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Yoko Sakai¹ and Kazuya Masuda^{2,*}

Secondary education and international labor mobility: evidence from the natural experiment in the Philippines

Abstract

International labor mobility is a key factor for a well-functioning labor market. Although educational attainment is known to affect regional labor mobility within a country, evidence of a relationship between schooling and international labor mobility is limited, particularly in developing countries. This study uses the across-cohort variation in the exposure to the 1988 free secondary education reform in the Philippines to examine the impact of years of education on the propensity of working abroad. The results suggest that free secondary education increased the years of education for men. Moreover, the additional years of education reduced the likelihood of working abroad by 3.2% points on average. However, an extra year of female education was not associated with the probability of working abroad. These results indicate that a program for improving access to secondary education may affect international labor mobility for men even after a few decades. It underscores the importance of considering the possible labor market consequences when designing the education reform in developing countries.

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1 Introduction

International labor mobility is a key factor for a well-functioning labor market.¹ While a growing literature has shown that extra educational attainment causally affects regional labor mobility in the United States and European countries, evidence on international labor migration is surprisingly limited. Understanding whether and how education affects the international labor mobility of individuals in developing countries is particularly of interest because international migration and remittance have been shown to reduce poverty (e.g., Adams and Page, 2005) and to increase household investment in children's education (e.g., Edwards and Ureta, 2003) in the migrant-sending country. Since these regions have been experiencing dramatic educational expansion, the question of how education changes international labor mobility will influence labor market development in both sending and hosting countries. The present study, in the context of a developing country, thus examines whether individuals become more or less likely to work abroad as they are educated.

The direction of the effects of education on labor mobility is theoretically ambiguous and, empirically, not straightforward. The human capital framework argues that an individual moves if the benefit from migration outweighs the cost and, generally, this suggests that education increases international labor mobility. Behind this prediction are three main mechanisms: attaining an extra year of education 1) improves the skills and knowledge that help individuals find alternative employment in a distinct labor market, 2) mitigates credit constraints by increasing borrowing credibility, and 3) reduces the psychological costs associated with international migration through tolerance for new experiences and the acquisition of the language spoken in the host country. On the contrary, education may reduce the propensity of an individual to work abroad. McHenry (2013) argues that additional schooling at a low level enhances local labor market contracts and increases the opportunity cost of moving.

Early studies on economics often used cross-sectional data, reporting a positive association between individual educational attainment and the frequency of regional migration (e.g., Greenwood, 1997). Identifying the causal effects of education on labor mobility is, however, challenging because of the nonrandom assignment of individual educational attainment. Ideally, if educational attainment is randomly assigned to each individual, ordinary least squares (OLS) would provide a consistent estimate of the causal effects of education on the outcomes of interest. In reality, however, individuals endogenously decide how many years to stay in school. Thus, if unobserved factors are correlated with both educational attainment and the decision to migrate overseas, a spurious relationship between these two factors may arise.² Against such a background, one possible solution to consistently identify the causal effects of education on the propensity of working abroad is to use the exogenous variation in schooling created by education reform.

For this purpose, the present study examines the 1988 free secondary education reform in the Philippines to investigate the effects of education on international labor mobility. This

1 On the one hand, this allows firms in the host country to employ labor at the lowest wage in a geographically broad international market. On the other hand, unemployed workers in the sending country may find employment opportunities in another country.

2 For example, as unobserved parental experience in international migration positively affects both educational attainment and the preference for international migration of their offspring, the ordinary least squares (OLS) estimate will be upward biased. Other possible sources of omitted variable bias include individual innate ability, career aspirations, and parents' preference for investment.

reform eliminated the tuition fee of public secondary schools to expand access to secondary education. Since the reform came into effect in the academic year of 1988, there is cross-cohort discontinuity in exposure to the reform. Moreover, since the reform was announced after pivotal cohorts were born, exposure to the reform around the cutoff point is plausibly random. Indeed, Sakellariou (2006) studies the same reform in the Philippines to estimate the rates of returns to education, and this has been shown to disproportionately increase the educational attainment of the cohorts born in 1975 or later. By using this plausibly exogenous variation, we study the effects of education on international migration by employing the two-stage least squares (2SLS) approach. The Labor Force Survey (LFS) of 1995–2014 provides information on whether an individual works abroad as well as on his/her educational attainment and birth year.

The results using fuzzy regression discontinuity design (RDD) suggest that attaining additional years of education reduced the probability of working abroad for men in the Philippines. The OLS estimates, however, show a significant and positive association between two factors, suggesting that existing literature using cross-sectional data is likely to be upward biased. Our results are robust to using different kernel weights. In summary, we, for the first time, show the causal association between individual educational attainment and international migration in the context of developing countries.

The present study contributes to the large literature on labor market returns to education. Quasiexperimental studies often use compulsory education reforms as a natural experiment and mostly report that an extra year of education is associated with higher labor market earnings.³ Recent studies show that the labor market return to education is not only limited to higher wages but also associated with greater regional labor mobility within a country.⁴ In Norway, Machin et al. (2012) use the cross-state variation in the timing of the compulsory education law (CEL) reform, finding that individuals become more likely to migrate within a country as they are educated. Similarly, Weiss (2015) uses the cross-country variation in the timing of the CEL reform in eight European countries and concludes that education makes people more mobile. Bauernschuster et al. (2014), in Germany, argue that the educated are more mobile over longer distances because they are more open to cross-cultural boundaries and migrate to places whose cultures differ from those at home. In summary, studies in Europe find a positive association between education and labor mobility.

By contrast, evidence from the United States is mixed. On the one hand, Malamud and Wozniak (2012) use the variation in college education due to draft-avoiding behavior among the Vietnam War generation and find that attaining a college degree is positively associated with the likelihood that an individual lives in a state other than his/her birth state. On the other hand, McHenry (2013) exploits the variation in education at a lower level by using the

3 In developed countries, recent studies use compulsory education reforms as a natural experiment and report that increased education raises wages in the United Kingdom (Oreopoulos, 2006; Devereux and Hart, 2010; Dolton and Sandi, 2017), France (Grenet, 2013), and Australia (Leigh and Ryan, 2008). As for evidence from developing countries, Aydemir and Kirdar (2017) find that wage-related returns to education in Turkey are 7%–8% for women and 2%–2.5% for men.

4 Another related but distinct literature on non-monetary returns to education includes its effects on adult health (Albouy and Lequien, 2009; Kemptner et al., 2011; Braakmann, 2011; Clark and Royer, 2013; Lleras-Muney, 2005; Behrman, 2015; Meghir et al., 2018), child health (Currie and Moretti, 2003; McCrary and Royer, 2011; Chou et al., 2010; Masuda 2020) fertility (Black et al., 2008; Fort et al., 2016; Monstad et al., 2008; Cygan-Rehm and Maeder, 2013; Osili and Long, 2008), crime (Brugard and Falch, 2013; Hjalmarsson et al., 2015; Machin et al., 2011; Bell et al., 2016), teenage marriage and risky sexual behavior (Masuda and Yamauchi, 2020; Keats, 2018), civic participation (Milligan et al., 2004), and religiosity (Hungerman, 2014; Cesur and Mocan, 2018; Mocan and Pogorelova, 2017; Masuda and Yudhista, 2020).

cross-state variation in the CEL reform in the United States and finds that individuals are less likely to migrate across states as they are educated. Overall, existing evidence usually examines the effects of education on labor mobility within a country, and empirical evidence is inconclusive.

