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Surveying the Extent and Wage Consequences of Education-Job Mismatches in the Philippine Labor Market

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ABSTRACT

The translation of educational investments into expanded employment opportunities and higher wages is among the ways in which a nation's educational outcomes are deemed successful. However, while education-skill mismatches are prevalent in both developed and developing economies, there is a need to extensively analyze this gap in the developing economy context, owing to the lack of data and other constraints. This paper seeks to estimate the extent of education-employment mismatches and the resulting wage consequences in the Philippine labor market. The results find that 39 percent of employed individuals are overeducated while over a quarter are undereducated. Overeducated individuals earn only 5 percent more for a surplus year of schooling relative to required years of schooling, which have returns of 7 percent to 19 percent. They underline the importance of labor market policies for improved job-skills matching, for instance, through the reduction of information asymmetries. Moreover, public subsidies must be reconsidered for higher education premised on improved wage prospects or higher productivity for highly educated individuals.

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INTRODUCTION

Educational outcomes are deemed successful when educational investments are translated into expanded employment opportunities and higher wage outcomes. While education-labor mismatches are prevalent in both developed and developing economies (Duncan and Hoffman 1981; Rumberger 1987; Hartog and Oosterbeek 1988; Sicherman 1991; Alba-Ramirez 1993; Cohn and Khan 1995; Groot and Van den Brink 1997), empirical analyses seem less extensive in the developing economy context because of the lack of data needed to quantify education-employment mismatches, such as the individual's number of years of schooling and the number of years of schooling needed to perform a given job (Mehta et al. 2011; Epetia 2018).

An individual is deemed to be overeducated (undereducated) when the level of education he has attained exceeds the years of schooling required by his current job. The prevalence of overeducation in an economy signals potential inefficiencies in the labor market, as investments to pursue education, such as time, financing, and other resources, fail to translate into higher wages or improved employment outcomes.[2] Workers whose educational attainment exceeds the level needed to perform their current jobs suffer a significant wage penalty and diminished job satisfaction relative to their well-matched peers (Dolton and Vignoles 2000; Hartog 2000; Frenette 2004; Korpi and Tåhlin 2009; Carroll and Tani 2013). The negative implications of education-labor market mismatches may be compounded in a developing economy where the rapid rise of education levels from a low base, low incomes, and highly variable education quality are prevalent (Mehta et al. 2011).

While education-labor market mismatches are indicative of labor market inefficiencies, it may not necessarily be inefficient or require policy intervention. Pay differences among individuals may reflect compensating differentials as workers trade monetary compensation for nonpecuniary characteristics of the job, which may be hard to observe (e.g., lower effort requirements, improved working conditions, and better amenities) (Acemoglu and Autor 2011; Sloane 2014). Overeducation may reflect individual preferences and personal reasons or may stem from one's desire to change job or profession. In such cases, social inefficiencies arise if overeducated workers received subsidies while in school. Education-labor market mismatches can be attributed to rigidities in education programs or policies. Required coursework might not be needed in the modern workplace but could be beneficial to society, such as in the form of well-rounded and more civic-minded individuals (Todaro and Smith 2015). Mismatches might be temporary for several reasons. Overeducation may stem from an individual's desire to invest in his future earning potential as it may translate to frequent promotions (Sicherman and Galor 1990). Job mismatches reflect the changing nature of jobs, with the growing complexity of tasks that require increasing education, skills, or competencies (Sloane 2014). It is difficult to categorically define education-labor market mismatches as inefficient or prescribe policy implications *ex-ante*. A starting point for analysis is to identify the extent of education-labor mismatches, particularly the degree to which an individual's acquired education exceeds or falls short of the level of education required by his job.

Given the potentially negative impacts of education-labor mismatches and the lack of similar studies in the Philippine setting, this paper seeks to build on the work of Mehta et al. (2011) and

[2] Overeducation is a form of vertical mismatch in the labor market. Vertical mismatches occur when an individual's level of education or skills is less or more than what is required for his current occupation. Horizontal mismatches occur when a worker's field of education or skill is not appropriate for his current occupation (e.g., worker obtained a humanities degree but working in a job that requires a mathematics background). In the Philippines, for instance, there is evidence for sheepskin effects, as investments in education does not necessarily translate to improved worker productivity but signals an individual's pre-existing ability (Olfindo 2018).

Epetia (2018)[3] to examine the extent of overeducation and undereducation in the country. The paper uses recent labor force survey data. It analyzes the extent and wage consequences of overeducation and undereducation and seeks to account for industry and regional labor market characteristics by adding controls for occupation, sector, region, and urban and rural dummies. The analysis adopts different approaches in identifying overeducated and undereducated individuals using job analysis and realized matches methods. It seeks to answer the questions: What is the extent of overeducation and undereducation in the Philippine labor market? Are the returns to surplus and deficit schooling significantly different from the returns to required schooling? What are the policy implications of the results?

DATA AND METHODS

Measuring education-labor mismatches

The literature on education-labor mismatches utilizes both subjective and objective means to establish discrepancies between an individual's educational credentials and his current occupation's requirements. Three methods to estimate job-specific required years of schooling are prevalent,[4] including (a) worker self-assessment, which directly appeals to the workers' judgments of the education requirements of their current occupations; (b) job analysis from information contained in occupational classifications and undertaken by labor market experts; and (c) realized matches or statistical methods—the mean and mode methods—which feature a systematic estimation of education level needed for each occupation. Any amount of schooling beyond (below) the required amount is considered a surplus (deficit). In the developing economy context, the mean or mode method is often difficult to implement, as years of schooling data are often missing from the labor force surveys (Mehta et al. 2011). To gauge the extent of education-labor mismatches in the Philippine labor market, this study applies job analysis and realized matches to define the amount of education required in a given occupation.[5] The Labor Force Survey (LFS) and the Family Income and Expenditures Survey (FIES) data preclude the utilization of worker self-assessments, as these do not ask respondents the level of education they think is required to perform their jobs.

Job analysis

The estimates of required years of schooling for each occupational grouping are in line with the classification system of the Filipino working population's occupations in the Philippine Standard Occupational Classification (PSOC) at the one-digit level set by the Philippine Statistics Authority (PSA). The PSOC is adapted from the International Labour Organization's International Standard Classification of Occupations (ISCO). Table 1 shows the major occupational groupings at the one-digit level and corresponding ISCO skill levels and the required level of education.[6]

[3] The analysis of Mehta et al. (2011) covers the Philippine labor force data from 1991 to 2004. Meanwhile, this analysis draws on data in 2006 and 2012. Epetia (2018) seeks to answer a similar question utilizing the merged FIES and LFS data from 2003 to 2009 to examine the extent of overeducation among college graduates in the Philippine labor market.

[4] Leuven and Oosterbeek (2011) provide a brief overview of the methods, while Epetia (2018) discusses the merits and disadvantages of each approach.

[5] As the LFS and the FIES lack data on the individual's years of schooling, this is imputed based on data on the highest grade completed. These correspond to 0 years of schooling for no grade completed, 4 years for elementary undergraduates, 6 for elementary graduates, 8 for high school undergraduates, 10 for high school graduates, 12 for college undergraduates, and 14 for college graduates. Figures for unfinished years of schooling are based on calculations using the Annual Poverty Indicators in 2004, 2007, 2008, and 2010, and follow Epetia (2018).

[6] Data cover the pre-K to 12 period. The years of education required assigned to ISCO skill level 4 is 14 rather than 16 years.

