Overeducation among graduates in developing countries: What impact on economic growth?

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1 Introduction

The human capital theory (Becker, 1964) considers education as an investment for a productivity enhancing and thus positively impacts individual earnings. At the national level, the models of endogenous growth view human capital as a factor of production that can increase the innovative capacity of the economy (Lucas, 1988 ; Romer, 1990). Education may also facilitate the diffusion and transmission of knowledge needed to successfully implement new technologies devised by others (Nelson & Phelps, 1966 ; Benhabib & Spiegel, 2005). Hence, from the theoretical point of view, higher education may generate a strong positive effect on economic growth.

As more education, more growth, countries are incited to invest in education. Consequently, a sharp increase in educational levels has been observed during the last few decades all over the world (Barro & Lee, 2001 ; OECD, 2014). Nevertheless, the positive impact of education on economic growth is very controversial from empirical studies, in particular for higher education sector.

While Chatterji (1998), Wolff (2000), Gyimah-Brempong et al. (2005) and Holland et al. (2013) find that higher education has a positive effect on economic growth, Holmes (2013) finds that mass higher education does not lead to higher growth in ninety one developed and developing countries during a period of forty years from 1966 to 2006. Hanushek (2013) also finds that the amount of tertiary education have no impact on economic growth for either developed or developing countries, especially when the quality of education is controlled.

The divergence between theoretical prediction and empirical studies on the role of higher education in the economic growth could be also related to the education-job matching process, particularly when the supply of highly educated workers is beyond the demand, generating a phenomenon called overeducation (Ramos et al., 2012 ; Kupets, 2015). Overeducation, or vertical educational mismatch, refers to an excess of education, beyond the level needed to perform a certain job (Hartog, 2000 ; McGuinness, 2006).

From the microeconomics' perspective, two approaches differ regarding the effect of overeducation. Papers in line with the "human capital approach" find that overeducated workers are more productive than their adequately educated colleagues in the same jobs thanks to their more years of education, which is rather positive for economic growth (Sattinger, 1993 ; Kampelmann & Rycx, 2012). Nevertheless, from the "job satisfaction approach", overeducated workers are found to be less satisfied that may reduce their work efforts/cooperation, and they are likely to quit their jobs (Tsang & Levin, 1985 ; Wald, 2005 ; Blenkinsopp & Scurry, 2007 ; Tarvid,

2012). This can incur additional hiring/training costs and constraint the firms' development, which can negatively affect economic growth (Mahy et al., 2015 ; McGuinness et al., 2017).

From a strict macroeconomics' viewpoint, educational mismatch represents wasteful public investments and resources allocated to higher education sector, thus risks of not training enough graduates for industries that extremely need them and too much graduates for fields that do not have enough demands. Hence, it could have an unfavorable effect on the countries' gross domestic product (GDP) (Cedefop, 2010).

Up to now, only few papers devote a special examination to a direct link between overeducation and economic growth. First, focusing on the French case between 1980 and 2002 and employing the vector autoregression (VAR) model, Guironnet & Jaoul-Grammare (2009) find that a share increase of overeducated workers of the higher education produces an unfavorable short-term effect on the economic growth with a significant threshold of 10%. In contrast, by using the ordinary least squares (OLS) regression and panel data models, Ramos et al. (2012) find that overeducation has a positive impact on economic growth in nine European countries.[1] Hence, the link between overeducation and economic growth is not clear. Furthermore, no studies focused yet on developing countries where there seems to be an increasing trend of overeducated graduates, and where resources for investment in education are severely constrained and can ill afford to be wasted (Keese & Tan, 2013).

Given the inconclusiveness of the existing literature, the objective of this paper is to investigate the impact of overeducation among tertiary graduates on economic growth with a focus on developing countries where educational mismatches may be also driven by factors other than those verified in developed countries.

Indeed, while there still exists a significant shortage of high skilled workers[2] reported by employers in several fields, the increase of higher education enrollment in developing countries is, however, accompanied by an increase in educational mismatches among graduates (Ra et al., 2015). Thus, higher education sector in developing countries seems to face two problems: **1- poor quality of education system and 2- inadequate link between the demand and supply of graduates in some sectors** (Reis, 2017).

[1] Those countries are Austria, France, Greece, Italy, Portugal, Romania, Slovenia, Spain and United Kingdom.

[2] Skill shortages refer to unfilled or hard to fill vacancies that have arisen as a consequence of a lack of qualified candidates for posts (McGuinness et al., 2017)

First, regarding the quality of education in developing countries, some higher education institutions (HEI) might have grown faster than qualified instructors, which affects the quality of teaching (Dessus, 1999 ; Chapman & Chien, 2014). For example, in 2011-2012, only 16% and 14% of university instructors hold doctoral degrees in China and in Vietnam, respectively (Chapman & Chien, 2014). Furthermore, in Cambodia for example, several HEI are only driven by commercial interests and do not focus on the quality of education (Kwok et al., 2010).

Second, in regard to the relation between supply and demand for graduates, a severe mismatch may occur in some sectors. For instance, the country's education system has not produced enough graduates for nursing and high-tech manufacturing in China (Ra et al., 2015), while excessive supply for finance and management majors (Hu, 2013). This supply-demand inadequacy also exists in other countries like in Egypt (Salama, 2012), Thailand EIC (2014), Cambodia (Madhur, 2014) and Latin American countries (Ferreyra, 2017). In fact, many students in developing nations, for example in Thailand and Cambodia, do not have enough information of labor market requirements, and they are more likely directed to simply attaining a degree rather than acquiring skills important for their future careers (Pholphirul, 2017 ; Peou, 2017). In other words, the *diploma disease*[3] coined by Dore (1976) is likely existing over there.