The only exception is the study by Fenoll and Kuehn (2017), who examine the association between education and international migration in Europe by using the cross-country variation in the timing of the CEL reform from 1950 to 1990. Consistent with McHenry (2013) but inconsistent with other studies, they find that an additional year of education reduces the number of individuals who migrate across the country by 9%. However, to the best of the authors' knowledge, evidence on the causal effects of education on international labor mobility from developing countries is lacking. This situation is unfortunate because the developing world sends the largest number of international migrants. The present study, therefore, provides the first evidence on the causal effects of education on the propensity of working abroad in the context of South–North migration from a developing country.

This study also contributes to the growing literature on the effects of free secondary education programs in developing countries. By examining free secondary education reforms in Africa in the 21st century,⁵ recent empirical studies find that such reforms have short-term effects on students' access to secondary education (Gajigo, 2016), with few negative effects on their academic achievement (Duflo et al., 2019; Brudevold-Newman, 2016; Blimpo et al., 2015; Garlick, 2013).⁶ No study, however, examines the long-term effects of these reforms because programs in sub-Saharan Africa only began in the late 2000s. Therefore, the findings of this study – for the first time – show that such reform affects labor market performance after a few decades, at least in some developing countries.

Finally, our study contributes to the literature on the determinants of international migration. The determinants of migration have been of interest since Borjas (1987) investigated the selection of immigrants from developing countries to developed countries. A series of papers have studied the factors related to international migration, such as the wage distribution and educational attainment (Borjas, 1987; Chiquiar and Hanson, 2005; Docquier and Marfouk, 2006), migration networks in the host country (McKenzie and Rapoport, 2011), and remittances (Gibson and McKenzie, 2011; Rapoport and Docquier, 2006; Yang, 2008, 2011). Nonetheless, evidence on the causal impact of education on the migration decision in developing countries is scarce. Our study thus uncovers the condition surrounding labor mobility and education attainment in a developing country, suggesting that higher education discourages international migration from low-income countries.

The remainder of this paper is organized as follows. Section 2 provides background information on international migration and the 1988 education reform in the Philippines. Section 3 discusses the data. Section 4 reports the empirical strategy, and Section 5 describes the results. Finally, Section 6 concludes the paper.

5 The reforms started in South Africa in 2007, the Gambia in 2001–2004, Uganda in 2007, Kenya in 2008, Tanzania in 2016, and Rwanda in 2007.

6 There is one empirical study from developed countries. In West Germany, Riphahn (2003) found that fee abolition at the secondary level increases educational attainment.

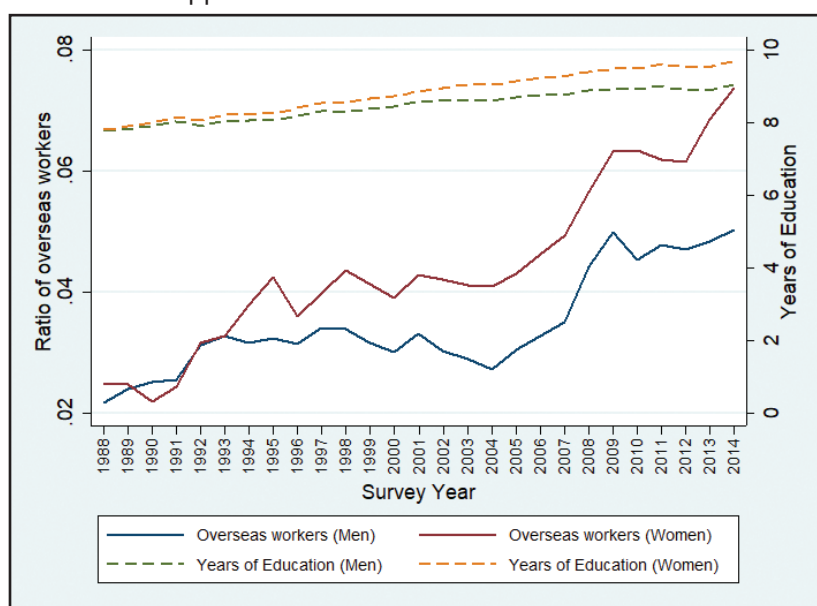
2 Background

2.1 Education and international migration in the Philippines

The Philippines is a low- to medium-income country; however, compared with other low- to medium-income developing countries, educational attainment in the Philippines is higher.⁷ Despite having a better-educated population, the unemployment and underemployment rates in the Philippines in the 21st century are high. The National Statistics Office of the Philippines (Labor Force Survey Report, 2018) has reported the unemployment rate in January 2018 as 5.3% and the underemployment rate as 18%. In particular, women have fewer job opportunities than men. The labor force participation rates among ≥ 15 -year-old males and females were 76.4% and 46.8%, respectively, in 2017. Hence, more than half of the women do not participate in the labor market. Yamauchi and Tiongco (2013) find that returns to education for women are lower than those for men and argue that women are discriminated against in the labor market in the Philippines.

On the contrary, Filipino women are known to work abroad more often than men do. Figure 1 presents the level and trend of international migration by sex from LFS data (1988–2014) in the Philippines. Since 1988, the estimated share of overseas workers has steadily increased for both men and women aged ≥ 25 years. In 1988, the estimated share of male and female overseas workers was 2%, and these shares increased two times more for men and three times more for women by 2014. As international migration is an important alternative for women to obtain employment, it has become common in the Philippines in the 21st century. Figure 1 depicts the level and change in average educational attainment by sex during the same period. In 1988, men and women attained about 8 years of education on average; however, this steadily increased until 2014. Taken together, these data suggest that the level of education is positively associated with the propensity of working abroad.

Figure 1 Changes in the share of overseas workers and educational attainment in the Philippines.



⁷ At least 58.5% of individuals had completed their upper secondary education in 2013 (World Bank Open Data, 2018). By comparison, the rate in Thailand was 32% in 2016 and the rate in Indonesia was 31% in 2014.

Table 1 Number of land-based overseas Filipino workers by occupation, new hires in 2014

Occupation	N
Household service workers	183,101
Nursing professionals	19,815
Waiters, bartenders, and related workers	13,843
Caregivers and caretakers	12,075
Charworkers, cleaners, and related workers	11,894
Laborers/helpers general	11,515
Wiremen and electrical workers	8,226
Plumbers and pipe fitters	7,657
Welders and flame-cutters	7,282
Cooks and related workers	5,707

Note: The number of workers includes both men and women.

