the base rate and calculated monthly real wages the following way: *real wage = monthly nominal wage / monthly deflator*.

3.4. Descriptive Statistics

Identifying individuals who work as teachers using the definition above suggests that in any year, there are on average 2223 teachers with at least 6 months of experience in the sample.

The average real wage of teachers with 6 months of experience between 2003 and 2011 is 165 826 HUF, which was 170 987 HUF before 2008 and 154 404 HUF after, reflecting the wage freeze and the abolishment of wage supplements brought about by the austerity measures following the global financial crisis in 2008. As a striking comparison, teaching assistants who work alongside teachers or fulfill a similar role at schools but only have college education, earn 92 134 HUF on average between 2003 and 2011, i.e. 55% of what teachers earn on average. Table 1 shows the average real wages of teachers with different job experience in each age group.

Age group	Average real wage of male teachers with 6 months of experience (in HUF)
Age group 1 (25-29)	127 704
Age group 2 (30-34)	149 632
Age group 3 (35-39)	165 808
Age group 4 (40-44)	180 283
Age group 5 (45-50)	193 413

1. TABLE: AVERAGE REAL WAGES OF MALE TEACHERS WITH 6 MONTHS OF EXPERIENCE, PER AGE GROUP.

Table 2 includes the average real wage of those individuals who share the same occupation code as teachers, working in either public or private sector jobs requiring high skills and university degrees. This figure is 242 667 HUF between 2003 and 2011, i.e. considerably higher than the average real wages teachers earn.

Occupation code (FEOR)	Average real wage (in HUF)
1 (managerial positions)	228 274
2 (jobs requiring high skills)	242 667
3 (jobs requiring medium skills)	109 863
4 (jobs requiring low skills)	93 500

2. TABLE: AVERAGE REAL WAGES BETWEEN 2003 AND 2011 ACROSS SKILL LEVELS.

The average attrition rate among teachers with at least 6 months of experience is 9%, 200 people on average. Sorting by age group, I find that attrition is more common among 25-29-year-olds and 30-34-year-olds than for the older generation of teachers, which is in line with the findings of Varga (2013). These figures may be a lower bound, as my sample excludes teachers who are younger than 25 and older than 50 years old, and teaching assistants as well.

I find that the average emigration rate among teachers with at least 6 months of experience is 2%. This figure rose in 2010 and 2011, when the Austrian and German labor markets became open, to 9.2% and 6.9%, respectively. Sorting by age group, I find that emigration is more common among 25-29-year-olds: it is 7%.

4. Methodology

In this section, I describe the methods I used to inspect teachers' wages with respect to their age and experience using a modified Mincer model, and to estimate the probability of attrition and emigration among them.

4.1. Modified Mincer Equation

The Mincer equation is most commonly used in labor economics to explain income from wages as a function of education levels and job market experience, instead of age. Thus, we can use the results that the Mincer equation produce to infer the returns to education.

The main purpose of this exercise in this context to inspect if the wages of workers in the private sector, who are not subject to the earnings set by the wage table, evolve differently than the wages of workers in the public sector. As a contrast, the wages of public sector employees, such as teachers, are most likely to grow linearly with age. I do this by first estimating the Mincer equation on a sample excluding public sector workers, and then a sample excluding private sector workers. As I cannot observe the education levels of individuals in this dataset, I can only use age and experience as explanatory variables.

My model is specified as follows:

$$Log\ real\ wage = \beta_1 experience + \beta_2 experience\ squared + \beta_3 age + \varepsilon,$$

where the outcome of interest is the logarithm of real wages, and the main explanatory variables are estimated job market experience and its square, age (observed as categorical variables).

I add T-1 year fixed effects to control for the time-invariant, unobservable factors that may simultaneously affect both the dependent and the independent variables. I estimate this model for two samples: a sample consisting only of private sector workers and another consisting only of public sector workers. I expect the coefficient of experience to be positive and the coefficient of experience squared to be negative, as the evolution of wages tends to follow an inverse U curve. I expect that the magnitude of these coefficients will be larger in the sample of private sector workers than in the sample of public sector workers. A threat to this model is the correlation between explanatory variables: age and experience are correlated, and the fact that I cannot include education levels to the model. However, labor market experience is calculated in a way that it includes an assumed education level. As mentioned in Section 3.3., experience is calculated as follows: *experience = age – years spent in education – 6*, where years spent in education equal 17 for those with university degrees, 15 for those with college degrees and 12 for those with high school degrees. The type of degree an individual has can be inferred from his occupation code.