Due to these two specific problems, overeducated graduates might be not necessarily overskilled (Sattinger et al., 2012). Thus, if the analysis of overeducation in developing countries seems at first sight not crucial given their still low educational attainments, it is actually much more important because the negative effect of overeducation might represent a risk of losing the potential growth as well as the capacity to catch up developed nations.

To analyze our research question, this article uses two sources of data, a macro data from the World Bank to mainly calculate the economic growth and a micro data from the Integrated Public Use Microdata Series International (IPUMSI) to principally measure the incidence of overeducation. Then, we combine these two data and get an unbalanced panel of thirty-eight developing countries between 1990 and 2011.

To deal with the unobserved heterogeneity between countries and endogenous problem of overeducation, two-stage least square (2SLS) regression with fixed-effects is employed.

[3]Diploma disease refers to credential inflation. As a consequence of the belief that educational certificates are the key to obtaining the best-paid jobs, individuals come to strive for constantly higher credentials in order to obtain jobs that previously did not demand those certificates, and for which their education does not in any case prepare them for those jobs and thus less likely to transform them into productive and innovative workers.

Hence, this paper contributes to the literature on three main points: 1- Matching a micro and macro data, which allows analyzing the impact of overeducation on economic growth, while the previous literature on the relation between higher education and economic growth seems to overlook this issue, 2- Setting alight on developing countries where previous researches mainly focus on developed countries, and 3- Dealing with unobserved heterogeneity between countries and endogeneity of overeducation that have not been fully resolved in the prior literature.

The paper is structured as follows: Section 2 describes the database and how we measure overeducation, section 3 focuses on descriptive statistics, section 4 presents the method and results, and section 5 concludes.

2 Data

Our estimated model on the impact of overeducation on economic growth is based on the growth models and the conceptual framework developed in OECD's and the World Bank's report (2013) on indicators of skills for employment and productivity.[4]

Nevertheless, there is no database available for us to directly test the model and analyze our research question. It is thus indispensable to construct a database by collecting both macro and micro data and then match them together.

At macroeconomics level, the World Bank's website permits us to extract data on several key variables,[5] but to complement the lack of data for some variables especially on the rate of overeducation among graduates, we need to employ a micro data from the IPUMSI.[6]

The IPUMSI's database provides integrated series of census micro data samples from 1960 to the present day. Nevertheless, given that the share of tertiary graduates has just started to increase in many developing countries from 1990s,[7] we choose to analyze the period between 1990 and 2011.[8]

The obvious advantage of using the IPUMSI's samples lies in the fact that a number of key variables such as educational level and occupations are recorded using a homogeneous classification, allowing us to calculate the rate of overeducation and other variables in a comparable way between different countries.

The IPUMSI's database contains sixty-three developing countries[9], but each country presented is not observed at the same year and contains a different number of observations. Thus, it is an unbalanced panel data that we will discuss and tackle this issue in the method part.[10]

[4]The conceptual framework consists of five inter-related domains of indicators, including: contextual factors which drive both the supply of and demand for skills (e.g, total population); skill acquisition which covers investments in skills (e.g, workforce with tertiary education); skill requirements which measure the demand for skills in the labour market (e.g, share of high skilled jobs); the degree of matching which captures how well skills obtained through education and training correspond to the skills required in the labour market (e.g, educational mismatch); and outcomes which reflect the impact of skills on economic performance (e.g, economic growth).

[5]Data source: `https://data.worldbank.org/indicator/`.

[6]Data source: `https://international.ipums.org/international/`

[7]The increasing trend of tertiary education can be seen on `https://ourworldindata.org/tertiary-education/`

[8]Because one of our dependent variables is the economic growth between t_0 and t_5, we cannot include the data after 2011 due to the unavailability of Gross Domestic Product (GDP) per capita at t_5.

[9]The data is extracted in September 2017.

[10]A country is classified as a developing country and which region it belongs to, is based on the World Bank's website. Reference:
`https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups`

Given that samples from Argentina, Bangladesh, Columbia, Kenya and Ukraine do not provide information on occupations, we are forced to exclude those countries because we cannot calculate their rate of overeducation. Next, having learned that the quality of census data in most sub-Saharan African countries, even in a big country like Nigeria, often suffer from operational glitches that affect the credibility of the results (Chandy,[11] 2015 ; Beguy,[12] 2016), we decide to exclude the countries from that region. This leaves us with a sample of thirty-eight countries equaling seventy-five observations.[13]

These countries are heterogeneous in terms of GDP, surface and geography. The GDP per capita (PPP) is ranked from 904 USD in 1998 for Cambodia until 18,094 USD for Romania in 2011. In terms of surface, we have small countries like Saint Lucia (617 km^2) and Fiji (18,274 km^2) to large countries like China (9.6 million km^2) and India (3.3 million km^2). In terms of location, our sample is composed of sixteen countries in Latin America & the Caribbean, nine countries in East-Asia & Pacific, six countries in the Middle-East & North Africa, five countries in Europe & Central Asia, and two countries in South Asia.

[11]Laurence Chandy is currently the director of data, research and policy at the UNICEF:
`https://www.brookings.edu/blog/africa-in-focus/2015/05/04/why-is-the-number-of-poor-people-in-africa-increasing-when-africas-economies-are-growing/`

[12]Donatien Beguy is the head of statistics and surveys unit at the African population and health research center:
`https://theconversation.com/poor-data-affects-africas-ability-to-make-the-right-policy-decisions-64064`

[13]The full list of countries are available in the in the Table 10 of the Appendix: A.

2.1 Macro data

Several main variables can be found in the World Bank's database.