Table 1. Major occupational grouping, ISCO skill level, and general level of required education

Major occupational grouping		ISCO skill level	Skills	General level of required education	Required years of education
1	Managers	3, 4	Complex problem solving and decisionmaking, extended levels of literacy and numeracy, and excellent interpersonal communication skills	Higher education	14
2	Professionals	4	Complex problem solving and decisionmaking, extended levels of literacy and numeracy, and excellent interpersonal communication skills	Higher education	14
3	Technicians and associate professionals	3	Factual, technical, and procedural knowledge in a specialized field; high level of literacy and numeracy; and well-developed interpersonal communication skills	Higher education	12
4	Clerical support workers	2	Basic literacy, simple arithmetic	First stage of secondary education	10
5	Service and sales workers				10
6	Skilled agricultural, forestry, and fishery workers				10
7	Craft and related trades workers				10
8	Plant and machine operators and assemblers				10
9	Elementary occupations	1	Simple routine physical or manual tasks	Primary education or first stage of basic education	6

ISCO = International Standard Classification of Occupations

Note: The classification above draws from the ISCO 2008 mapping of major groups to skill levels. Armed forces occupations are omitted from the analysis because they are subsumed under public sector employees. The years of education required for occupations with a two-digit PSOC code of 14 corresponding to supervisors are specified to be 12 years.

Source: International Labour Organization (2012)

The same reasoning is applied to ISCO skill levels 3 and 2. The use of the PSOC's one-digit level to determine the extent of education-labor mismatches can lead to aggregation biases, as it adopts a broad definition of occupation, particularly a higher estimate of the incidence of overeducation. See the subsection *"Estimating the extent of education-labor mismatches in the Philippine labor market"* for a broader discussion of the limitations of the job analysis method.

Realized matches

The years of education required for each occupational grouping are computed using the mean and mode methods. The computation takes the years of education required for each occupation as the mean (mode) years of education attained by individuals in an occupation.

Computing years of overeducation and undereducation

Years of overeducation are computed using job analysis and realized matches methods as the difference between the years of education attained and the year of education required in the occupational grouping for individuals whose years of attained education exceed that of required education. Years of undereducation are given as the difference between the years of education required for an occupation and the years of education attained for individuals whose level of education fall short of the amount required for their occupations. Years of overeducation (undereducation) equal zero if workers are not overeducated (undereducated).

Applying job analysis and realized matches methods to determine the required level of education in a given job helps circumvent any measurement errors in a specific method and allows for a comparison of the wage effects in different methods.

Examining the wage effects of education-labor mismatches

Following Duncan and Hoffman (1981), the analysis adopts the convention used prominently in the overeducation literature of extending the Mincerian wage equation to account for over-, under-, and required education. It also includes controls for the region, industry sector, family size, and urban and rural areas. A control for the change in the mean number of years of schooling accounts for changes in labor market conditions. The mean years of schooling arise as a result of the prevailing demand and supply in the labor market. The function estimating the wage effects of overeducation is specified as follows:

$$\ln W_i = \beta_0 + \beta_1 educ_i^r + \beta_2 educ_i^o + \beta_3 educ_i^u + \beta_4 exp_i + \beta_5 exp_i^2 + \beta_6 changeschool_{i,k} + \sum p_j sector_i + \sum r_j region_j + \mu urb_{ij} + \boldsymbol{X_i}\boldsymbol{\delta} + u_i \quad (1)$$

where W_i measures the wage of individual *i;* $educ_i^r$ signifies years of required education, $educ_i^u$ years of overeducation, and years of undereducation; *exp* denotes potential labor market experience;[7] exp^2 signifies the squared term of potential labor market experience; $changeschool_{i,k}$ refers to the change in the mean number of years of schooling from 2006 to 2012 in occupation *k* for 2012, and from 2003 to 2006 for 2006; *sector* represents occupational sector; *region* is a dummy variable for location (i.e., region); *urb* is a dummy variable signifying urban or rural; $\boldsymbol{X_i}$ is a vector of demographic characteristics, including marital status and sex; and u_i is the error term. In the absence of direct data on the relative bargaining power of an individual, controls for local labor market conditions and changes in these conditions are included to account for the employer's bargaining power and mitigate the possibility of omitted variable bias.[8] A limitation in the Duncan and Hoffman specification, and more generally, the standard Mincerian wage equation, is that it does not control for sample selection bias because the analysis is concentrated on individuals with observable wages (i.e., the analysis excludes nonworking individuals whose wages are not observable or individuals who might be unemployed as they have higher reservation wages).

[7] Potential labor market experience is defined as age in years of schooling (see footnote 6 about the computation). This measure is used in place of actual years of work experience, since such data are missing from the LFS.

[8] Controls for industry, occupation, and location partly capture the local labor market conditions.

The analysis employs the Heckman selection method to control for the sample selection bias. The selection equation to estimate an individual's probability of being employed is specified below:

$$employed_i = \propto_0 + \propto_1 familysize_{i,j} + \propto_2 householdhead_{i,j} + Z\, less5_{i,j} + \sum r_j region_j + \boldsymbol{\delta X_i} + V_i \quad (2)$$

where $employed_i$ is a dummy variable taking the value of 1 if an individual is employed and 0 otherwise; $familysize_{i,j}$ signifies the number of family members belonging to household *j*; $householdhead_{i,j}$ is a dummy variable taking the value of 1 if individual, *i*, is the head of household *j* and 0 otherwise; $less5_{i,j}$ is an instrumental variable signifying the number of children below the age of five residing in the household *j*;[9] $region_j$ is a dummy variable for location; $\boldsymbol{X_i}$ is a vector of demographic characteristics, including marital status, sex, age, and a squared age term; and V_i is the error term. The choice to instrument for the number of young children (defined as individuals below five years old) in the household follows Epetia (2018) and is further motivated by empirical evidence that the presence of young children in the household affects an individual's likelihood of employment (Bose 1984; Cook and Beaujot 1996; Das and Zumbyte 2017).[10]

Test of coefficients: Examining theories for education-labor mismatches

Studies have utilized the Duncan and Hoffman modification (equation [1]) to the Mincerian wage equation to test which among the labor market theories best explain the incidence of overeducation, with studies concentrating on the human capital theory, job competition model, and assignment theory (McGuiness 2006; Leuven and Oosterbeek 2011).

The assignment theory advances the idea that wages are shaped by the human capital of an individual as encapsulated by his level of education and the requirements of the job. Thus, drawing from equation (1), the following should hold under the assignment model:[11]

$$H_o: \beta_1 \neq \beta_2 \neq \beta_3; \beta_i \neq 0 \text{ for } i = 1, 2, 3 \quad (3)$$

The years of required, surplus, and deficit schooling will have an effect on an individual's wage but the effect will not be equal.

The assumption that wages reflect the marginal productivity of a worker is embedded in the human capital model. Under this framework, only the amount of schooling attained by an individual should matter for wages. The formal test for whether the job competition model holds is therefore one of joint equality where:

$$H_o: \beta_1 = \beta_2 = \beta_3 \quad (4)$$

That is, the years of required schooling and the years of deficit or surplus schooling have an equal effect on wages.

In contrast, the job competition model puts forward the idea that an individual's amount of schooling does not directly affect his wages and the marginal product is determined by his job's requirements. As such, using equation (1), the following should hold:

$$H_o: \beta_2 = \beta_3 = 0 \quad (5)$$

That is, years of surplus or deficit schooling have no effect on wages.