4.2. Linear Probability Models

To be able to estimate the probability of attrition and emigration, I use a linear probability model (LPM). The LPM setting means running a linear regression model, where the outcome variable is binary, and the coefficients of the explanatory variables are estimated using least squares.

I differentiate between three main scenarios: (i) an individual with at least 6 months of teaching experience who then emigrates; (ii) an individual with at least 6 months of teaching experience who then switches to a different job domestically (attrition); (iii) an individual with at least 6 months of teaching experience who first switches to a different job domestically and then emigrates. I study the probability of the occurrence of these events starting from September. The findings of Varga (2013) suggest that teacher attrition is more likely to start from September, not at the end of an academic year, so that teachers can still receive salaries for the duration of the summer break for fewer hours spent at work. Thus, what I estimate is the probability of each of the above scenarios starting from September.

I estimate three models, which are described as follows:

- In **LPM1**, the dependent variable is 1 if the individual emigrates for at least 6 months and 0 if the individual continues to be a teacher for at least 6 months, starting in September. The independent variables include age categories, the logarithm of real wages, with year fixed effects added. Robust standard errors are applied.
- In **LPM2**, the dependent variable is 1 if the individual switches to a different job domestically for at least 6 months and 0 if the individual continues to be a teacher for at least 6 months, starting in September. The independent variables include age categories, the logarithm of real wages, with year fixed effects added. Robust standard errors are applied.
- In **LPM3**, the dependent variable is 1 if the individual emigrates for at least 6 months and 0 if the individual switches to a different job domestically for at least 6 months, starting in September. The independent variables include age categories, the logarithm of real wages, with year fixed effects added. Robust standard errors are applied.

I estimate these three models for individuals with 6 months of teaching experience. My expectation is that younger individuals are less likely to continue to be teachers, and that an increase in real wages is associated with a lower probability of attrition and emigration, on average.

4.3. Non-Linear Probability Models

While the setup of linear probability models is not difficult to estimate and its results are fairly easy to interpret, its drawback is that it can produce non-sensical results, such as a probability lower than 0 or larger than 1. To overcome this issue, I estimate logit models as well, which follows a logistic distribution, with an S-shaped curve, produced by this function: $\Lambda(a) = \frac{e^a}{1+e^a}$. I run the same three models as above, for the same samples of teachers.

5. Results and Discussion

In this section, I describe the results my models yielded, and I interpret them. I then check how the results change using a different sample and discuss some limitations of my estimation strategy. In all specifications, the coefficient belonging to the log of real wages is highly significant, confirming the association between wages and the willingness of teachers to emigrate, or to leave their jobs. In some models, I find that older teachers are less likely to do so.

5.1. Modified Mincer Equation

With the modified Mincer equation, I aim to explore if the wages earned in the private and public evolve differently. Table 3 below shows the output for this regression. Column (1) shows the coefficients for the sample of private sector workers, Column (2) shows the coefficients for the sample of public sector workers. In both estimations, the reference category is the youngest age group (age group 1, ages 25-29). For both samples, all coefficients are highly significant.

For the sample of private sector workers, the 'experience' coefficient suggests that an additional year spent on the job reduces real wages by 8.97 - 0.0814*experience percentage points at any given value of experience. For example, in the case of 20 years of experience, this value would be 7.342 percent. For the sample of public sector workers, the 'experience' coefficient suggests that an additional year spent on the job corresponds to a drop in real wages by 5.34 +

0.1198*experience percentage at any given value of experience. For example, in the case of 20 years of experience, this value would be -7.736 percent.