First, we can extract data on our dependent variable: the growth of Gross Domestic Product (GDP) per capita based on Purchasing Power Parity (PPP). Previous researches on the impact of overeducation on economic growth have used two different measures of economic growth: short-term ($t = 1$) for Guironnet & Jaoul-Grammare (2009) and medium-term ($t = 5$) for Ramos et al. (2012). We will employ thus two measures, different in years-term: GDP per capita growth between 1- t_0 and t_1 and 2- t_0 and t_5. This allows to observe the impact of overeducation more completely from the short to medium terms.

Next, regarding the independent variables, the classical models view the quantity of labor as an essential element to economic growth (Eltis, 2000). We employ therefore the total population and labor force participation rate as proxies for the quantity of labor. Then, the neoclassical growth model finds that there exists the convergence effect between poor and rich countries (Barro & Sala-i Martin, 1992), so we introduce the initial GDP per capita into our model. Afterward, the endogenous growth theory recommends the role of education in stimulating economic growth (Lucas, 1988), and some empirical evidences also find that education especially the quality of education matters to economic growth (Hanushek & Wößmann, 2007). We use thus the pupils to teacher ratio in primary school as a proxy for the quality of education[14] because several studies use class size to infer the effect of school quality on student outcomes (Bernal et al., 2016). Infrastructure also plays a key role in supporting economic growth (Barro, 1990), we employ thus the access to mobile phone as a proxy variable for infrastructure.

[14]This indicator is preferable than the pupils-teacher ratio in secondary school or in tertiary school because the typical school dropouts in developing countries would lower the pupils-teacher ratio at higher grades, thus using these last two indicators to represent the educational quality might be bias.

2.2 Micro data

For some missing variables at macroeconomics level, the IPUMSI database allows us to overcome this problem.

Indeed, the OECD's and the World Bank's report (2013) mention the importance of skill requirement that determines how productive each country's economy is and its potential economic growth. We calculate thus the shares of high-skilled jobs[15] as a proxy for the skill requirements in each country. Next, the skill acquisition among the workforce is another key driver of economic growth because it is a source of skills for meeting the skill requirement of employers, and more educated workforce can also be more productive (Becker, 1964 ; Lucas, 1988). We calculate then the percent of workforce with secondary and tertiary education as proxies for skill acquisition. Lately, Wei & Zhang (2011) find that the sex-ratio imbalance stimulates economic growth in China because men are more likely to take risks in their careers (thus higher returns), are expected to get more supports from parents in access to education, and gender inequality in the labor market that favor men to gain access to managerial positions. We add therefore the male ratio in the workforce calculated from the IPMUSI database as another independent variable.

Finally, our main independent variable is the rate of overeducation among tertiary graduates that measures how well the skill requirement and skill acquisition match each other in each country or how the tertiary education acquired by graduates is transformed into productive activities for economic growth enhancing (please refer to the Box 1 below to see how we measure overeducation).

[15] We consider jobs as high-skilled jobs if those jobs need tertiary education. For a detailed description, please refer to the Tables 8 and 9 in the Appendix: B.

Table 1 summarizes the variables and sources of data used in this research:

Table 1: Variables and data sources

Indicator domains	**Variables**	**Data sources**	**Nature of data**
Outcome or dependent variable	Economic growth	**World Bank**	**Macro data**
Contextual factors	Total population Labor force participation rate Initial GDP per capita Pupils-teacher ratio Access to mobile phone		
	Male ratio in the Workforce	**IPUMSI**	**Micro data**
Skill requirement	Share of high-skilled jobs		
Skill acquisition	Workforce with secondary education Workforce with tertiary education		
Matching	Graduates' overeducation rate		

Table source: OECD's and the World Bank's report (2013)

Box 1: Overeducation indicators

Based on the IPUMSI data, two methods can be used to calculate the incidence of overeducation: Job analysis (JA) and statistical method. Between these two measures, (Hartog, 2000) and (Sloane, 2003) consider JA to be conceptually superior because the statistical measure possesses several drawbacks.

One of the main shortcomings of statistical measure lies in the fact that in case of excess supply of graduates for a given occupation, it will underestimate the level of overeducation and will overestimate in case of excess demand (Kiker et al., 1997 ; de Oliveira et al., 2000).

For example, suppose a country is facing an excess of tertiary graduates, and consequently, to avoid unemployment, many of them may accept to work as clerical support workers, an occupation that, however, does not needs tertiary education. The statistical measure calculates the average (or mode) number of years of education of all workers occupying the clerical position and then classifies a worker in this occupation as overeducated if his/her number of years of study is above the average plus one or two standard deviations (or alternatively above the modal value). Thus, if a high proportion of graduates work as clerical clerks, this will raise the average years of education within this occupation. As a result, those graduates are likely not deemed to be overeducated, which underestimates the true level of overeducation. Thus, the use of statistical measure is often regarded as inferior and is only used when there is no available data to conduct the JA method (Leuven et al., 2011).

In our data, we do observe that the incidence of overeducation based on statistical measure (using mode) has a significant negative correlation (coefficient = -0.61) with the proportion of graduates in the workforce, that is to say, a country having a high proportion of graduates is more likely to have a low incidence of overeducation, and vice versa. This seems to be in line with the inconvenience of using statistical measure mentioned by the literature above. Hence, we decide to only employ the JA measure.