McGuiness (2006) and Leuven and Oosterbeek (2011) note that the tests embodied by equations (4) and (5) are almost always rejected by the data. This signifies that the human capital

[9] In 2006, 39 percent or 12,303 employed individuals included in the sample were residing in households with children below the age of five. In 2012, the corresponding figure was 39 percent or 14,293.

[10] Empirical analysis points to the reduced employment probability for women in households with young children and the increased probability of employment for men.

[11] Further elaboration on the connection of the empirical tests and the theoretical framework can be found in Dolton and Vignoles (2000); Rubb (2003); McGuiness (2006); Leuven and Oosterbeek (2011).

theory and job competition model fail to effectively explain the emergence of overeducation and undereducation. They consequently find support for the assignment theory, which asserts the importance of human capital characteristics and job requirements in determining wages (Annexes 2.1 to 2.4).

Data reject the argument of joint equality of the coefficients of required, surplus, and deficit schooling embodied by the human capital theory ($\beta_1 = \beta_2 = \beta_3$) and the argument advanced by the job competition model that only job characteristics matter for wages ($\beta_2 = \beta_3 = 0$). These findings provide support for the assignment model ($\beta_1 \neq \beta_2 \neq \beta_3$).

Data

Data were drawn from the merged FIES and LFS in 2006 and 2012,[12] which utilized multistage stratified random sampling, covering a sample of about 50,000 households representing the national and regional levels.

Summary statistics in Annex 1 are in line with expectations and generally within bounds.[13] The mean basic pay per day of PHP 227 in 2006 and PHP 294 in 2012 roughly cohere with the average minimum daily wage rates across regions. It reflects a higher representation of males than females among employed individuals and a greater concentration of married than single individuals. Permanent employees and individuals working in the services sector account for nearly half of wage earners in the sample. In 2006, over half of the wage earners were located in rural areas. In 2012, the divide between urban and rural workers was roughly equal. Individuals residing in the National Capital Region (NCR) account for the highest share at 16 percent to 17 percent.

RESULTS

Estimating the extent of education-labor mismatches in the Philippine labor market

The estimated proportions of overeducated and undereducated individuals in the Philippines in 2006 and 2012 based on the method used are presented in Figure 1. In both survey years, job analysis identifies the largest share of workers who were overeducated at 38 percent to 39 percent of the total employed individuals. The mode method identifies the next highest proportion of overeducated individuals at nearly a quarter of the total employed workers. The mean method of determining overeducation returns the smallest proportion of 10 percent of employed individuals classified as overeducated. Similarly, estimates of undereducated individuals vary considerably, ranging from 28 percent to 29 percent under the job analysis method to nearly 80 percent under the realized matches mean method. Therefore, the method used to determine education-labor mismatches plays a critical role in establishing the proportion of overeducated and undereducated individuals in the Philippine labor market as the range is considerable.[14]

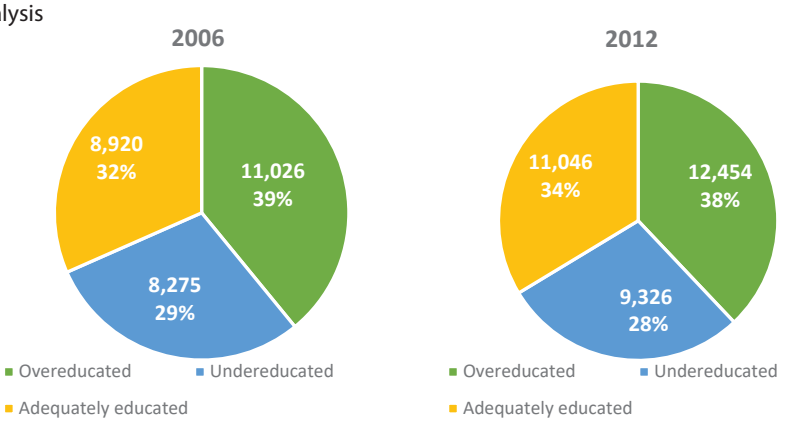
[12] Although the 2015 and 2018 rounds of the FIES-LFS were available at the time of writing, the older datasets were chosen in the interest of consistency in variable definition and inclusion. The variable of the highest grade completed was defined differently starting in the 2015 round to account for the beginning of the K to 12 program. A variable of interest, the rural-urban distinction, was not available in the later rounds.

[13] In 2006, the change in the mean number of school years was -5.1 for traditional medicine practitioners, -5.7 for shoemakers and related workers, and -9.4 for charcoal makers and related workers. In 2012, the corresponding figures were -5.4 for precision instrument makers and repairers and -9.4 for traditional medicine practitioners.

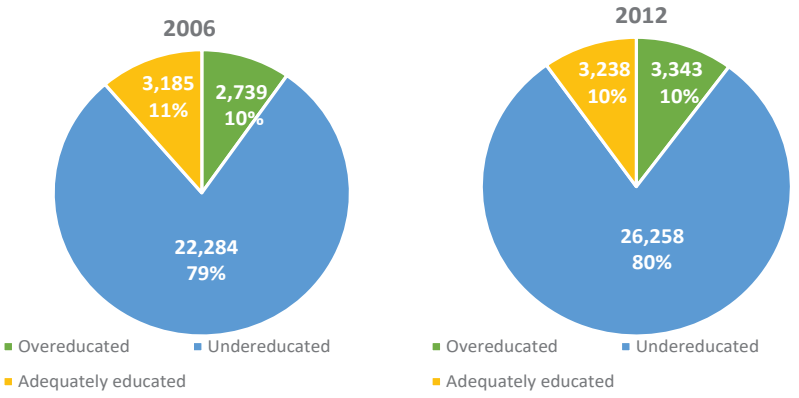
[14] Surveys of the literature on overeducation document a wide range of estimates. McGuinness (2006) cites estimates of the incidence of overeducation, which range from 7 percent to 57 percent. Hartog (2000) documents a considerable variation of the estimates of overeducation ranging from 7 percent to 42 percent and variations in estimated incidences of undereducation from 11 percent to 48 percent.

Figure 1. Proportion of overeducated and undereducated individuals

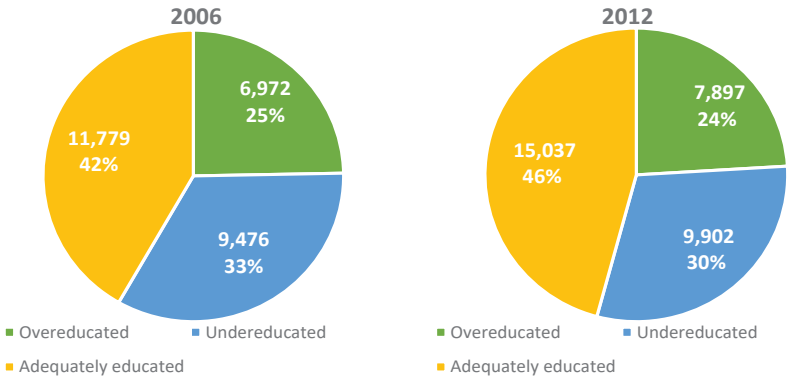
a. Job analysis



b. Realized matches (mean)



c. Realized matches (mode)



Note: The figures depict the frequencies and percentages of overeducated, undereducated, and adequately educated individuals under the different methods for a given year.
Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, and 2012b)

A limitation of the realized matches method is the tendency to overestimate the number of years of required schooling in case the supply in highly educated workers—in this case, secondary and tertiary workers—is not met with an equivalent demand for skilled workers (Epetia 2018). Highly educated individuals would then occupy unskilled jobs, raising the years of required schooling for these jobs. This would result in the underestimation of the proportion of overeducated workers under the realized matches methods. In addition, the elevated estimates of required years of schooling under this method can simultaneously lead to the overestimation of undereducation incidence. Under the mean method, nearly 80 percent of individuals are identified as undereducated in both years. This could result in considerable bias—the mean method estimates that only 10 percent to 11 percent of individuals are adequately matched across the two survey years. In the mode method, these figures rise more reasonably to 42 percent to 46 percent.