	(1)	(2)
VARIABLES	Log real wage	Log real wage
Experience	-0.0897***	-0.0534***
	(-0,000218)	(-0.000491)
Experience squared	0.000814***	-0.000599***
	(-0.00000586)	(-0.00001250)
Age group 2 (30-34)	0.423***	0.421***
	(-0.000875)	(-0.00221)
Age group 3 (34-39)	0.752***	0.816***
	(-0.00126)	(-0.00311)
Age group 4 (40-44)	1.038***	1.218***
	(-0.00159)	(-0.00376)
Age group 5 (45-50)	1.308***	1.720***
	(-0.00201)	(-0.00436)
Constant	11.98***	11.90***
	(-0.00131)	(-0.00267)
Observations	11 294 769	776 428
R-squared	0.049	0.169
Year fixed effects	YES	YES
Robust standard errors in parentheses		
***** p<0.01, ** p<0.05, * p<0.1**		

3. TABLE: REGRESSION OUTPUT FOR THE MODIFIED MINCER EQUATION.

5.2. Linear Probability Models

Table 4 below shows the output for LPM1, i.e. the linear probability model estimating the probability of emigration for 6 months against the probability of continuing to work as a teacher for 6 months for a sample of male teachers with at least 6 months of experience, from September. The reference category is the youngest age group, ages between 25-29. The coefficients for age groups are not significant, only the coefficient for log real wage is. It suggests that 1 percentage point increase in real wages is associated with decreasing the probability of emigration by 1.5 percentage points.

	(1)
VARIABLES	Probability of emigration for 6 months vs remaining a teacher
Age group 2 (30-34)	0,000283
	(-0,00167)
Age group 3 (34-39)	0,00231
	(-0,00228)
Age group 4 (40-44)	0,00161
	(-0,00212)
Age group 5 (45-50)	0,00276
	(-0,00233)
Log real wage	-0.0150***
	(-0,00487)
Constant	0.180***
	(-0,0574)
Observations	15 243
R-squared	0,015
Year-fixed effects	YES
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

4. TABLE: REGRESSION OUTPUT FOR LPM1.

Table 5 shows the output for LPM2, i.e. the linear probability model estimating the probability of attrition for 6 months against the probability of continuing to work as a teacher for 6 months for a sample of male teachers with at least 6 months of experience, from September. The reference category is the youngest age group, ages between 25-29. Similarly to LPM1, the only significant coefficient is the one corresponding to log real wages. It suggests that one percentage point increase in real wages is associated with decreasing the probability of attrition by 3.52 percentage points.

	(1)
VARIABLES	Probability of attrition for 6 months vs remaining a teacher
Age group 2 (30-34)	0.0031
	(-0.00423)
Age group 3 (34-39)	0.00215
	(-0.00412)
Age group 4 (40-44)	0.00232
	(-0.00405)
Age group 5 (45-50)	-0.0000342
	(-0.00382)
Log wage	-0.0352***
	(-0.00506)
Constant	0.433***
	(-0.0603)
Observations	12 628
R-squared	0.015
Year-fixed effects	YES
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

5. TABLE: REGRESSION OUTPUT FOR LPM2.

Table 6 below shows the output for LPM3, i.e. the linear probability model estimating the probability of emigration for 6 months against the probability of attrition for 6 months for a sample of male teachers with 6 months of experience, from September. The reference category is the youngest age group, ages between 25-29. Similarly to LPM1 and 2, the only significant coefficient belongs to log real wages. It suggests that one percentage point increase in real wages is associated reducing the probability of attrition by 11.8 percentage points.

	(1)
VARIABLES	Probability of attrition for 6 months vs emigration
Age group 2 (30-34)	-0.025
	(-0.064)
Age group 3 (34-39)	0.00603
	(-0.0677)
Age group 4 (40-44)	-0.0574
	(-0.0617)
Age group 5 (45-50)	0.00488
	(-0.0793)
Log wage	-0.118***
	(-0.0396)
Constant	1.490***
	(-0.455)
Observations	234
R-squared	0.097
Year-fixed effects	YES
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

6. TABLE: REGRESSION OUTPUT FOR LPM3.

5.3. Non-Linear Probability Models

As a drawback of LPM is that it can produce probabilities lower than 0 or greater than 1, I also run a non-linear probability models, the logit. Table 7 below shows the output for Logit Model 1, i.e. the logit model estimating the probability of emigration for 6 months against the probability of continuing to work as a teacher for 6 months for a sample of male teachers who have 6 months of teaching experience, starting from September. The reference category is the youngest age group (age group 1, ages 25-29). The coefficients of the logit model should be interpreted as marginal effects, which means that the coefficient is the change in the z-score for a unit change in the explanatory variables. As in the case of the linear probability models, the only significant coefficient is the one of log real wages. It may be interpreted as follows: a one

percentage points increase in real wages corresponds to a decrease of 0.000294 in the z-score of the probability of emigration for 6 months.