Box 1: Overeducation indicators (continued)

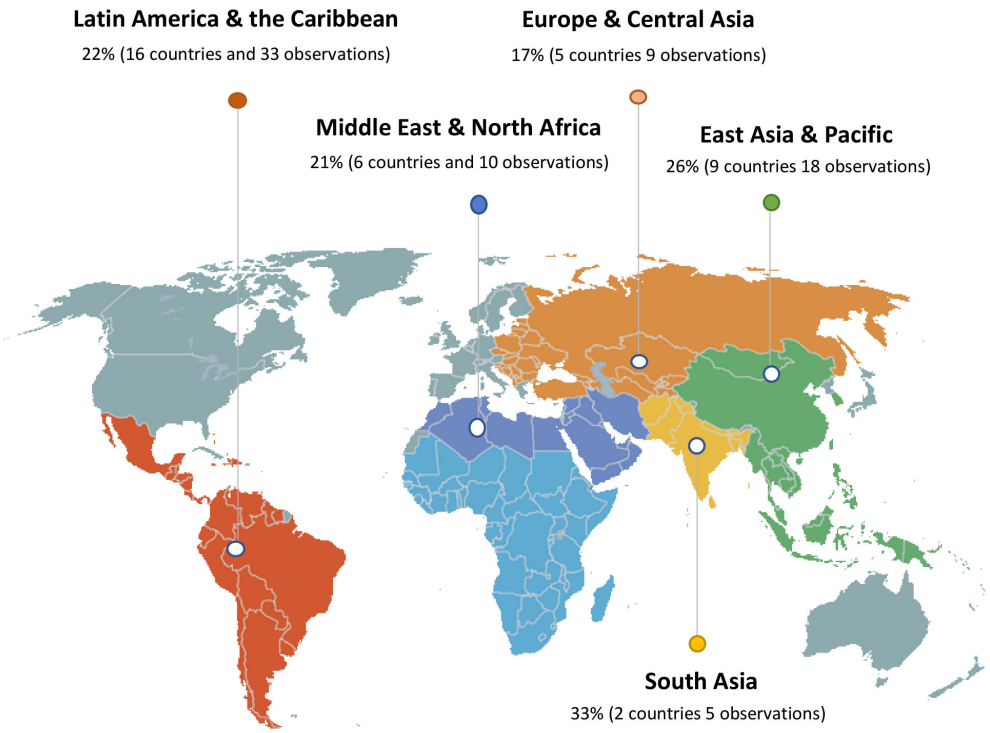
The IPUMSI database classifies the individual occupation following the International Standard Classification of Occupations Code (ISCO). Based on JA measure, each occupation is assigned to what level of skill or education required classified in the International Standard Classification of Education (ISCED). For example, the occupational levels 1 (managers), 2 (professionals) and 3 (technicians) classified in the ISCO are assigned to educational levels 5 and 6 (first stage and second stage of tertiary education) in the ISCED. Thus, if graduates are employed in those occupational levels, they are considered as matched workers because those occupations need tertiary education. In contrast, if they are employed in occupational levels of ISCO that require education lower than the levels 5 and 6 in ISCED, they are defined as overeducated.[a]

After defining which individual is overeducated, we calculate the proportion of graduates who are overeducated in each country. Results highlight that the incidence of overeducation quite differs between countries. For example in 2011, the rate of overeducation among graduates is found to be 17% in Romania and 30% in Armenia. Within the same country, overeducation seems to increase over time, which gives us more motivation to analyze its impact. For instance in Costa Rica, the overeducation rate was 12% in 2000 and increased to 23% in 2011. Between regions, the difference also pronounces: Overall, the rate ranked from 17% in Europe & Central Asia to 33% in South Asia (Figure 1).[b]

[a] Tables specifying the matching process between the occupational classes and the required educational levels, are in the Appendix: A.

[b] The incidence of overeducation in each region is calculated by the sum of each country's incidence and then is divided by the number of countries in the region.

Figure 1: Overeducation rate among tertiary graduates across regions



3 Descriptive statistics

Table 2 below presents the descriptive statistics. Q1 & Q2 in the Table 2 refer to the first two quartiles of dependent variables containing only the half of sample with lower economic growth, while Q3 & Q4 refer to the last two quartiles of dependent variables containing only the half of sample with higher economic growth.