Source: The data are from the Philippines Overseas Employment Administration (2014).

To understand the types of employment opportunities in the host country for Filipino migrants, Table 1 shows the number of land-based overseas Filipino workers (new hires only) by occupation in 2014. The majority of migrants engage in low-skilled jobs, such as household service and waiting/bartending. Therefore, increased educational attainment may lead to a lower probability of working overseas. However, high-skilled jobs such as nursing are also popular occupations among Filipinos (Carino, 1994). In the Philippines, students need to complete 3 years at nursing school or 4 years at nursing college and then pass the national vocational qualification test to officially work as a nurse. Additionally, some host countries have their own certification systems. Even if the selection process is complicated and difficult, high-skilled occupations are also popular among Filipinos. Given these mixed employment opportunities in host countries, it is empirically unclear whether individuals are more (or less) likely to work abroad if they are educated.

To determine whether an individual goes abroad to work, the direct and indirect costs of moving play a critical role, and these costs should be associated with educational attainment. The costs of working overseas for higher-educated people should be less than the costs for less-educated people because educational attainment 1) improves the skills and knowledge that help individuals find alternative employment in a distinct labor market, 2) mitigates credit constraints by increasing borrowing credibility, and 3) reduces the psychological cost associated with international migration through tolerance for new experiences and acquisition of the language spoken in the host country. For example, those who acquire the host country's language can more easily assimilate into the culture of that country. Fenoll and Kuehn (2017) find that students who learn foreign languages tend to migrate to countries in which those languages are spoken, presumably because their financial and psychological costs of moving abroad are much lower than those who are not familiar with other languages. On the other hand, as McHenry (2013) indicates, policy reform may increase the opportunity costs of moving; it then discourages higher-educated people from moving away from their local community. Additional education increases job opportunities in the local labor market since schooling expands local networks connecting students, parents, and teachers, who share information about local jobs (McHenry 2013). Therefore, the reform that promotes access to primary or secondary education may increase or decrease the probability of an individual working abroad.

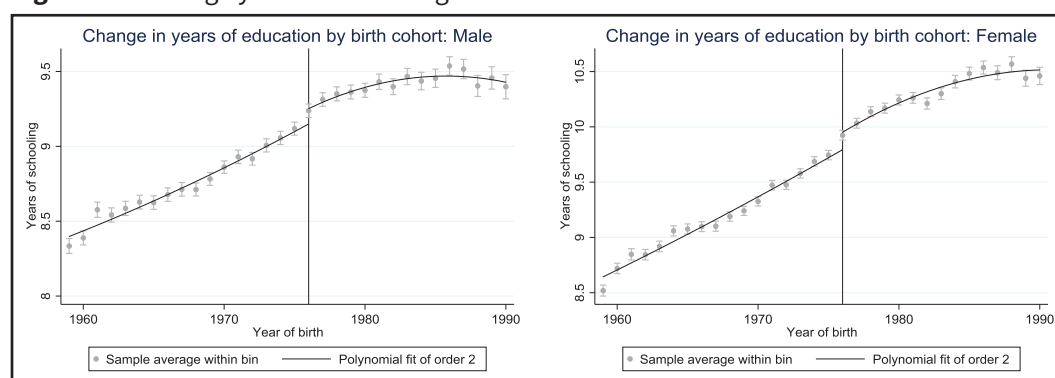
2.2 Education system in the Philippines and the 1988 educational reform

During our study period, the formal education system in the Philippines consisted of three levels: primary, secondary, and tertiary.⁸ Primary education contains six compulsory grades, and secondary school involves 4 years. Students are required to start the first grade of primary school at 6 years of age; therefore, they graduate from secondary school at the age of 15 or 16 years. After completing secondary education, students may transition to tertiary school, which consists of college, masters, and doctoral programs.

The World Bank Open Data (2018) show that the gross enrollment ratio of students in secondary school has been increasing in the Philippines over the past 3 decades. In 1981, the enrollment ratio of women was 70%, compared with 58% for men. In 2013, these ratios had increased to 93% and 84%, respectively.⁹

In 1988, the Philippines Congress passed legislation on free secondary education. Under the program, students who enroll in secondary school pay no tuition fee; however, school fees related to membership in the school community, such as identification cards, student organizations, and publications, needed to be paid (Free Public Secondary Education Act of 1988 (No. 6655)). This Act commenced in the 1988–1989 school year. In the Philippines, children usually enter primary school at 6 years of age¹⁰ and transit to secondary school at the age of 12 years. Thus, people born in 1976 were the first cohort fully exposed to this reform.¹¹ The academic year starts in June or July every year. Therefore, people born in 1975 include both un-treated (people born from January to August) and treated (those born from September to December) by this Act. Figure 2 shows the change in the average years of schooling for different birth cohorts. The figure also shows the estimate of global second-order polynomials fitted to these data simply for exploratory visual aid; the statistical inference in the main analysis uses local linear regressions, which are discussed in the Section 3 on “Data”. Consistent with

Figure 2 Average years of schooling for different birth cohorts.



8 In the Philippines, the educational system started to shift from K-10 to K-12 in 2012. The new education system extends compulsory education and consists of 6 years of primary school, 4 years of middle school, and 2 years of high school. After high school, there is a stage of 4 years of university education. This policy change does not affect our study, since our sample only includes those ≥ 21 years in 2014 who had already completed education.

9 In 2006, the public secondary school enrollment rate was 79.4% and the private secondary school enrollment rate was 19.9%.

10 According to the basic education enrollment policy, primary schools accept children who will turn 6 years of age by August 31st.

11 The program abolished the school fees of secondary school entrants in 1988, and students who were already attending secondary school in 1988 had to pay tuition fees until their graduation.

Sakellariou (2006), we observe a jump in educational attainment around the cutoff point for both men and women.

Prior to the program implementation, the article in the Constitution of the Republic of the Philippines adopted in 1987 mentioned free provision of primary and secondary education. It, however, does not explain the timing of the implementation. Thus, students and their families could not have been able to predict the exact timing of the implementation and its content.

It should also be noted that the socioeconomic circumstances dramatically changed in 1986 because the Marcos dictatorship ended, and Philippines made the transition to a democratic government conducted by President Corazon Aquino. This transition might have had an impact on the way people live, suggesting that everyone in the country received the impacts from the event. It means that there were no specific effects on the treated or untreated cohort. Therefore, it is reasonable to assume that the exposure to the reform around the cutoff is exogenous and that the individual characteristics of the cohorts around the cutoff point are plausibly similar.

In this setting, where the treatment was assigned as if randomly around the cutoff point, we applied fuzzy RDDs in our analysis and used the dichotomous variable for being born in 1976 or later as an instrument for the two-stage instrumental variable (IV) estimation. In summary, the 1988 free secondary education reform in the Philippines provides an ideal setting within which to study the effects of educational attainment on labor mobility across countries for both men and women in a developing country.