While the job analysis method is considered more objective and can provide more detailed descriptions of needed qualifications, it cannot easily account for the jobs' changing requirements since updates are infrequent and costly (Hartog 2000). Job analyses are unable to account for variations in required schooling across jobs (Leuven and Oosterbeek 2011). Under the job analysis method, 32 percent to 34 percent of individuals are classified as adequately matched.

All told, the estimates under the realized matches methods, particularly the mean method, can be taken as the lower bound estimate of overeducation and upper bound estimate of undereducation. The corresponding proportions from the job analysis method can be considered as the upper bound estimate of overeducation and lower bound estimate of undereducation. The mode method might be considered in future analyses, because it identifies a more reasonable extent of mismatch relative to the mean method while circumventing the limitations inherent in job analyses—the infrequency and costliness of reflecting changing job requirements.

Estimating the wage consequences of education-labor mismatches

Ordinary least squares (OLS) estimation

Estimates of overeducation's wage effects, following OLS analysis, are shown in Tables 2 and 3. The returns to years of over-, under-, and required education are in line with the general findings that while the returns to surplus schooling are positive, they are substantially lower than the returns to required education. The estimated returns to years of surplus schooling range from 5 percent to 8 percent across different specifications in line with the meta-analysis of Rubb (2003), which estimated a mean value of 5.2 percent for excess years of schooling. These estimates are all significant at 1-percent level. By contrast, returns to required years of schooling range from 7 percent to 19 percent across the different estimations. Estimates for the returns to undereducation range from -4 percent to -10 percent.[15] The returns to experience and the squared experience term are consistent with expectations in both years, demonstrating increasing returns to experience but at a decreasing rate. Similarly, females and single individuals earn less than their male and married counterparts, respectively. The existence of wage disparities across men and women echo the earlier findings of significant gender disparities in labor and employment outcomes in the Philippines (Yap and Melchor 2015).[16] Workers from the NCR earn more relative to their counterparts from different regions. All results are significant at the 1-percent level.

[15] See Annex 2 for a discussion on the test of coefficients.

[16] See Doan et al. (2018) for similar findings for the returns to experience, squared experience, and sex in a developing country setting, particularly in Viet Nam.

Across different estimations for both survey years, workers from urban areas earn less than their rural counterparts, with the results being significant at the 1-percent level. Nominal urban-rural wage gaps almost disappear when prices and wages are measured with greater precision (Williamson 2016). After controlling for skill level, for instance, the urban-rural real wage gap declined to 6 percent for unskilled labor and 0 percent for skilled labor from the earlier estimates of 34 percent. Utilizing the Oaxaca decomposition of urban-rural wage gaps shows that education and experience alone account for 71 percent of the real income gap (Chua et al. 2015; Williamson 2016). Individuals from urban areas have lower returns than those from rural areas under certain specifications (Gerochi 2002). In examining the returns to technical-vocational education, Choi (2021) finds that returns to education are more pronounced.

Results for the occupational sector suggest that the industry sector yields the highest wages (significant at the 1-percent level). This coheres with the findings of Luo and Terada (2009) that manufacturing or industry workers earn more than individuals employed in services or manufacturing. In line with expectations, permanent employees enjoy higher returns than their peers employed in seasonal or casual work. This is significant at the 1-percent level across specifications for both years, with exceptions of the realized matches mean method in 2006 when the coefficient is still positive but insignificant. The results for change in the mean number of school years by occupation suggest that increasing education attainment per occupation has a positive effect on wages. This is significant at the 1-percent level for all specifications.

Table 2. Regression results, 2006

	Job analysis		Realized matches: Mean		Realized matches: Mode	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Natural logarithm of basic pay per hour						
Years of education required	0.174***	0.084***	0.191***	0.134***	0.138***	0.083***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.065***	0.047***	0.054***	0.050***	0.076***	0.047***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.070***	-0.045***	-0.063***	-0.041***	-0.096***	-0.046***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Experience	0.033***	0.020***	0.038***	0.020***	0.036***	0.020***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Squared experience	-0.0005***	-0.0003***	-0.0006***	-0.0003***	-0.0005***	-0.0003***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Male		0.303***		0.322***		0.326***
		(0.01)		(0.01)		(0.01)
Single		-0.125***		-0.132***		-0.133***
		(0.01)		(0.01)		(0.01)
Permanent		0.049***		0.028***		0.060***
		(0.01)		(0.01)		(0.01)
Urban		-0.075***		-0.075***		-0.075***

Table 2. (continuation)

	Job analysis		Realized matches: Mean		Realized matches: Mode	
	(1)	(2)	(3)	(4)	(5)	(6)
		(0.01)		(0.01)		(0.01)
Change in mean number of school years		0.121***		0.075***		0.133***
		(0.00)		(0.01)		(0.00)
Regional controls		Yes		Yes		Yes
Controls for sector of employment		Yes		Yes		Yes
N	28178	26625	28222	26667	28135	26590
F	2972.578	916.253	2907.385	895.528	2420.845	894.601
R-squared	0.355	0.496	0.332	0.490	0.289	0.493

Notes: Robust standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01
Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, and 2012b)

Table 3. Regression results, 2012

	Job analysis		Realized matches: Mean		Realized matches: Mode	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Natural logarithm of basic pay per hour						
Years of education required	0.156***	0.066***	0.178***	0.151***	0.127***	0.101***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.060***	0.046***	0.052***	0.048***	0.074***	0.046***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.064***	-0.042***	-0.055***	-0.037***	-0.083***	-0.041***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Experience	0.028***	0.018***	0.031***	0.018***	0.028***	0.018***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Squared experience	-0.0004***	-0.0002***	-0.0005***	-0.0002***	-0.0004***	-0.0002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Male		0.278***		0.293***		0.298***
		(0.01)		(0.01)		(0.01)
Single		-0.099***		-0.104***		-0.105***
		(0.01)		(0.01)		(0.01)
Permanent		0.052***		0.006		0.041***
		(0.01)		(0.01)		(0.01)
Urban		-0.073***		-0.074***		-0.074***

Table 3. (continuation)

	Job analysis		Realized matches: Mean		Realized matches: Mode	
	(1)	(2)	(3)	(4)	(5)	(6)
		(0.01)		(0.01)		(0.01)
Change in mean number of school years		0.140***		0.060***		0.121***
		(0.00)		(0.01)		(0.00)
Regional controls		Yes		Yes		Yes
Controls for sector of employment		Yes		Yes		Yes
N	32822	30928	32829	30934	32811	30918
F	2585.216	777.670	2588.842	775.005	2141.582	785.969
R-squared	0.297	0.432	0.285	0.432	0.247	0.436

Notes: Robust standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01
Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, and 2012b)

Heckman model

The returns to over-, under-, and required education after controlling for selection bias are shown in Tables 4 and 5. The returns to years of overeducation are positive for both years, yielding a return of 5 percent after controlling for personal attributes, household characteristics, region, and nature of employment. The returns to required years of schooling in both survey years range from 7 percent to 19 percent after the inclusion of additional controls. Undereducation yields returns in the range of -3 percent to -10 percent. These estimates are significant at the 1-percent level.