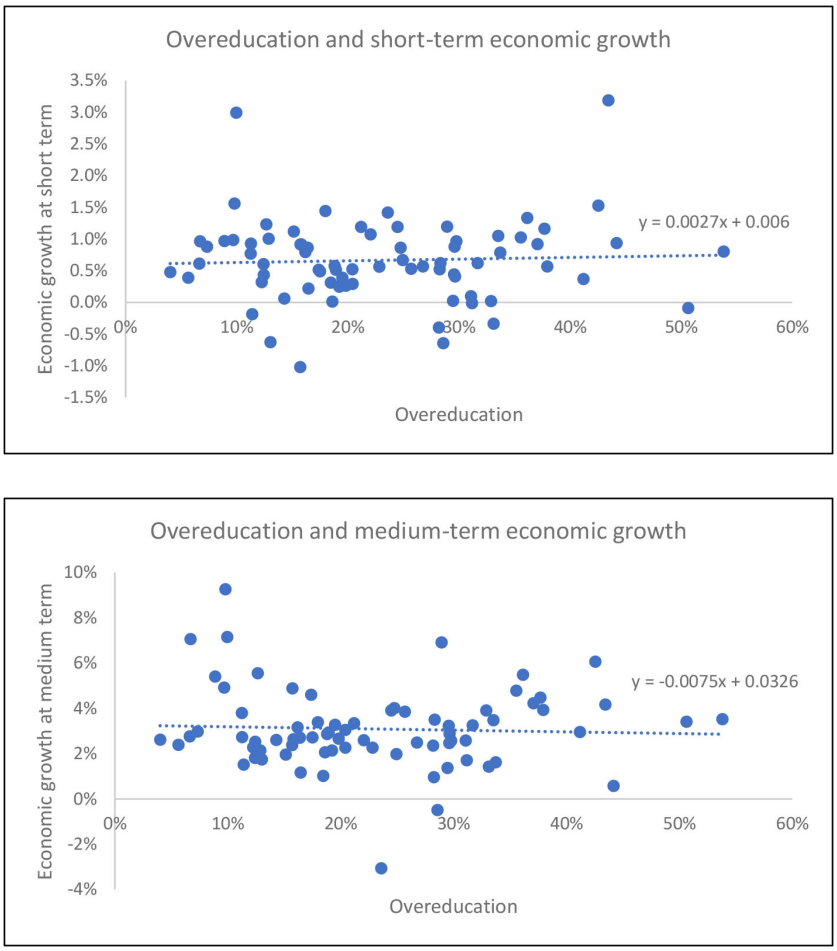
Table 2: Descriptive statistics

VARIABLES	**All observations**		**Q1 & Q2 (Low)**		**Q3 & Q4 (High)**	
Dependent Variable	**Mean**	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**
Economic growth at t_1 (g_1) (%)	0.66	0.65	0.21	0.39	1.13	0.53
Independent Variables						
Total population (million)	128.73	299.59	64.55	169.11	194.65	382.47
Labor force participation rate (%)	61.08	9.56	60.16	7.69	62.02	11.20
Log GDP per capita at t_0	8.52	0.71	8.66	0.65	8.38	0.76
Pupils-teacher ratio	26.84	7.33	27.54	6.43	26.12	8.18
Access to mobile phone (%)	25.02	38.26	24	33.32	26.07	43.18
Male ratio in the workforce (%)	66.50	10.32	66.65	9.08	66.36	11.57
Share of high-skilled jobs (%)	17.18	7.39	16.91	6.05	17.47	8.63
Workforce with secondary education (%)	25.35	16.43	23.81	12.81	26.94	19.52
Workforce with tertiary education (%)	9.07	6.47	8.59	5.86	9.57	7.09
Overeducated graduates (%)	23.00	11.12	22.11	10.02	23.91	12.22
Dependent Variable	**Mean**	**Std.**	**Mean**	**Std.**	**Mean**	**Std.**
Economic growth at t_5 (g_5) (%)	3.09	1.82	1.90	1.09	4.31	1.46
Independent Variables						
Total population (million)	128.73	299.59	46.03	57.65	213.67	407.98
Labor force participation rate (%)	61.08	9.56	58.49	7.43	63.74	10.82
Log GDP per capita at t_0	8.52	0.71	8.79	0.66	8.25	0.67
Pupils-teacher ratio	26.84	7.33	26.28	5.98	27.41	8.54
Access to mobile phone (%)	25.02	38.26	30.06	39.23	19.85	37.05
Male ratio in the workforce (%)	66.5	10.32	67.96	9.88	65.00	10.67
Share of high-skilled jobs (%)	17.18	7.39	18.25	7.00	16.09	7.72
Workforce with secondary education (%)	25.35	16.43	26.57	15.89	24.10	17.09
Workforce with tertiary education (%)	9.07	6.47	9.46	7.38	8.68	5.46
Overeducated graduates (%)	23	11.12	20.45	8.94	25.62	12.58
Total observations	**75**		**38**		**37**	

According to the Table 2, economic growth seems to be linked to several factors. First, population and labor force participation rate seem to yield positive impacts. Next, less developing economies look to grow faster. Nevertheless, the relation with other variables are not clearly observed. For example, the workforce with secondary or tertiary education seem to be positive for economic growth at short term but negative at medium term.

Regarding the effect of overeducation, the rate of overeducation might have a positive effect. To make their relation more clearly, we create a scatter plot with a linear regression line in the figure 2 below:

Figure 2: Relation between overeducation and economic growth



Based on the figure 2, the relation between overeducation and economic growth seems to be a bit perplex. At short term, overeducation seems to yield a positive effect. In contrast, at medium term, it looks to have a negative impact.

The uncertainty of their relation may be due to two factors: 1- The influence of other variables on the economic growth that we need to control for their effects, and 2- overeducation might be endogenous as suggested by prior researches (Dolton & Vignoles, 2000 ; Korpi &

Tåhlin, 2009). For example, the quality of education is found to affect both economic growth (Hanushek, 2013) and overeducation (Charlot & Decreuse, 2005). The existence of search friction in the labor market can also make graduates take more time to find a matched job (Jovanovic, 1979). Therefore, a good infrastructure that facilitates the communication and reduces the asymmetric of information may affect not only economic growth (Barro, 1990), but also overeducation (Chua & Chun, 2016).

It is thus necessary to conduct an econometric analysis to identify the real impact of overeducation on economic growth.

4 Method and Results

4.1 Method

The descriptive statistics have shown that the incidence of overeducation among graduates and other variables may have an impact on GDP growth per capita.

To identify the impact of overeducation on economic growth, we face two main problems: 1- Unobserved heterogeneity between countries and 2- Endogeneity of overeducation.

To deal with the first problem, we employ a fixed-effect (FE) model that offers an estimate of the following equation:

$$g_{it} = a_i + \alpha' x_{it} + \beta overeducation_{it} + u_{it} \tag{1}$$

where g_{it} defines the observed GDP growth per capita in country i at time t, a_i the individual-specific effects, x_{it} is a vector of independent variables (including total population, labor force participation rate, log of initial GDP per capita, pupils-to-teacher ratio, access to mobile phone, male ratio in the workforce, share of high-skilled jobs, percent of workforce with secondary and tertiary education), $overeducation_{it}$ reflects the observed rate of overeducation among graduates, u_{it} defines the error term, and α, β are unknown parameters, such that β represents the estimated effect of overeducation on economic growth, *ceteris paribus*.