3 Data

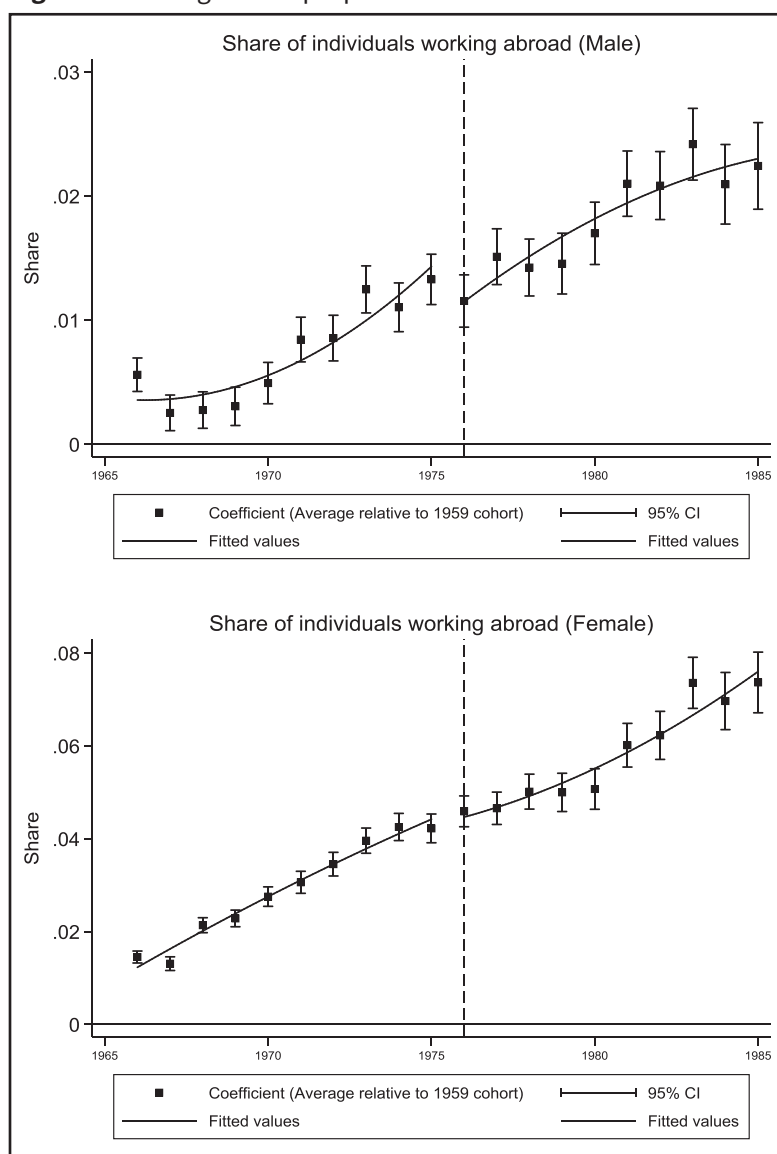
The data that we used in this study were obtained from the 1995–2014 waves of the LFS (Labor Force, 2014), a quarterly nationally representative repeated cross-sectional survey conducted by the National Statistics Office of the Philippines. We used the across-cohort variation in the exposure to the 1988 reform as a source of the exogenous variation in individual educational attainment to study whether education improves labor mobility. Ideally, we would measure the birth year of each individual directly from the LFS data set. However, such information is lacking in our primary data set. Thus, we imputed the year of birth information from the age of the respondent at the time of the interview.¹²

Our main outcome was a dummy variable indicating whether the individual worked abroad or in the domestic labor market at the time of the survey. As the present study is interested in the effects of education on workers' locations rather than on whether they work or not, the sample was restricted to individuals in the labor force. The main advantage of using the LFS is that it provides information on employment status in both local and international labor markets. This information allows us to identify the year of birth and educational attainment of both overseas and domestic workers in the same data set.

Figure 3 illustrates the reduced-form relationship between our treatment and the propensity of working abroad. The vertical axis shows the estimated coefficients (symbols) and confidence intervals (bars) of birth-year dummies from a regression of indicator for working overseas on birth-year dummies, as well as age fixed effects. Figure 3

¹² Although the LFS is conducted in January, April, July, and October every year, to avoid measurement errors in our instrument, we only used data collected in January. By doing so, we are most likely to identify the correct year of birth.

Figure 3 Change in the proportion of overseas workers.



Notes: The coefficients (symbols) and confidence intervals (CIs) (bars) indicate the estimates of birth-year dummies from a regression of indicator for working overseas on birth-year dummies, as well as age fixed effects where reference cohort is 1959 cohort. The curves (thick lines) are quadratic polynomials that are fit separately (on the coefficient estimates) on each side of the cutoff. The sample includes those in the labor force who are ≥ 21 years of age in the 1995–2014 Labor Force Surveys.

Source: Data are from the 1995–2014 LFS.

also shows the estimate of global second-order polynomials fitted to these data simply for exploratory visual aid; the statistical inference in the main analysis uses local linear regressions with respondents' age controls, which are discussed in the Section 4. The upper panel represents a reduction in the share of respondents who work abroad around the cutoff point for males. The discontinuity in educational attainment around the cutoff point in Figure 2 suggests that education may have a causal impact on international labor mobility, particularly among men in the Philippines. In contrast, the impact of education for females in terms of international labor mobility is somewhat unclear, and we will formally test this point in the main analysis.

The data were collected by using a questionnaire-based interview; the interviewees, mostly household heads, answered the questions for all household members. An individual was defined as an overseas worker if he/she worked abroad at the time of the interview. As a result, this study defines only temporary overseas workers who have left their families behind in the original country as international migrant workers. There may be some concern that examining the effects of education on permanent migration is empirically more relevant than its effects on temporal migration because the status of permanent migration may help identify the impacts of educational attainment on lifetime income. However, we argue that being a temporary migrant is relevant in the context of the North–South migration from developing countries. Dustmann and Gorlach (2016) clarify that the behaviors and economic phenomena of temporary migrants differ from those of permanent migrants. For instance, migrants expecting a shorter stay in the host country send more remittances to their home country. Remittance is an important income source for supporting the family left behind, particularly in developing countries; therefore, examining the determinants of being a temporary overseas worker is at least as important as is the case of permanent migrants in developing countries.