After accounting for selection bias under the Heckman method, the results are slightly lower than those under the OLS regression, particularly with returns to years of overeducation being lower under the Heckman method. Tests of the differences in the coefficients of required education, overeducation, and undereducation under the OLS and the Heckman methods in Annex 3 generally point to statistically significant differences between the coefficients using these two methods. This reinforces the importance of accounting for sample selection bias. Moreover, as highlighted in the regression tables (Tables 4 and 5), empirics on the instruments used suggest their validity (a first-stage F statistic greater than 10 and a Hansen J statistic in line with valid instrumentation) and the inverse Mills ratio is significant at the 1-percent level across the different models, indicating the presence of bias using OLS analysis.

The results for experience, squared experience, and personal attributes are in line with the general expectations in both survey years. Increasing years of experience lead to positive returns but do so at a decreasing rate. Once again, it suggests the concavity of experience. In line with expectations, males earn more than their female counterparts (an estimated 32 percent to 35 percent more for both years), single individuals earn less than married individuals (-10 percent in 2006 and -6 percent to -7 percent in 2012), and employed individuals residing in the NCR earn the highest returns across both survey years. Likewise, employees in permanent positions earn more than those in seasonal or casual employment in 2006 and 2012, and individuals employed in the industry sector enjoy higher returns than their peers in services and agriculture. Individuals employed in urban areas earn less

than their counterparts in rural areas. An increase in the mean years of schooling of an occupation translates to an increase in wage. Results are significant at the 1-percent level.

While the study suggests the existence of education-labor mismatches in the Philippine labor market and its negative impact on wages, there are a few areas that might be considered for future study. A limitation of the present analysis is the inability to directly account for the relative bargaining powers of employed individuals and their employers and for their reservation wages and incomes. To attenuate the effect of omitted variables in the estimates, additional controls capturing local labor markets conditions were included. Notwithstanding these controls as proxy variables, part of the worker's productivity captured by years of education is fairly exogenous. Most employees included in the survey already completed their reported years of schooling before joining the labor market.

The present analysis fails to account for the possible effects of socioeconomic factors or the role of sex in potentially exacerbating education-labor mismatches despite previous evidence that these play a significant role in the Philippine labor market (de Dios and Dinglasan 2013; Yap and Melchor 2015; Epetia 2018). It is beyond the scope of this study to examine heterogeneities in the skill profiles of educated workers or different skill requirements across similar occupations.[17]

While the study identifies the extent and wage impact of undereducation, policy implications are not examined at length. It concentrates on the implications of overeducation, as the effects of negative wages on overeducated individuals are believed to be greater. Sattinger and Hartog (2013) model the wage effects of undereducation as a reward, as individuals with a lower education level profit from finding a job whose education requirement exceeds their own level of schooling. In this way, undereducated individuals earn a higher wage from obtaining employment in roles that require a higher level of schooling than they possess relative to the wage they would earn from jobs that matched their level of education. Sattinger and Hartog (2013) note that a positive undereducation reward is consistent with empirical findings.[18] Among the explanations advanced for the occurrence of undereducation is the presence of individual heterogeneity among workers, as undereducated workers possess above average abilities (Büchel and Mertens 2004). Undereducated workers may also substitute their lack of schooling with a greater amount of relevant experience. The presence of undereducation may reflect a mix of schooling and experience, which workers and employers deem sufficient (Kiker et al. 1997). In this way, a tradeoff between education and human capital can contribute to the presence of undereducation, such that individuals with different levels of schooling but similar levels of human capital occupy the same jobs. Greater elaboration on the causes and policy implications underlying undereducation suggests possible avenues for further study or potential extensions.

[17] Further research to better account for differing skill levels can be useful. Recent analyses point to the role of skills, as captured by learning outcomes, among others, in impacting wages (Patrinos and Psacharopoulos 2020).

[18] A negative coefficient on the return to years of deficit schooling would still be consistent with an undereducation reward, as the returns to undereducation are estimated relative to returns to required education. Should the return to each year of required education exceeds the return to each year of deficit schooling, the coefficient for returns to undereducation would be negative. However, an undereducation reward would persist, as returns to years of deficit schooling are positive although lower than for those of required education.

Table 4. Heckman results, 2006

	Job analysis		Realized matches: Mean		Realized matches: Mode	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Natural logarithm of basic pay per hour						
Main						
Required years of education	0.175***	0.084***	0.193***	0.135***	0.139***	0.084***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.065***	0.048***	0.052***	0.051***	0.072***	0.049***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.072***	-0.045***	-0.065***	0.041***	-0.097***	-0.046***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Experience	0.042***	0.017***	0.050***	0.017***	0.047***	0.017***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Squared experience	-0.0007***	-0.0002***	-0.0008***	-0.0002***	-0.0007***	-0.0002***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Male		0.327***		0.354***		0.354***
		(0.01)		(0.01)		(0.01)
Single		-0.099***		-0.099***		-0.103***
		(0.01)		(0.01)		(0.01)
Permanent		0.048***		0.026***		0.059***
		(0.01)		(0.01)		(0.01)
Urban		-0.075***		-0.075***		-0.075***
		(0.01)		(0.01)		(0.01)
Change in mean number of school years		0.121***		0.075***		0.133***
		(0.00)		(0.01)		(0.00)
Regional controls		Yes		Yes		Yes
Controls for sector of employment		Yes		Yes		Yes
Selection						
Number of household members below age 5	0.026**	0.026**	0.026**	0.026**	0.026**	0.026**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Male	-0.300***	-0.300***	-0.299***	-0.299***	-0.300***	-0.300***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Single	-0.177***	-0.177***	-0.178***	-0.178***	-0.178***	-0.178***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Age as of last birthday	0.055***	0.055***	0.054***	0.054***	0.054***	0.054***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age squared	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***

Table 4. (continuation)

	Job analysis		Realized matches: Mean		Realized matches: Mode	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Natural logarithm of basic pay per hour						
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
College	-0.037	-0.037	-0.036	-0.036	-0.037	-0.037
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Household head	0.161***	0.161***	0.161***	0.161***	0.161***	0.161***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Family size	-0.008**	-0.008**	-0.008**	-0.008**	-0.008**	-0.008**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

	Job analysis		Realized matches: Mean		Realized matches: Mode	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Natural logarithm of basic pay per hour						
Regional controls		Yes		Yes		Yes
Inverse-Mills Ratio	0.576***	-0.220***	0.746***	-0.285***	0.701***	-0.256***
	(0.04)	(0.07)	(0.05)	(0.07)	(0.05)	(0.07)
Wald test of independent equations (rho = 0) chi-square	929.11	140.46	1158.43	140.88	1090.12	140.34
Chi-square p-value	0.00	0.00	0.00	0.00	0.00	0.00
N	35290	35290	35332	35332	35255	35255
N censored	8665	8665	8665	8665	8665	8665