One more useful thing about using the fixed effect model is that it also allows attrition, an eventual problem caused by unbalanced panel data, to be also captured by a_i, the unobserved individual-specific effects (Wooldridge, 2012, p.492).

Nevertheless, please note that an unbalanced panel data may cause attrition only if the reason that makes the panel unbalanced is correlated with the idiosyncratic error (Wooldridge, 2012, p.491). Provided the reason that each country usually conducts its census surveys in different years, and the length of time between two surveys can also differ from country to country, it is naturally random that our data is unbalanced. Thus, if the data is purely unbalanced due to survey availability in the relevant country, it should be not correlated with the idiosyncratic errors (Chun et al., 2017, p.11). Consequently, unbalanced panel of this type should not cause attrition or any serious problems (Wooldridge, 2012, p.491 ; Andress et al., 2013, p.177).

FE model supposes, however, that all variables are exogenous, but we have done the Durbin test, and it shows that overeducation is not exogenous:

Table 3: Test for endogeneity of overeducation

	Short-term economic growth (g_1)		Medium-term economic growth (g_5)	
Hypothesis	Durbin score	P-value	Durbin score	P-value
H_0: Overeducation is exogenous	15.446	0.0001	6.645	0.0099

Indeed, according to the Table 3, the p-value is highly significant, which rejects the null hypothesis that overeducation is exogenous.[16] Thus, to also deal with the endogenous problem, 2SLS regression with FE is used in the Model 2.

To employ the 2SLS regression model, we need an instrumental variable that has to fill two conditions: 1- instrument relevance and 2- instrument exogeneity (Wooldridge, 2012, p.514). The relevance of instrument implies that it must be correlated with the endogenous variable. The exogeneity assumption requires that the instrument must be exogenous (uncorrelated with the error term) and not a direct cause of the dependent variable.

In advanced economies, they find that older graduates are less likely to be overeducated because they have more experience, better relevant skill sets, and more opportunities for upward mobility (Morano, 2014 ; Kupets, 2015). Thus, graduates' age can be correlated with overeducation. Next, we find no evidence that graduates' age can directly impact economic growth. Hence, graduates' age should be exogenous. Therefore, the average of graduates' age, calculated from the IPUMSI data, should be eligible to be the instrumental variable.

Next, we also check the quality of this instrument by using the Cragg-Donald Wald test:

Table 4: Test for the quality of instrument

Hypothesis	Cragg-Donald Wald F-statistic	P-value
H_0: Instrument is weak	14.729	0.005

Based on the Cragg-Donald Wald test in the Table 4, the F-statistic value is significant and higher than the conventional value of 10 proposed by by Staiger & Stock (1994) and Stock et al. (2002), which allows us rejecting the null hypothesis that the instrument is weak. Thus, employing graduates' age as instrumental variable is not subjected to be bias.

We pay attention as well to the possible high multicollinearity between independent variables that we have selected. One common way to measure multicollinearity is the variance

[16]Reference: Stata manual at `https://www.stata.com/manuals13/rivregresspostestimation.pdf`

inflation factor (VIF), which assesses how much the variance of an estimated regression coefficient increases if the predictors are correlated (Wooldridge, 2012, p.98). Table 5 below presents the results of multicollinearity test using VIF:

Table 5: Variance inflation factor

Variables	VIF
Male ratio in the workforce	4.65
Labor force participation rate	4.5
Share of high skilled job	4.19
Workforce with tertiary education	3.39
Initial GDP per capita	2.39
Workforce with secondary education	2.30
Access to mobile phone	2.14
Overeducation	1.92
Pupils-teacher ratio	1.85
Total population	1.41
Mean VIF	2.87

Hair et al. (2009)[p.193] and Wooldridge (2012)[p.98] state that a VIF value smaller than 10 is commonly acceptable in the literature, and thus the correlations between independent variables should not cause serious problems.
According to the Table 5, we observe that the mean VIF value is only 2.87 and each variable possesses a VIF value less than 5 in accordance with the conventional threshold (VIF < 10) generally employed in the literature.

Finally, it is recommended to add a time variable in the panel data regression (Damodar et al., 2004, p.643) because if there exists a negative (or positive) economic shock in a given period, overeducation rate at that time could be high (or low) and economic growth could be low (or high). To check the presence of time effects, we conduct a Chi-squared test: .

Table 6: Test for time effects

Hypothesis	Chi-squared value	P-value
H_0: No effects of time variable	4373.18	0.000

The test result shows a significance of p-value, which leads to the rejection of null hypothesis that there are no time fixed effects (Damodar et al., 2004, p.644). Consequently, a year dummy indicator is added as another control variable in the regression model.