Thus, to simplify the interpretation of the results, our primary explanatory variable is “continuous years of education”. For this purpose, ideally, LFS has a direct measure of completed years of education. One limitation of the LFS, however, is that, among the 1995–2014 waves, a continuous indicator (i.e., years of schooling) is available only in the 2012–2014 waves. By contrast, those in the 1995–2011 waves coded the highest grade completed as seven categorical levels: no grade completed, elementary undergraduate, elementary graduate, high school undergraduate, high school graduate, college undergraduate, and college graduate. To have a sufficient number of observations and high statistical power, the main analysis in this study uses data from 1995 to 2014. Therefore, we recategorize educational attainment at each education level¹³ (no education, elementary, high school, and college) into a continuous measure.¹⁴

Another advantage of using the LFS is that the data cover >130,000 respondents per wave over a decade. This setting allows us to identify the impact of a change in educational attainment on international migration after controlling for the flexible time trend (i.e., survey year fixed effects). Including the survey year fixed effects in the analysis allows us to control for the unobserved year-specific factors that affect both demand for and the supply of international labor. For instance, employers in the host country may be reluctant to hire additional workers from other countries when they face financial shocks. Such cross-year confounding factors that affect all the countries at the same time are controlled for by using the survey year fixed effects. In summary, we examine whether individuals are more likely to work abroad as they are educated within the same survey year by including the survey year fixed effects.

13 These are “0” for no grade completed, “3” for under elementary education, “6” for elementary education completed, “8” for under high school, “10” for high school education completed, “12” for under college, and “14” for college education completed.

14 Some may consider that we can use a binary variable to indicate attendance or the completion of each level of education. We, however, used the continuous years of education as an explanatory variable because excluding the restriction of the instrument is unlikely to be satisfied if we use such dichotomous variables as an explanatory variable alternatively. For example, as can be seen in Table A1, women who were exposed to the reform had a higher probability of completing not only lower high school but also upper high school. Therefore, if we use an indicator for upper high school completion as a measure of schooling in our instrument, the reform exposure should affect the outcome of interest only through its change in upper high school completion. However, this exclusion restriction is unlikely to be satisfied under the current setting.

Migration studies often lack information on illegal migrants since the official data in host countries do not recognize them. However, we are likely to incorporate illegal migrants as well as legal migrants because the family member of the overseas worker living in the sending countries provides the information in the LFS. This situation is another advantage of this study, compared with existing studies.

4 Empirical strategy

Our study is interested in the extent to which educational attainment changes the propensity of working abroad in a developing country. Therefore, we consider the following causal model:

$$Y_{ijc} = \alpha_0 + \alpha_1 S_{ijc} + f(B_j) + \lambda_c + \varepsilon_{ijc} \quad (1)$$

where Y_{ijc} indicates the outcome variable, which takes the value of “1” if the individual i , born in year j , observed in survey c works in a foreign country; and the value “0” if he/she participates in the local labor market (including employed and unemployed people). The term S_{ijc} indicates the continuous years of schooling, and α_1 represents the impacts of schooling on the decision to work in another country. The term ε_{ijc} is the idiosyncratic error term. λ_c is the survey year fixed effects, which allows us to control for the individual’s age at the time of the interview as well.

The OLS estimates from Equation (1), however, are likely to suffer from bias because of the endogeneity of the observed educational attainment, since this tends to be correlated with unobservable factors that affect an individual’s decision to work overseas. For example, people who have high career aspirations tend to go to school and migrate to other places (Bauernschuster et al., 2014), and an unobserved factor such as this may produce the spurious positive association between educational attainment and the propensity of working abroad. Thus, to address the endogeneity of educational attainment, we use the fuzzy RDD approach and exploit the across-cohort variation in the exposure to the free secondary education reform in 1988 to identify the effect of education on the probability of working overseas.

Our first-stage equation of the fuzzy RD approach using the reform exposure indicator T_j is as follows:

$$S_{ijc} = \beta_0 + \beta_1 T_j + f(B_j) + \lambda_c + \eta_{ijc} \quad (2)$$

The treatment group consists of those born in 1976 or after, and therefore, T_j is a dummy indicating whether an individual was exposed to the program at age 12 or younger; this dummy takes the value “1” if the individual was born in 1976 or after and takes the value “0” otherwise. Here, $f(B_j)$ and λ_c are polynomial functions of the birth year and survey year fixed effects, respectively. We estimate Equation (2) using nonparametric local linear regression proposed by Calonico et al. (2014a, 2014b) to avoid making strong assumptions about the functional form that describes the relationship between the running variable and potential outcomes. Here, η_{ijc} is the error term, and the standard errors are clustered by the year of birth to allow individuals in the same cohort to correlate with others in the cohort. To investigate the heterogeneous impacts of the reform on educational attainment for men and women, we perform regression on the equation for each sex separately. Therefore, we obtain different β_1 values for men and women; these are our interests in Equation (2).

The reduced-form equation of the fuzzy RD approach is as follows:

$$Y_{ijc} = \alpha_0 + \gamma_1 T_j + f(B_c) + \lambda_c + \mu_{ijc} \quad (3)$$

where the coefficient of interest is λ_1 , which we expect to be positive if an individual is more likely to work abroad as he/she is educated.

In a fuzzy RD approach, the estimator of the interest is a Wald estimator in which the estimated discontinuity in outcome at the discontinuity point, γ_1 is divided by the corresponding discontinuity in the educational attainment β_1 . We choose an optimal bandwidth to minimize the mean squared errors with a triangular kernel weight. To investigate the heterogeneous impacts of educational attainment on international labor mobility for men and women, we also perform regression on Equation (3) for these groups separately.

To consistently estimate the coefficient of interest by using a fuzzy RDD approach, an instrument (i.e., reform exposure indicator) should satisfy two conditions. First, the instrument, the dichotomous indicator for being born in 1976 or later, should explain a sufficient degree of the variation in the endogenous variable (i.e., educational attainment). Since the model statistics for nonparametric RDD have not been developed in the literature, we will report the first-stage estimates to examine whether the empirical evidence supports the assumption.

Second, our instrument needs to affect the decision to work overseas only through its effects on individual years of schooling. We argue that this exclusion restriction is likely to hold in the present study because the reform in 1988 was an unanticipated exogenous shock for the parents of the sample children. There may be some concern, for example, that treated mothers may manipulate the timing of conception and birth so that their children are young enough to benefit from the free secondary education reform. If such nonrandom assignment of the year of birth is empirically observed, the characteristics of the children, parents, and households may be systematically different between children born in 1976 and those born in 1975. This situation is, however, unlikely in our setting because we exploit the as-if-random across-cohort variation regardless of whether children were aged ≥ 12 years in 1988; thus, parents must have accurately anticipated in which year the reform would be implemented 12 years before it occurred. Therefore, our instrument, namely, the year of birth around the cutoff point, is unlikely to be correlated with ability, motivation, or other unobserved characteristics, and thus the estimated coefficient of educational attainment is likely to represent the effects of education on labor mobility alone. In summary, the identification assumptions in the current study are likely to be satisfied. We, therefore, use the fuzzy RD method to estimate the impacts of schooling on the decision to work overseas.