Test of validity of instrument

	Job analysis	Realized matches: Mean	Realized matches: Mode
Hansen J statistic (overidentification test of all instruments)	1.167	1.097	1.387
Chi-square p value	0.280	0.295	0.239

Notes: Standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01

Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, and 2012b)

Table 5. Heckman results, 2012

	Job analysis		Realized matches: Mean		Realized matches: Mode	
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable: Natural logarithm of basic pay per hour						
Main						
Required years of education	0.154***	0.066***	0.178***	0.151***	0.126***	0.101***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.060***	0.046***	0.051***	0.049***	0.072***	0.047***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.064***	-0.043***	-0.055***	-0.038***	-0.082***	-0.041***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Experience	0.031***	0.013***	0.037***	0.013***	0.032***	0.013***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Squared experience	-0.0005***	-0.0001***	-0.0006***	-0.0001***	-0.0005***	-0.0001***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Male		0.323***		0.340***		0.340***
		(0.01)		(0.01)		(0.01)
Single		-0.059***		-0.062***		-0.068***
		(0.01)		(0.01)		(0.01)
Permanent		0.050***		0.003		0.039***
		(0.01)		(0.01)		(0.01)
Urban		-0.073***		-0.074***		-0.075***
		(0.01)		(0.01)		(0.01)
Change in mean number of school years		0.138***		0.058***		0.120***
		(0.00)		(0.01)		(0.00)
Regional controls		Yes		Yes		Yes
Controls for sector of employment		Yes		Yes		Yes
Selection						
Number of household members below age 5	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Male	-0.231***	-0.231***	-0.231***	-0.231***	-0.231***	-0.231***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Single	-0.175***	-0.175***	-0.176***	-0.176***	-0.175***	-0.175***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Age as of last birthday	0.056***	0.056***	0.056***	0.056***	0.056***	0.056***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age squared	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***

Table 5. (continuation)

	Job analysis		Realized matches: Mean		Realized matches: Mode	
	(1)	(2)	(3)	(4)	(5)	(6)
Some college	-0.142***	-0.142***	-0.143***	-0.143***	-0.142***	-0.142***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
College	0.010	0.010	0.010	0.010	0.010	0.010
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Household head	0.054**	0.054**	0.054**	0.054**	0.053**	0.053**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Family size	-0.008**	-0.008**	-0.008**	-0.008**	-0.008**	-0.008**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Regional controls		Yes		Yes		Yes
	Job analysis		**Realized matches: Mean**		**Realized matches: Mode**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Dependent variable: Natural logarithm of basic pay per hour						
Inverse-Mills Ratio	0.229***	-0.465***	0.383***	-0.489***	0.274***	-0.440***
	(0.04)	(0.09)	(0.04)	(0.09)	(0.04)	(0.09)
Wald test of independent equations (rho = 0) chi-square	588.88	108.79	796.69	113.37	750.30	100.36
Chi-square p-value	0.00	0.00	0.00	0.00	0.00	0.00
N	40388	40388	40394	40394	40378	40378
N censored	9460	9460	9460	9460	9460	9460
Test of validity of instrument						
	Job analysis		**Realized matches: Mean**		**Realized matches: Mode**	
Hansen J statistic (overidentification test of all instruments)	2.586		2.284		2.281	
Chi-square p value	0.108		0.131		0.131	

Note: Standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01
Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, and 2012b)

DISCUSSION AND CONCLUSION

This paper sought to establish the extent of overeducation and undereducation in the Philippine labor market and their ensuing wage effects using merged FIES and LFS data in 2006 and 2012. Job analysis and realized matches methods were employed to determine the extent of overeducation. In both survey years, job analysis identified the highest share of overeducated individuals at an estimated 38 percent to 39 percent of the total employed individuals. The mode and mean methods

estimated from 24 percent to 25 percent, and 10 percent, respectively, of employed individuals as overeducated. As the range of estimates resulting from the job analysis and realized matches methods is considerable, the method used to determine education-labor mismatches is critical. It suggests the mode method for future analyses and identifies a more moderate extent of education-labor mismatches relative to the mean method while circumventing the limitations inherent in job analysis methods—the infrequency and costliness of accounting for changing job requirements. The different methods do not fully account for the different skill requirements within a given occupation, as it is beyond the scope of the study. The strengths and limitations of each approach should be considered in determining mismatches.

The results suggest an estimated 5-percent return to years of overeducation across the different specifications after controlling for individual, sectoral, and regional conditions, among other controls. By contrast, returns to required years of schooling are higher, ranging from 7 percent to 19 percent across different estimations. Estimates for the returns to undereducation range from -4 percent to -10 percent. These results point to the wage penalty facing overeducated individuals, as returns to surplus schooling, while positive, are substantially lower than the returns to required years of schooling.

The high prevalence of overeducation has important implications. Previous studies found evidence to support the connection of overeducation, diminished job satisfaction, and large wage penalties that signal inefficiencies in the labor market. Investments in time, money, and other resources do not translate to improved employment outcomes or higher wages. Such negative effects are significant in a developing economy context where education quality is highly variable and low incomes are prevalent.

The results have two broad policy implications. First, labor market policies to improve job-skills matching, including those that aim to minimize job information asymmetries or enhance job matches should be considered (e.g., by labor market fairs or platforms that expand individuals' knowledge on prospective opportunities or skills). Improvements in job-skills matching can help promote job satisfaction and boost wages.

Policies to facilitate job-skills matching can alleviate challenges in the Philippine labor market, such as the continued gender disparities in labor outcomes. The coronavirus disease 2019 (COVID-19) pandemic has largely exacerbated existing job market vulnerabilities. In August 2021, LFS data showed that the unemployment rate increased to 8.1 percent from 5.3 percent in January 2020 before the onset of the pandemic. Female unemployment rate was higher at 8.3 percent relative to their male counterparts at 7.9 percent. In the same month, more than 70 percent of individuals in the labor force worked fewer than 40 hours in a week. Of this number, nearly 60 percent cited the variable nature of working time and work as the motivation for reduced hours. Social safety nets and adequate social protection can help mitigate these challenges and the wage penalties experienced by overeducated individuals.

The results prompt policymakers to reconsider the merits of full subsidies for higher education. Arguments that publicly subsidized higher or tertiary education will translate into improved wage prospects for highly educated individuals or higher productivity may not bear out in reality, raising concerns over the efficiency of public investment in tertiary schooling. The 2021 Commission on Higher Education budget for universal access to tertiary education amounted to PHP 44.2 billion, the bulk of the agency's PHP 50.9-billion budget in the said year (de la Cruz 2020). As of October 2021, an estimated 1.6 million students enrolled in 219 state universities and colleges who benefitted from free tertiary education were set to graduate in 2022 (Montemayor 2021). In light of the considerable funding allocated to subsidies and the evidence that this has failed to translate to improved wage

prospects, there must be strong consideration for more targeted higher education support. Subsidies for those from the lower income and vulnerable groups combined with strong social safety nets can better balance tradeoffs between efficient public investments and sufficient social support.