	Marginal effects
VARIABLES	
Age group 2 (30-34)	-0.000984
	(-0.00124)
Age group 3 (34-39)	-0.000512
	(-0.00131)
Age group 4 (40-44)	-0.00189
	(-0.00118)
Age group 5 (45-50)	-0.00156
	(-0.0012)5
Log real wage	-0.00294***
	(-0.000842)
Observations	15 243
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

7. TABLE: REGRESSION OUTPUT FOR LOGIT MODEL 1.

Table 8 below shows the marginal effects produced by Logit Model 2, i.e. the logit model estimating the probability of attrition for 6 months against the probability of continuing to work as a teacher 6 months, starting from September, for a sample of male teachers who have at least 6 months of teaching experience. As before, the reference category is youngest age group (age group 1, ages 25-29). This specification produced a highly significant coefficient for log real wages and a slightly significant one for age group 5 (ages 45-50). The coefficient for log real wages may be interpreted as follows: a one percentage point increase in real wages is associated with a 0.0212 reduction in the z-score of the probability of attrition for 6 months. The coefficient for age group 5 would suggest that compared to age group 1, the z-score of the probability of attrition for 6 months is less by 0.00709.

	(1)
VARIABLES	Marginal effects
Age group 2 (30-34)	-0.00207
	(-0.00304)
Age group 3 (34-39)	-0.00295
	(-0.00305)
Age group 4 (40-44)	-0.00345
	(-0.00319)
Age group 5 (45-50)	-0.00709**
	(-0.00291)
Log real wage	-0.0212***
	(-0.00297)
Observations	15 421
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

8. TABLE: REGRESSION OUTPUT FOR LOGIT MODEL 2.

Finally, let us turn to Table 9, containing the marginal effects produced by Logit Model 3, which estimates the probability of attrition for 6 months against the probability of emigration for 6 months, starting from September, for a sample of male teachers with at least 6 months of teaching experience. The reference category is youngest age group (age group 1, ages 25-29). Similarly to the previous models, the coefficient of log real wages is highly significant, to be interpreted as follows: a one percentage point increase in real wages corresponds to a 0.084 decrease in the z-score of probability of attrition for 6 months.

	(1)
VARIABLES	Marginal effects
Age group 2 (30-34)	-0.0345
	(-0.0595)
Age group 3 (34-39)	-0.0196
	(-0.0639)
Age group 4 (40-44)	-0.0823
	(-0.0575)
Age group 5 (45-50)	-0.0112
	(-0.09)
Log real wage	-0.0840***
	-0,0268
Observations	234
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

9. TABLE: REGRESSION OUTPUT FOR LOGIT MODEL 3.

5.4. Robustness Checks

The aim of the following exercise is to check how the results above would change after adding some tweaks the original specifications. I do this by setting the outcome of interest to emigration or attrition lasting for 12 months in all models (LPM 1, 2, 3 and Logit Model 1, 2, 3). The sample and the explanatory variables remain unchanged.

Table 10 below shows the output for the modified LPM1, where the outcome of interest is the probability of emigration lasting for 12 months versus the probability of continuing to be a teacher for 12 months, starting from September. As in the original LPM1, the coefficient for log real wages is significant. Here, it implies that a one percentage point increase in real wages corresponds to a 1.48 percentage point lower probability of emigration.