Under these identification assumptions, the estimated treatment effects of the individual's education on his/her probability of working abroad are interpreted as Local Average Treatment Effects (LATE). The parameters are average treatment effects among the compliers of the reform (i.e., those who stop their education in the absence of the reform but continue to attend an extra year of schooling if the tuition fee of the secondary education is eliminated). This suggests that the parameter estimated by fuzzy RD is more likely to apply to the subpopulation from the lower socioeconomic households, whose decision on their child's education is linked to their liquidity constraints.

Relatedly, to consistently estimate the effects of the reform on educational attainment and satisfy the exclusion restriction in the second stage, another education reform around 1988 should not disproportionately affect the treated or control cohorts. Although Sakellariou

(2006), who uses the same reform as a natural experiment, does not explicitly mention this point in his study, government secondary schools nationally increased dramatically from 1988 to 1990 in response to the 1987 Constitution (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2009).¹⁵ This policy was implemented around the same time as the program of interest.

Some may be concerned, therefore, that the coefficient of interest in the first stage may be overestimated because of the effects of the school construction program. Unlike the free secondary education reform, however, the school construction program is likely to have affected both the cohort born in 1976 or after and that born in 1975 or earlier. Such effects, which differ across cohorts, should, therefore, be controlled for by including the polynomial function of the birth year as a control variable. Therefore, we argue that the variation in educational attainment used to estimate its effects on international labor mobility is derived from the 1988 free secondary education reform. In summary, by using the 1988 reform as a source of exogenous variation in educational attainment, we use the 2SLS approach to identify the effects of educational attainment on international labor mobility and present the results of the first- and second-stage estimations in the following section.

5 Results

5.1 Diagnostic test and possible effects on permanent migrations

Before showing the main results, it is informative to show the empirical evidence that supports our identification assumption. The identification assumption of RD strategies, for the first stage and reduced form, respectively, is that the conditional expectations of the potential outcomes in the current study (years of education and the probability of working abroad) are continuous around the cutoff point. We, therefore, study whether predetermined outcomes discontinuously change around the cutoff to test this assumption. Since the reform should not affect such predetermined outcomes, we expect that they are continuous near the cutoff. For this purpose, we use two predetermined characteristics: cohort size and share of female overseas workers. We use this information because it is the only available predetermined variable collected in the LFS.

The upper panel of Figure 4 shows the results of the density test proposed by McCrary (2008), in which the results do not indicate discontinuity near the cutoff. The estimated discontinuity is small and statistically significant. The lower panel confirmed that there is no disproportionate jump in the predetermined outcome, namely, the share of female overseas workers. Overall, the empirical evidence supports the validity of the identification strategy of this study. The subsequent section presents the main results.

5.2 Main results

To understand whether and how much the free secondary education program increased individuals' years of education, Table 2 presents the results of the first-stage estimation for the male and female subsamples, respectively. Columns (1) and (4) present the baseline specifications,

¹⁵ Similarly, hundreds of public schools had been constructed since the start of the Aquino administration in 1986.

Figure 4 Diagnostics.

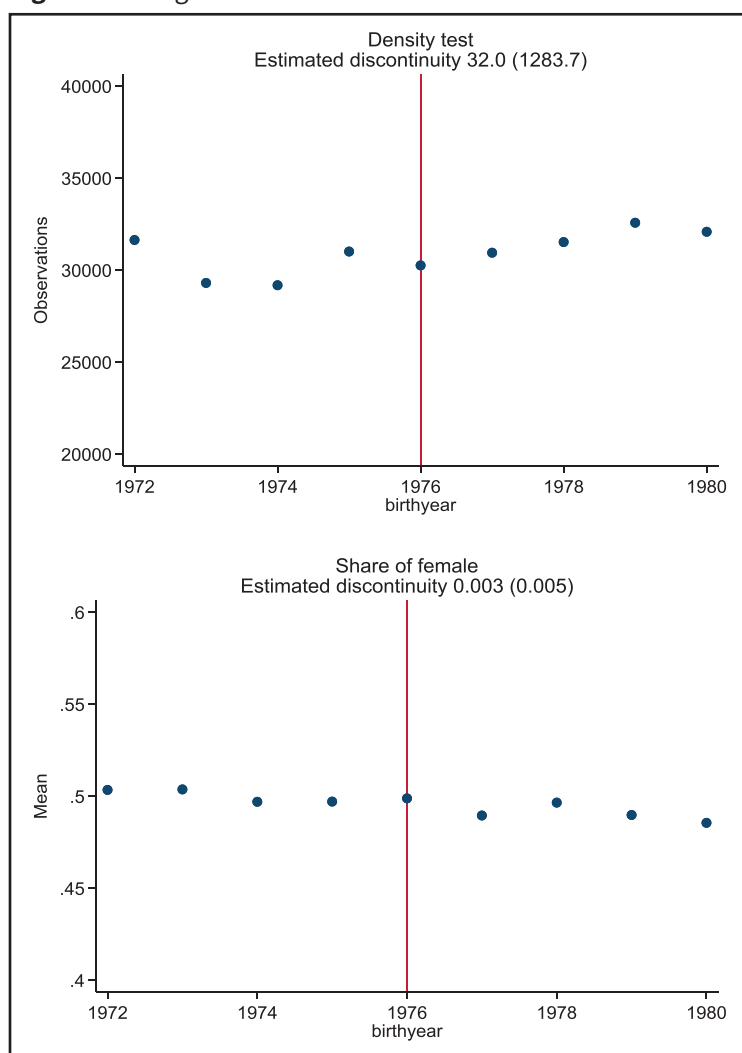


Table 2 First stage: the effect of free secondary education on schooling

	Men			Women			Overall		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
“1” if born in 1976 or later	0.070***	0.073***	-0.011	0.107***	0.109***	0.038	0.111***	0.102***	0.019
	(0.015)	(0.017)	(0.038)	(0.021)	(0.020)	(0.044)	(0.014)	(0.016)	(0.041)
Survey year fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Optimal bandwidth	5	6	7	5	6	7	4	7	8
Cutoff year	1976	1976	1971	1976	1976	1971	1976	1976	1971
Effective observations	210,612	252,952	370,678	249,434	292,480	371,676	207,786	589,047	742,354

Notes: Individuals aged ≥ 21 years at the time of the interview are included in the sample. We show the coefficients and standard errors for the local linear regression (using bandwidths selected via the procedures of Calonico et al., 2014a, 2014b) with the triangular kernel weight and the covariate being the survey year dummies. The bandwidth is selected to minimize the mean squared errors. Standard errors are clustered at the year of birth. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Source: Data are from 1995–2014 LFS.

and our preferred specifications are in Columns (2) and (5). The coefficients of interest in Columns (1) and (4) are all positive and statistically different from zero, suggesting that the reform significantly increased years of schooling, especially for men. In the estimated regressions in Columns (2) and (5), the results are qualitatively similar both for males (0.07 additional years of schooling) and females (0.11 additional years of schooling), suggesting that the first-stage results are robust to controlling for the year-specific effects¹⁶. Both coefficients are statistically significant at the 1 % level, suggesting that our identification assumption, namely, the relevance of the instrument, is likely to be satisfied.