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ANNEXES

Annex 1.1. Summary statistics of variables included in the analysis, 2006

Variable	Obs.	Mean	Std. Dev.	Min	Max
Log basic pay per hour	28,222	5.17	0.74	1.61	9.17
Employed	31,439	0.90	0.30	0	1
Some college	31,439	0.13	0.34	0	1
College	31,439	0.14	0.34	0	1
Required years of education: job analysis	31,385	8.71	2.59	6	14
Years of overeducation: job analysis	31,385	1.20	1.75	0	8
Years of undereducation: job analysis	31,385	0.96	1.72	0	12
Required years of education: realized matches - mean	31,439	8.95	2.13	5.82	14
Years of overeducation: realized matches - mean	31,439	0.99	1.41	0	8
Years of undereducation: realized matches - mean	31,439	0.93	1.55	0	13
Required years of education: realized matches - mode	31,342	9.37	3.19	4	14
Years of overeducation: realized matches - mode	31,342	0.85	1.69	0	10
Years of undereducation: realized matches - mode	31,342	1.26	2.06	0	14
Experience	31,439	18.75	12.62	0	58
Squared experience term	31,439	510.81	586.11	0	3364
Male	31,439	0.64	0.48	0	1
Female	31,439	0.36	0.48	0	1
Single	31,439	0.38	0.48	0	1
Married	31,439	0.58	0.49	0	1
Age as of last birthday	31,439	33.70	11.77	15	64
Age squared	31,439	1274.21	868.69	225	4096
Household head	31,439	0.39	0.49	0	1
Family size	29,713	5.55	2.30	1	27
Number of household members below age 5	31,439	0.54	0.79	0	6
Agriculture	31,439	0.23	0.42	0	1
Industry	31,439	0.25	0.44	0	1
Services	31,439	0.52	0.50	0	1
Permanent	31,439	0.66	0.47	0	1
Short term/seasonal/casual	31,439	0.34	0.47	0	1
Urban	29,713	0.44	0.50	0	1
Rural	29,713	0.56	0.50	0	1

Annex 1.1. (continuation)

Variable	Obs.	Mean	Std. Dev.	Min	Max
Change in mean number of school years	31,439	0.00	1.65	-9.43	7.58
Ilocos Region	31,439	0.05	0.21	0	1
Cagayan Valley	31,439	0.05	0.21	0	1
Central Luzon	31,439	0.10	0.30	0	1
CALABARZON	31,439	0.12	0.33	0	1
MIMAROPA	31,439	0.04	0.18	0	1
Bicol Region	31,439	0.05	0.21	0	1
Western Visayas	31,439	0.07	0.26	0	1
Central Visayas	31,439	0.07	0.25	0	1
Eastern Visayas	31,439	0.04	0.19	0	1
Zamboanga Peninsula	31,439	0.03	0.17	0	1
Northern Mindanao	31,439	0.04	0.21	0	1
Davao Region	31,439	0.06	0.23	0	1
SOCCSKSARGEN	31,439	0.05	0.22	0	1
National Capital Region	31,439	0.17	0.37	0	1
Cordillera Administrative Region	31,439	0.03	0.16	0	1
Autonomous Region in Muslim Mindanao	31,439	0.01	0.09	0	1
Caraga	31,439	0.03	0.18	0	1

Obs = observations; Std. Dev. = standard deviation; Min = minimum; Max = maximum; CALABARZON = Cavite, Laguna, Batangas, Rizal, and Quezon; MIMAROPA = Occidental Mindoro, Oriental Mindoro, Marinduque, Romblon, and Palawan; SOCCKSARGEN = South Cotabato, Cotabato, Sultan Kudarat, and Sarangani

Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, 2012b)

Annex 1.2. Summary statistics of variables included in the analysis, 2012

Variable	Obs.	Mean	Std. Dev.	Min	Max
Log basic pay per hour	32,829	5.44	0.72	1.16	10.78
Employed	37,138	0.88	0.32	0	1
Some college	37,138	0.09	0.29	0	1
College	37,138	0.14	0.34	0	1
Required years of education: job analysis	37,127	8.66	2.60	6	14
Years of overeducation: job analysis	37,127	1.18	1.74	0	8
Years of undereducation: job analysis	37,127	0.89	1.63	0	14
Required years of education: realized matches - mean	37,138	8.95	2.10	0	14
Years of overeducation: realized matches - mean	37,138	0.97	1.41	0	8

Annex 1.2. (continuation)

Variable	Obs.	Mean	Std. Dev.	Min	Max
Years of undereducation: realized matches - mean	37,138	0.91	1.53	0	11
Required years of education: realized matches - mode	37,118	9.24	3.20	0	14
Years of overeducation: realized matches - mode	37,118	0.87	1.75	0	10
Years of undereducation: realized matches - mode	37,118	1.17	2.01	0	14
Experience	37,138	19.93	13.24	-2	58
Squared experience term	37,138	572.50	631.04	0	3364
Male	37,138	0.65	0.48	0	1
Female	37,138	0.35	0.48	0	1
Single	37,138	0.37	0.48	0	1
Married	37,138	0.58	0.49	0	1
Age as of last birthday	37,138	34.87	12.40	15	64
Age squared	37,138	1370.05	935.51	225	4096
Household head	37,138	0.37	0.48	0	1
Family size	35,017	5.53	2.34	1	19.5
Number of household members below age 5	37,138	0.53	0.78	0	5
Agriculture	37,138	0.24	0.42	0	1
Industry	37,138	0.24	0.43	0	1
Services	37,138	0.52	0.50	0	1
Permanent	37,138	0.61	0.49	0	1
Short term/seasonal/casual	37,138	0.39	0.49	0	1
Urban	35,017	0.53	0.50	0	1
Rural	35,017	0.47	0.50	0	1
Change in mean number of school years	37,138	0.00	1.55	-9.41	7.56
Ilocos Region	37,138	0.05	0.21	0	1
Cagayan Valley	37,138	0.05	0.22	0	1
Central Luzon	37,138	0.10	0.30	0	1
CALABARZON	37,138	0.12	0.33	0	1
MIMAROPA	37,138	0.03	0.17	0	1
Bicol Region	37,138	0.05	0.21	0	1
Western Visayas	37,138	0.07	0.26	0	1
Central Visayas	37,138	0.07	0.25	0	1
Eastern Visayas	37,138	0.04	0.20	0	1
Zamboanga Peninsula	37,138	0.04	0.19	0	1
Northern Mindanao	37,138	0.05	0.21	0	1

Annex 1.2. (continuation)

Variable	Obs.	Mean	Std. Dev.	Min	Max
Davao Region	37,138	0.06	0.24	0	1
SOCCKSARGEN	37,138	0.05	0.22	0	1
National Capital Region	37,138	0.16	0.37	0	1
Cordillera Administrative Region	37,138	0.03	0.18	0	1
Autonomous Region in Muslim Mindanao	37,138	0.01	0.12	0	1
Caraga	37,138	0.03	0.17	0	1

Obs = observations; Std. Dev. = standard deviation; Min = minimum; Max = maximum; CALABARZON = Cavite, Laguna, Batangas, Rizal, and Quezon; MIMAROPA = Occidental Mindoro, Oriental Mindoro, Marinduque, Romblon, and Palawan; SOCCKSARGEN = South Cotabato, Cotabato, Sultan Kudarat, and Sarangani

Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, 2012b)