4.2 Results

Table 7: Impact of graduates' overeducation on economic growth

Impact on economic growth	**Short-term growth (g_1)**		**Medium-term growth (g_5)**	
VARIABLES	**FE**	**2SLS-FE**	**FE**	**2SLS-FE**
Overeducated graduates (%)	-0.006	-0.032***	-0.104**	-0.158***
	(0.014)	(0.011)	(0.050)	(0.050)
Log GDP at t_0	-0.716	-0.495	-4.698**	-4.251***
	(0.784)	(0.415)	(2.060)	(1.500)
Share of high skilled jobs (%)	-0.077	-0.103**	-0.086	-0.140
	(0.076)	(0.046)	(0.154)	(0.105)
Total population (million)	0.005**	0.005***	0.019***	0.0180***
	(0.002)	(0.001)	(0.006)	(0.004)
Labor force participation rate (%)	0.007	0.005	0.032	0.029
	(0.031)	(0.019)	(0.066)	(0.049)
Male ratio in the workforce (%)	0.076**	0.093***	0.241**	0.275***
	(0.034)	(0.023)	(0.095)	(0.063)
Workforce with secondary education (%)	0.009	0.017**	0.029	0.045*
	(0.014)	(0.008)	(0.031)	(0.024)
Workforce with tertiary education (%)	0.030	0.048*	0.061	0.099*
	(0.049)	(0.027)	(0.082)	(0.058)
Pupils to teacher ratio	-0.011	-0.006	-0.153	-0.143**
	(0.037)	(0.023)	(0.102)	(0.066)
Access to mobile phone (%)	0.007	0.005	0.030*	0.027*
	(0.009)	(0.005)	(0.018)	(0.014)
Constant	1.300	0.134	27.13	23.08
	(8.093)	(4.300)	(22.79)	(15.51)
Overeducated graduates[a] (%)				
Pupils-teacher ratio		1.282		1.282
		(0.980)		(0.980)
Access to mobile phone		0.011		0.011
		(0.180)		(0.180)
Mean of graduates' age		-3.54**		-3.54**
		(1.491)		(1.491)
Constant		199.61		199.61
		(190.63)		(190.63)
Year dummies	yes	yes	yes	yes
Observations	75	75	75	75
Countries	38	38	38	38
R^2	0.89	0.96	0.87	0.95
R^2 (no year dummies)	0.29	0.63	0.36	0.79

*** $p<0.01$, ** $p<0.05$, * $p<0.1$. Notes: Robust standard errors are in brackets.

[a]The 2SLS consists of two-stage equations. The equation that explains the endogenous variable (overeducation) is the first stage equation, and the one that explains dependent variable (economic growth) is the second stage equation. Readers may observe that the coefficient results for the first stage equation is the same for both columns (short and medium terms) because only the dependent variable in the second stage equation that was changed (from g_1 to g_5), while there is no modification for the first stage equation.

According to the model 2SLS-FE in the Table 7, several **contextual factors** affect the economic growth.

First, a high quantity of population, which may indicate a labor abundance, exerts a positive impact on economic growth as suggested by the classical model (Eltis, 2000). Then, we also note that the male ratio in the workforce does yield a positive impact at both short and medium terms as found by Wei & Zhang (2011). Perhaps, the gender inequality in developing countries, favoring males in education and access to managerial positions, is systematically large in developing countries (Jayachandran, 2015), making men more productive and being able to contribute more to economic growth. Reducing gender inequality in those countries should improve their economic development (Hakura et al., 2016). Next, there exists the convergence effect between poor and rich countries as estimated by the neoclassical model (Barro & Sala-i Martin, 1992), but only at medium term. An increase in pupils-teacher ratio, a proxy for a lower quality of education, decreases the economic growth rate at medium term as well, which emphasizes the importance of educational quality (Hanushek & Wößmann, 2007). Infrastructure, proxied by the access to mobile phone, positively influences the medium term growth rate as suggested by the endogenous growth model of Barro (1990).

Regarding the **skill requirement**, the share of high skilled jobs has a negative effect at short term that is a bit surprising at first glance. Having learned, however, that many high-skilled vacant jobs are unfilled or hard to fill at short-term, which can lead to high costs at both company and country levels (BCG, 2016), the negative sign of the share of high-skilled jobs can be comprehensible. Looking at another side to the **skill acquisition**, the workforce with secondary and tertiary education do have positive impacts for both short and medium terms. This also supports the human capital theory of Becker (1964) and endogenous growth model of Lucas (1988) who recommend that more educated people are more productive.

Finally, overeducation among graduates, the **matching indicator** between skill requirement and acquisition, is found to have a negative impact on economic growth. Without taking into account the endogeneity of overeducation (Model FE), this educational mismatch only significantly affects economic growth at medium term. After correction for the endogenous problem (Model 2SLS-FE), overeducation affects the growth rate at both short and medium terms, with also stronger effects. Thus, if we do not consider the endogenous problem, we will underestimate the impact of overeducation.

We also note that at $t = 1$, the impact of overeducation is marginal. Perhaps, at short-term, some overeducated graduates still feel optimistic to find a better matched job in the future, and thus, their job satisfaction are not yet too low. However, at medium-term of five years, they may feel more dissatisfied, which strongly impacts their productivity.

The negative effect of overeducation might also indicate that overeducated graduates in developing countries are perhaps not overskilled due to the possible lack of quality in education and inadequacy problem between supply and demand for graduates in some fields. Thus, the expansion of higher education might be not fully beneficial to those countries if educational mismatches among graduates are not taken into consideration.

5 Conclusion

Using a combination of the World Bank and IPUMSI data, this article analyzes the impact of overeducated graduates' incidence on economic growth with a focus on thirty-eight developing countries. Job analysis is employed to measure the overeducation rate, and to deal with unobserved heterogeneity between countries and endogeneity of overeducation, two-stage least square regression with country fixed-effects is estimated on the economic growth at short-term (one year) and medium-term (five years).

We find that higher rate of overeducated graduates lower the GDP growth per capita with a stronger effect at medium-term and when the endogeneity of overeducation is taken into account. This result is therefore more conforming to the "job satisfaction approach" than the "human capital approach". Indeed, many overeducated graduates in developing countries might be not overskilled due to the quality of education and the inadequacy between the supply and demand for graduates in some economic sectors. This may also explain why some researches did not find a significant relationship between higher education and economic growth, especially when the data contains developing countries. The main key contribution of this research is thus to take into consideration the education-job matching that the theoretical prediction and empirical literature on the link between tertiary education and economic growth seemly ignore.

Perhaps, to exploit the potential benefits of higher education, developing countries should improve more the quality of their education system from the primary school to tertiary education, such that students will graduate with the actual skills that correspond to their educational level. At the same time, they also need to strengthen the links between the higher education sector and the labor market. The negative impact from investing in higher education could discourage people, especially young generations, to apply more effort on their human capital development, which could make the situation worse in the future.