Results of the falsification test are shown in Columns (3) and (6), in which the reform exposure indicator is falsely assigned 5 years prior to the true cutoff point (i.e., 1971). Since there was no treatment at such a false cutoff point, we expect that the outcome is not discontinuous around this point. The results are consistent with our hypothesis. The estimates indicate that false treatment has little impact on the years of education both for males and females. This result further suggests that the estimated discontinuity in the primary specification results from the free secondary education reform. On balance, the results show that the 1988 free secondary education significantly increases the years of education for both males and females.

Table A1 in Appendix further studies whether the reform exposure increased the probability of completing primary school, lower secondary school, upper secondary school, and college by gender. The results suggest that, for men, the reform has increased the completion of primary school and lower and upper secondary school, whereas it is not associated with the completion of college. Unlike men, the reform has significantly increased not only primary school and lower and upper secondary school completion, but also college completion, for women. The following sections, therefore, discuss the results for males and females separately because the reform might have affected subpopulations (i.e., compliers) differently, and relevant LATE interpretation of the results may be different for men and women.

Table 3 OLS and fuzzy RDD estimates of the effects of schooling on working overseas

	Men		Women		Overall	
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	Fuzzy RDD	OLS	Fuzzy RDD	OLS	Fuzzy RDD
Years of schooling	0.009*** (0.000)	-0.032*** (0.016)	0.006*** (0.000)	-0.007 (0.016)	0.009*** (0.000)	-0.028** (0.011)
Optimal bandwidth	9	9	7	7	9	9
Effective observations	351,222	351,222	168,696	168,696	565,870	565,870

Notes: Individuals aged ≥ 21 years at the time of the interview are included in the sample. Columns 1 and 3 are estimated using linear probability model using the same sample as Columns 2 and 4 for ease of comparison. In Columns 2 and 4, we show the coefficients and standard errors for the local linear regression (using bandwidths selected using the procedures of Calonico et al., 2014a, 2014b) with the triangular kernel weight and the covariate being the survey year dummies. The bandwidth is selected to minimize the mean squared errors. Standard errors are clustered at the year of birth. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Source: Data are from the 1995–2014 LFS.

¹⁶ Table A3 in Appendix further confirms that our results are not solely driven by the definition of the years of education because the results are not sensitive to specification using raw group indicator for educational attainment (0–5).

Table 3 presents the fuzzy RDD regression results to study how an individual's level of education affects the propensity of working abroad. For ease of comparison, Columns (1), (3), and (5) provide the results from the OLS estimations, showing that years of schooling and propensity for international migration are positively and significantly correlated for both men and women. Columns (1) and (3) show that another year of educational attainment is associated with a 0.9% point increase for men and a 0.6% point increase for women. In summary, these results suggest that (consistent with the existing literature) educational attainment is positively associated with the propensity of working abroad in the Philippines. These estimates are, however, likely to suffer from bias unless the observed educational attainment is unrelated to the unobserved error term.

To consistently estimate the effects of educational attainment on the probability of working abroad, Columns (2), (4), and (6) show the fuzzy RDD estimates, suggesting that male individuals are less likely to work abroad if they are educated for longer years. Specifically, an extra year of education decreases the probability of working abroad by 3.2% points, on average, for men. Compared with the mean of the control cohort, this effect size is as large as an 82% decrease, suggesting an economically significant effect of education on international labor mobility. In contrast, the extra year of female education was not associated with the probability of working abroad for women, although its coefficient was negative. Taken together, the fuzzy RD estimates suggest that after controlling for the endogeneity of schooling, another year of education rather reduces the international labor mobility for males; it is likely to have little effect for females, suggesting that the impacts of education derived from OLS are largely biased.

Theoretically, education may have positive and negative consequences on migration decisions. On the one hand, education may increase overseas workers since it reduces the cost of migration, such as job search costs in other countries and psychological costs. On the other hand, education lets people stay in the domestic labor market because educated people easily find jobs locally, and the opportunity costs of moving increase. Our results suggest that education has negative effects on the decision to work overseas for men on average, at least in some developing countries.

Indeed, our results are consistent with those of McHenry (2013), suggesting that people who stay in school longer would obtain a strong connection to the local community, helping them to easily find jobs in the local labor market and receive benefits of shorter unemployment spells. Moreover, to find better jobs in the international labor market, people usually need to register with agencies to search for jobs and prepare for submission of their degree or diploma certificates to employers. Therefore, the search costs in the international labor market may be higher than those for finding a job in the local labor market. Likewise, Fenoll and Kuehn (2017) exploit the cross-country variation in the timing of the compulsory education reform in Europe and show that the number of individuals that migrate across countries reduces as the length of compulsory education is increased. They argue that this situation is likely because medium-educated individuals had lower emigration rates compared to low- or high-educated individuals, and the reform shifts a population from low to medium education. Likewise, given that the reform in the Philippines was conducted in the secondary education level and is likely to shift a significant fraction of the subpopulation from low to medium educational attainment, especially for males, it may not be surprising for this study's results to be consistent with the results of Fenoll and Kuehn (2017).

The results in Table 3 show that the sign of the OLS estimates is positive, whereas that of the fuzzy RD estimates is negative. The signs of the estimates are different from each other, possibly for two reasons. First, the OLS estimates can suffer from omitted variable bias. In other words, unobserved factors that influence both schooling and working abroad may produce a spurious positive association between two variables. Our results imply that the OLS estimates are overestimated; thus, possible unobserved characteristics may negatively (positively) affect years of schooling and negatively (positively) affect the decision to work overseas. For example, parental income, unless explicitly controlled for, can be associated with both children's years of schooling and the decision to work abroad at the same time. Parental income tends to be positively associated with children's years of schooling. Additionally, it can positively affect migration status since parents from wealthy households can afford initial costs of moving, such as transportation costs. Another possible source of omitted variable bias may be the motivation of the individual. A youth with career motivation may stay in school longer to obtain more skills than a less-motivated youth, who tends to terminate schooling before completion of education. At the same time, high-motivated individuals are eager to enter the international labor market because they may get higher opportunities to receive higher wages than at local jobs.¹⁷ These unobserved factors may explain the underestimation of the true size effects in the OLS estimates.

Second, the IV estimates may be interpreted as LATEs, which provide the average treatment effects among compliers. In other words, the IV estimates are the average treatment effects among individuals who would not change educational attainment in the absence of the reform but would attain an extra year of education if the public secondary school fee was eliminated. Considering that the reform reduced the cost of attending secondary education, the compliers of the reform are likely to be the low-educated individuals from a low socioeconomic status household with liquidity constraint. Therefore, the effects of tertiary education on international labor mobility may be different from those in the present study. It would be an important future research question since it may cause brain drain.