Annex 2.1. Test of coefficients and regression, 2006

Variables	Job analysis		Realized matches: Mean		Realized matches: Mode	
Dependent variable: Natural logarithm of basic pay per hour						
Years of education required	0.17***	0.08***	0.19***	0.13***	0.14***	0.08***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.06***	0.05***	0.05***	0.05***	0.08***	0.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.07***	-0.04***	-0.06***	-0.04***	-0.10***	-0.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
F value (Beta of years of overeducation = 0)	701.59	423.27	357.01	352.75	990.15	435.82
p value	0.00	0.00	0.00	0.00	0.00	0.00
F value (Beta of required years = Beta of years of overeducation)	2130.02	181.43	2212.50	42.62	944.69	64.81
p value	0.00	0.00	0.00	0.00	0.00	0.00
F value (Beta of years of overeducation = Beta of years of undereducation)	2081.17	903.19	1304.83	897.06	3131.11	953.99
p value	0.00	0.00	0.00	0.00	0.00	0.00

Note: Robust standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01

Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, 2012b)

Annex 2.2. Test of coefficients and regression, 2012

Variables	Job analysis		Realized matches: Mean		Realized matches: Mode	
Dependent variable: Natural logarithm of basic pay per hour						
Years of education required	0.16***	0.07***	0.18***	0.15***	0.13***	0.10***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.06***	0.05***	0.05***	0.05***	0.07***	0.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.06***	-0.04***	-0.05***	-0.04***	-0.08***	-0.04***
Dependent variable: Natural logarithm of basic pay per hour						
F value (Beta of years of overeducation = 0)	734.43	456.75	406.52	397.97	1187.23	512.60
p value	0.00	0.00	0.00	0.00	0.00	0.00
F value (Beta of required years = Beta of years of overeducation)	1963.98	58.34	2254.45	73.07	873.11	176.46
p value	0.00	0.00	0.00	0.00	0.00	0.00
F value (Beta of years of overeducation = Beta of years of undereducation)	2064.91	963.11	1336.14	942.96	3201.15	984.42
p value	0.00	0.00	0.00	0.00	0.00	0.00

Note: Robust standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01
Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, 2012b)

Annex 2.3 Test of coefficients, Heckman, 2006

Variables	Job Analysis		Realized Matches: Mean		Realized Matches: Mode	
Dependent variable: Natural logarithm of basic pay per hour						
Years of education required	0.17***	0.08***	0.19***	0.13***	0.14***	0.08***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.07***	0.05***	0.05***	0.05***	0.07***	0.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.07***	-0.05***	-0.06***	-0.04***	-0.10***	-0.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Chi-square (Beta of years of overeducation = 0)	695.81	456.47	281.63	357.50	634.28	392.83
p value	0.00	0.00	0.00	0.00	0.00	0.00
Chi-square (Beta of required years = Beta of years of overeducation)	2191.51	182.57	2019.58	59.84	762.49	73.82
p value	0.00	0.00	0.00	0.00	0.00	0.00

Annex 2.3. (continuation)

Variables	Job Analysis		Realized Matches: Mean		Realized Matches: Mode	
Chi-square (Beta of years of overeducation = Beta of years of undereducation)	2037.80	999.47	1209.99	968.99	2496.59	971.90
p value	0.00	0.00	0.00	0.00	0.00	0.00

Note: Standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01
Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, 2012b)

Annex 2.4. Test of coefficients, Heckman, 2012

Variables	Job analysis		Realized matches: Mean		Realized matches: Mode	
Dependent variable: Natural logarithm of basic pay per hour						
Years of education required	0.15***	0.07***	0.18***	0.15***	0.13***	0.10***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.06***	0.05***	0.05***	0.05***	0.07***	0.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.06***	-0.04***	-0.06***	-0.04***	-0.08***	-0.04***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Chi-square (Beta of years of overeducation = 0)	682.25	451.11	328.67	362.96	842.54	448.91
p value	0.00	0.00	0.00	0.00	0.00	0.00
Chi-square (Beta of required years = Beta of years of overeducation)	1905.77	55.91	1952.79	89.36	648.60	197.33
p value	0.00	0.00	0.00	0.00	0.00	0.00
Chi-square (Beta of years of overeducation = Beta of years of undereducation)	1973.11	997.11	1242.42	953.22	2736.00	966.53
p value	0.00	0.00	0.00	0.00	0.00	0.00

Note: Standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01
Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, 2012b)

Test of Coefficients under OLS and Heckman methods

The estimated returns to surplus, deficit, and required years of schooling under the job analysis and realized matches methods, employing an OLS regression and Heckman model are summarized in Annex 3.1 and Annex 3.2. The results, after accounting for selection bias under the Heckman method, are slightly lower although similar to those under the OLS regression.

Tests of the differences in the coefficients of required, overeducation, and undereducation under the OLS and Heckman methods generally point to statistically significant differences between coefficients using the two methods, with some exceptions. While the coefficients are statistically and significantly different, the difference in coefficients is economically small.

Annex 3.1. Summary of results and test of coefficients: OLS regression and Heckman, 2006

Variables	Job analysis		Realized matches: Mean		Realized matches: Mode	
OLS Regression						
Years of education required	0.174***	0.084***	0.191***	0.134***	0.138***	0.083***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.065***	0.047***	0.054***	0.050***	0.076***	0.047***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.070***	-0.045***	-0.063***	-0.041***	-0.096***	-0.046***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Heckman						
Years of education required	0.175***	0.084***	0.193***	0.135***	0.139***	0.084***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.065***	0.048***	0.052***	0.051***	0.072***	0.049***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.072***	-0.045***	-0.065***	-0.041***	-0.097***	-0.046***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Beta OLS = Beta Heckman						
Chi-square (Years of required education)	68.48	1.45	41.44	0.00	80.12	0.10
p value	0.00	0.00	0.00	1.00	0.00	1.00
Chi-square (Years of overeducation)	7.83	0.01	12.77	4.72	38.99	15.72
p value	0	1.00	0.00	0.00	0.00	0.00
Chi-square (Years of undereducation)	3.73	0.02	6.02	7.58	5.93	7.44
p value	0	1.00	0.00	0.00	0.00	0.00

OLS = ordinary least squares

Notes: Robust standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01

Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, 2012b)

Annex 3.2. Summary of results and test of coefficients: OLS regression and Heckman, 2012

Variables	Job analysis		Realized matches: Mean		Realized matches: Mode	
OLS Regression						
Years of education required	0.156***	0.066***	0.178***	0.151***	0.127***	0.101***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.060***	0.046***	0.052***	0.048***	0.074***	0.046***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	0.00)
Years of undereducation	-0.064***	-0.042***	-0.055***	-0.037***	-0.083***	-0.041***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Heckman						
Years of education required	0.154***	0.066***	0.178***	0.151***	0.126***	0.101***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
Years of overeducation	0.060***	0.046***	0.051***	0.049***	0.072***	0.047***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Years of undereducation	-0.064***	-0.043***	-0.055***	-0.038***	-0.082***	-0.041***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Beta OLS = Beta Heckman						
Chi-square (Years of required education)	56.43	6.25	24.43	0.33	54.33	6.96
p value	0.00	0.00	0.00	1.00	0.00	0.00
Chi-square (Years of overeducation)	7.16	7.21	10.79	3.11	28.38	0.00
p value	0.00	0.00	0.00	0.00	0.00	1.00
Chi-square (Years of undereducation)	0.50	0.21	2.22	2.18	16.05	8.12
p value	0.00	1.00	0.00	0.00	0.00	0.00

OLS = ordinary least squares

Note: Robust standard errors in parentheses; * p<0.1; ** p<0.05; *** p<0.01. Wages are expressed in Philippine peso.

Source: Author's computation based on data from PSA (2006a, 2006b, 2012a, 2012b)