Given a limited available data, we cannot further analyze the effect of overeducation for specific regions and specific economic sectors. A future research is obviously needed to shed more light on this issue.

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Appendix: A

Table 8: Percentage of overeducated graduates by regions, countries and years

		Year and incidence of overeducation among graduates									
	Region & Country	**Year**	**% Overedu.**	**Year**	**% Overedu.**	**Year**	**% Overedu.**	**Year**	**% Overedu.**	**Year**	**% Overedu.**
I	**Latin America & Caribbean**	**1990-1994**	**18%**	**1995-1999**	**18%**	**2000-2004**	**22%**	**2005-2009**	**26%**	**2010-2011**	**28%**
1	Bolivia	1992	19%			2001	20%				
2	Brazil	1991	19%			2000	19%			2010	28%
3	Costa Rica					2000	12%			2011	23%
4	Cuba					2002	10%				
5	Dominican republic					2002	33%			2010	30%
6	El Savador							2007	18%		
7	Ecuador	1990	12%			2001	30%			2010	30%
8	Haiti					2003	33%				
9	Jamaica	1991	6%			2001	12%				
10	Mexico	1990	32%	1995	19%	2000	31%			2010	34%
11	Nicaragua			1995	16%			2005	25%		
12	Panama	1990	21%			2000	31%			2010	24%
13	Paraguay	1992	27%			2002	20%				
14	Peru	1993	18%					2007	34%		
15	Saint Lucia	1991	13%								
16	Venezuela	1990	15%			2001	16%				
II	**South Asia**	**1990-1994**	**26%**	**1995-1999**	**38%**	**2000-2004**	**36%**	**2005-2009**	**38%**	**2010-2011**	**n/a**
1	India	1993	37%	1999	38%	2004	36%	2009	38%		
2	Pakistan	1991	16%								

Table 8: Percentage of overeducated graduates by regions, countries and years (continued)

		Year and incidence of overeducation among graduates									
	Region & Country	**Year**	**% Overedu.**	**Year**	**% Overedu.**	**Year**	**% Overedu.**	**Year**	**% Overedu.**	**Year**	**% Overedu.**
III	**Europe and Central Asia**	**1990-1994**	**12%**	**1995-1999**	**17%**	**2000-2004**	**17%**	**2005-2009**	**11%**	**2010-2011**	**24%**
1	Armenia									2011	30%
2	Belarus			1999	9%			2009	11%		
3	kyrgyzstan			1999	25%						
4	Romania	1992	4%			2002	7%			2011	17%
5	Turkey	1990	20%			2000	28%				
IV	**East Asia & Pacific**	**1990-1994**	**21%**	**1995-1999**	**27%**	**2000-2004**	**25%**	**2005-2009**	**33%**	**2010-2011**	**n/a**
1	Cambodia			1998	43%			2008	51%		
2	China	1990	10%			2000	29%				
3	Fiji			1996	11%			2007	16%		
4	Indonesia	1990	36%	1995	44%			2005	54%		
5	Malaysia	1991	16%			2000	14%				
6	Mongolia					2000	17%				
7	Philippines	1990	29%			2000	41%				
8	Thailand	1990	13%			2000	26%				
9	Vietnam			1999	10%			2009	11%		
V	**Middle East & North Africa**	**1990-1994**	**13%**	**1995-1999**	**24%**	**2000-2004**	**18%**	**2005-2009**	**19%**	**2010-2011**	**29%**
1	Egypt			1996	7%			2006	16%		
2	Iran							2006	22%	2011	29%
3	Iraq			1997	43%						
4	Jordan					2004	7%				
5	Morocco	1994	13%			2004	28%				
6	Palestine			1997	24%			2007	20%		
	38 countries (75 obs.)	**1990-1994**	**19%**	**1995-1999**	**24%**	**2000-2004**	**23%**	**2005-2009**	**26%**	**2010-2011**	**27%**

Appendix: B

Table 9: Correspondence between occupational class and educational level

ISCO-08 occupational class	ILO skill level	ISCED-97 educational level
1. Manager	3 + 4	6, 5a and 5b
2. Professionals	4	6 and 5a
3. Technicians	3	5b
4. Clerks	2	4, 3 and 2
5. Service and sales	2	4, 3 and 2
6. Skilled agricultural	2	4, 3 and 2
7. Craft and related	2	4, 3 and 2
8. Plant and machine operators	2	4, 3 and 2
9. Elementary occupations	1	1

Source: ISCO-08, volume I

Table 10: Description of educational level required for each skill level

Skill level	Educational level	Description of educational level
4	6	Second stage of tertiary education (advanced research qualification)
	5a	First stage of tertiary education, 1st degree (medium duration)
3	5b	First stage of tertiary education (short or medium duration)
2	4	Post-secondary, non-tertiary education
	3	Upper secondary level of education
	2	Lower secondary level of education
1	1	Primary level of education

Source: ISCO-08, volume I

Notes: One limit of using this measure to estimate the rate of overeducation is that the same job title may not mean that workers are performing the same tasks, and thus workers can be required to possess different educational levels. Nevertheless, other measures of overeducation also possess other drawbacks as we have mentioned earlier regarding the statistical measure for example (please see the literature review of McGuinness (2006), Sala et al. (2011) and Leuven et al. (2011) for a further discussion on this matter). Additionally, the use of this measure is also constrained by the data availability. Previous researches on education-job mismatches in developing countries conducted by the International Labour Organization and Asian Development Bank also employ this same method by assigning the ISCO with 1 digit level to the ISCED (e.g., Sparreboom & Staneva, 2014 ; ILO and ADB, 2015).