	(1)
VARIABLES	Probability of emigration for 12 months vs remaining a teacher
Age group 2 (30-34)	-0.000339
	(-0.00173)
Age group 3 (34-39)	0.00165
	(-0.00234)
Age group 4 (40-44)	0.00122
	(-0.0022)
Age group 5 (45-50)	0.00185
	(-0.00234)
Log real wage	-0.0148***
	(-0.00505)
Constant	0.178***
	(-0.0596)
Observations	14 730
R-squared	0.016
Year-fixed effects	YES
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

10. TABLE: REGRESSION OUTPUT FOR LPM1/B.

Table 11 shows the output for the modified LPM2, i.e. the probability of attrition for 12 months versus the probability of continuing to be a teacher for 12 months, starting from September. Similarly to the above results, the coefficient for the log of real wages is the only significant ones, implying that a one percentage point increase in real wages corresponds to 3.87 percentage point lower probability of attrition lasting for 12 months.

	(1)
VARIABLES	Probability of attrition for 12 months vs remaining a teacher
Age group 2 (30-34)	-0.000201
	(-0.00383)
Age group 3 (34-39)	0.000278
	(-0.00376)
Age group 4 (40-44)	0.00175
	(-0.00377)
Age group 5 (45-50)	0.000269
	(-0.00356)
Log real wage	-0.0387***
	(-0.00513)
Constant	0.477***
	(-0.0613)
Observations	14 891
R-squared	0.017
Year-fixed effects	YES
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

11. TABLE: REGRESSION OUTPUT FOR LPM2/B.

Table 12 contains the results for the modified LPM3, estimating the probability of attrition for 12 months versus the probability of emigration for 12 months, starting from September. The significant coefficient of log real wage persists and implies that one percentage point increase in real wage corresponds to a 12.5 percentage point lower probability of attrition.

	(1)
VARIABLES	Probability of attrition for at least 12 months vs emigration
Age group 2 (30-34)	-0.0459
	(-0.0621)
Age group 3 (34-39)	-0.0221
	(-0.0632)
Age group 4 (40-44)	-0.0591
	(-0.0615)
Age group 5 (45-50)	-0.0621
	(-0.0674)
Log real wage	-0.125***
	(-0.0384)
Constant	1.577***
	(-0.441)
Observations	230
R-squared	0.123
Year-fixed effects	YES
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

12. TABLE: REGRESSION OUTPUT FOR LPM3/B.

Turning to estimating the logit models with a different outcome variable (the duration of emigration and attrition are now 12 months), I find similar results. Table 13 contains the marginal effects of the modified Logit Model 1. The interpretation follows the same logic as above: one percentage point increase in real wage corresponds to a drop of 0.00263 in the z-score of the probability of emigration for 12 months. Table 14 shows the marginal effects of the modified Logit Model 2, suggesting that one percentage point increase in real wage is associated with a reduction of 0.0189 in the z-score of the probability of attrition lasting for 12 months. Finally, Table 15 shows the marginal effects of the modified Logit Model 3, which may be interpreted as follows: one percentage point increase in real wage corresponds to a 0.0898 drop in the z-score of the probability of attrition for 12 months.

VARIABLES	Marginal effects
Age group 2 (30-34)	-0.00159
	(-0.00132)
Age group 3 (34-39)	-0.00121
	(-0.00135)
Age group 4 (40-44)	-0.00222*
	(-0.00127)
Age group 5 (45-50)	-0.00264**
	(-0.00121)
Log real wage	-0.00263***
	(-0.000835)
Observations	14 730
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

13. TABLE: REGRESSION OUTPUT FOR LOGIT MODEL 1/B.

	(1)
VARIABLES	Marginal effects
Age group 2 (30-34)	-0.00179
	(-0.00302)
Age group 3 (34-39)	-0.00278
	(-0.00301)
Age group 4 (40-44)	-0.00285
	(-0.00315)
Age group 5 (45-50)	-0.00680**
	(-0.00284)
Log real wage	-0.0189***
	(-0.00281)
Observations	14 891
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

14. TABLE: REGRESSION OUTPUT FOR LOGIT MODEL 2/B.

	(1)
VARIABLES	Marginal effects
Age group 2 (30-34)	-0.0585
	(-0.0574)
Age group 3 (34-39)	-0.0549
	(-0.0578)
Age group 4 (40-44)	-0.0886
	(-0.0585)
Age group 5 (45-50)	-0.102
	(-0.0705)
Log real wage	-0.0898***
	(-0.0231)
Observations	230
Robust standard errors in parentheses	
***** p<0.01, ** p<0.05, * p<0.1**	