Before concluding this study, we estimate Equation (3) by using different kernel weights to perform a robustness check. Table 4 shows that the estimated coefficients and statistical significance levels are qualitatively the same when we change the kernel weight for both the first-stage and fuzzy RD estimates. Taken together, our results consistently show that the reform significantly and disproportionately increased the individual educational attainment of the treated cohort and that this as-if exogenously increased education is negatively associated with the propensity of working abroad for males. In contrast, it had little impact on international labor mobility for females.

6 Conclusion

Previous studies have identified mixed effects of individual educational attainment on labor mobility in developed countries. However, we know little about whether individuals in the developing countries become more likely to work abroad as they are educated. This study uses the 1988 free secondary education program in the Philippines to examine whether individuals

¹⁷ The Philippines Statistic Authority shows that the average cash remittance per professional worker for 6 months in 2015 was 101,000 PHP, and the average monthly wage rate for skilled workers in 2016 was 14,663 PHP. For unskilled workers, the average annual family income in 2015 was approximately 267,000 pesos.

Table 4 Robustness test: different kernel weights

	Male	Female	Overall	Male	Female	Overall
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A (main specification)		First stage			Fuzzy RDD	
Triangular kernel	0.073*** -0.017	0.109*** -0.02	0.102*** -0.016	-0.032*** (0.016)	-0.007 (0.016)	-0.028** (0.011)
Optimal bandwidth	6	6	7	9	7	9
Panel B						
Rectangular kernel	0.101*** (0.020)	0.093*** (0.022)	0.090*** (0.011)	-0.026* (0.015)	0.010 (0.018)	0.007 (0.008)
Optimal bandwidth	6	5	4	6	5	4
Panel C						
Epanechnikov kernel	0.089*** (0.016)	0.094*** (0.022)	0.081*** (0.012)	-0.030* (0.016)	0.012 (0.015)	-0.009 (0.011)
Optimal bandwidth	8	5	5	8	5	5

Notes: Individuals aged ≥ 21 years at the time of the interview are included in the sample. We show the coefficients and standard errors for the local linear regression (using bandwidths selected using the procedures of Calonico et al., 2014a, 2014b) with kernel weight explained in each row and the covariate being the survey year dummies. The bandwidth is selected to minimize the mean squared errors. Standard errors are clustered at the year of birth. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Source: Data are from the 1995–2014 LFS.

in developing countries become more likely to work abroad as they are educated. We exploited the across-cohort variation in exposure to the program in the Philippines as a source of exogenous variation in educational attainment. By using the LFS data from 1995 to 2014, we found that additional schooling reduced the propensity of working abroad for males in the Philippines. The fuzzy RD estimates suggest that an extra year of education reduces the likelihood of working abroad by 3.2% points on average for men, whereas it had little impact on women, suggesting that the policy improving access to secondary education does not encourage international labor mobility in the Philippines. The fuzzy RD estimates of the effects of education on labor mobility and the OLS estimates have opposite signs. This finding implies that the positive association between education and migration rates reported in the empirical literature may have been largely overestimated in the context of developing countries.

The findings of this study also contribute to the literature on returns to free secondary education in developing countries in general by showing the long-term effects of the program on labor mobility. Considering that an increasing number of developing countries in sub-Saharan Africa have eliminated secondary school tuition fees since the late 2000s, this region may observe a smaller rate of international labor mobility in the future. In summary, the evidence of this study underscores the importance of considering the consequences of long-term labor mobility when designing secondary education reforms in developing countries.

Finally, we emphasize that the estimated effect of education on international labor mobility in the current study is LATE, and the effects of education at different levels of education may be different. Specifically, what we estimated was the treatment effects for the subpopulation that does not continue its education in the absence of the free secondary education reform but would continue if the tuition fee of secondary education is eliminated. Therefore, the reform

that promotes access to college education may, for instance, have different effects on international labor mobility even in developing countries. The current study cannot assess this possibility, and future research should explore this point.

Declarations

Availability of data and materials

Restrictions apply to the availability of the data used under license from the Philippines Statistics Authority for this study. Data are available from the authors upon reasonable request and with permission of the Philippines Statistics Authority only.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

YS curated and analyzed the data and was the major contributor in writing the original manuscript. KM conceptualized the research and supervised analysis. YS and KM interpreted the data, acquired funding, wrote the original manuscript, and reviewed and edited the manuscript. All authors read and approved the final manuscript.

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Appendix

Table A1 The effect of free secondary education on completion of primary school, high school, and college

	Men			College	Women			College
	Primary school	Lower high school	Upper high school		Primary school	Lower high school	Upper high school	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
“1” if born in 1976 or later	0.006***	0.006***	0.006***	0.002	0.005***	0.006*	0.010***	0.016***
	-0.001	-0.002	-0.002	-0.002	-0.002	-0.004	-0.002	-0.003
Survey year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bandwidth	5	5	7	8	5	5	7	6
Observation	252,952	252,952	252,952	376,997	207,786	249,434	292,480	292,480

Notes: Cohorts born between 1959 and 1993 and aged ≥ 21 years at the time of the interview are included in the sample. The standard errors clustered at the year of birth are in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Source: Data are from the 1995–2014 LFS.

By exploiting the long period of the survey year, for exploratory purpose, Table A2 in Appendix examines the heterogeneity in the effects of education on international labor mobility by the years of the survey. Although the current setting does not allow us to isolate the age effects from the periodic effects because the age of the relevant cohorts and the year of the survey move simultaneously, we believe it is interesting to characterize whether the effects of education are different across the survey years. To this end, Columns (2) and (5) present the results using only the 2005 survey year or earlier, whereas Columns (3) and (6) show those using only the 2006 survey year or later. We divide the sample at the 2005 survey year because it is the median year. The results for males suggest that educated males tend to work abroad in the earlier survey years, which corresponds to the years when pivotal cohorts were roughly aged ≤ 30 years. This situation is likely because they were less mobile in their 20s when they were single and have become more mobile after marriage to care for their families. Alternatively, this situation may be simply because of periodic effects, such as the decreased demand for Filipino workers in the labor market abroad in the 1990s and early 2000s. In contrast, educated women were more likely to work abroad when they were young; however, they tend to stay in the local labor market after 2006 or later. It is interesting to find the *positive* association between female education and international labor mobility at a younger age; this gender difference could be explained by the reform that extended the length of schooling at the higher level (see Table A1 in Appendix). In other words, the reform increased the probability of college completion only for women, whereas the reform affected the lower level of education for males. As argued by Fenoll and Kuehen (2017), individuals tend to migrate when the reform moves them from middle to high educational attainment. We argue that our results are consistent with such an interpretation. On balance, this study cannot speak to the underlying mechanism that explains the heterogeneity over the survey year; such an analysis is beyond the scope of this study. Even with the caveat, it is interesting to find that the education reform had long-term consequences on international labor mobility. Future studies should explore this point.