15. TABLE: REGRESSION OUTPUT FOR LOGIT MODEL 3/B.

5.5. Limitations

In this section, I discuss a few limitations of my estimation strategy. As noted in Section 2.4., the survey results of Sik and Szeitl (2015) indicate several factors that influence the willingness to emigrate, such as family status, owning property, settlement type or political affiliation. I cannot observe any of these variables in my dataset, causing omitted variable bias in my estimation. One implication of Roy's model (1951) and the relating empirical literature is that emigrants are a self-selected group, who tend to decide to emigrate if they have better skills in their home countries than the average. The dataset I used does not contain any information on the quality of teachers, i.e. I cannot test if those teachers emigrate who perform better, or those who do worse. Furthermore, teachers' skills are less transferable[2] and they may face transaction costs in the form of additional examinations depending on the specific country's policy to start teaching in another country, their tendency to emigrate is lower than that of the general

[2] Less so for teachers specializing in foreign languages and STEM-related subjects.

population. Also, I also cannot observe education levels in the dataset, threatening the estimation of the Mincer equation. Finally, the definition I created to identify potential migrants may include individuals working in the black economy as well.

6. Policy Recommendations and Conclusions

6.1. Policy Recommendations

The results above point to a relationship between wages earned by teachers and their propensity to leave their profession, either by switching to a different position domestically, or by emigration. The implications of such a tendency affect the education sector adversely, as it reduces the number of teachers per student. Furthermore, from Roy's model (1951) and the relating empirical literature it follows that emigrants tend to be better skilled than those who do not decide to emigrate. This case of positive selection may be true for teachers as well, leaving worse performing teachers in the education sector. Varga (2007, 2010) notes that the low earnings in the public sector tend to discourage high performing students to obtain a teaching-related degree. Thus, the system of public wages should be such that it attracts individuals with better than average capabilities and it also reduces the extent of attrition. Considering return migrants, Ambrosini et. al. (2011) find that they tend to enjoy a premium for their international experience upon returning to their home countries. Thus, the government may consider developing a program that incentivizes migrants to return and utilize their international experience so that public welfare somewhat increases.

In the policy recommendations I outline below, I focus on possible suggestions to the system of wages in the public sector, inspired by Varga (2007, 2010). Although the nature of my thesis is exploratory rather than causal, its results may be interpreted in a way that wages have some sort of influence on teachers' attrition and emigration decisions. A key issue that policy makers may solve first is that public sector wages only consider the degree specialization and years spent in the position and put less emphasis on performance. This way, teachers are possibly

disincentivized from improving their methods from time to time. Adding a component to the wage table that rewards this could be a good incentive. Similarly, wage supplements that are given to teachers who teach children from lower socio-economic background or who have disabilities could attract teachers with better skills to such schools. Furthermore, policy makers could assess if there is a shortage of teachers specializing in certain fields on both the national and local level. Higher wages paid to those filling these gaps could ensure that the shortage is mitigated. Finally, in order to attract some of best students to the relevant training, the government and universities could offer scholarships. Nevertheless, all of these recommendations require more in-depth studies, mechanism experiments and impact evaluations before implementation.

6.2. Conclusions

In this thesis, I examined teachers' emigration and attrition patterns and analyzed if real wages are likely to influence their willingness to leave their profession. Teachers' wages are subject to a wage structure that is set by the government, and that rewards highly educated workers to a lesser extent than the private sector. Even though there have been attempts in the past to decrease this gap, teachers still earn considerably less than equally educated workers in the private sector. Using linear and non-linear probability models, I found that changes in real wages are significant across all specifications, implying that increasing real wages by a percentage point corresponds to a lower probability of emigration or attrition, on average. With respect to age, I did not find any significant effects, although former findings in this strand of literature suggest that younger individuals are more likely to emigrate. A limitation to my analysis is that there are many other individual factors that I cannot observe in the dataset I used, such as family status or ownership of property, which change the costs of migration, and

the absence of these variables may confound my results. A thorough reconsideration of the system and structure of public sector wages, including components that attract students with the best abilities and that reward the performance of practitioners, could provide an overall improvement to education sector.

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