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Income returns in a low-productivity country: Who benefits most from the Peruvian postsecondary educational system?

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Abstract

This research project investigates income returns of four different levels and different fields of study of Perú's postsecondary educational system. The theoretical foundation is the human capital theory and assumptions about labour market wage formation mechanisms of demand and supply. Data were taken from the "Encuesta nacional de hogares" (ENAHO), the Peruvian national household survey in 2017 (n = 65.615). The unit of analysis is the economically active population between 14 and 70 years of age, without students and pupils and without postsecondary education (PSE) droppers. Predominantly, employees and workers reported about their income data, although many Peruvians work at own account. The emerging selectivity bias was considered by applying a Heckman-two-stage regression.

Concerning different levels of PSE, I find that the working population with one (basic level) and two years (medium level) of PSE has no significant income increase in comparison to individuals without PSE. I assume two main reasons for this finding. First, the demand for those graduates is very low and they have to compete with a majority of individuals without PSE. Second, the quality of basic and medium level institutes are often assessed as of poor quality which subsequently might lower human capital for their graduates. However, for the group of employees and workers there are income increases of 17% for one year, and 13% for two years of PSE in Perú in comparison to employees and workers without PSE. Thus, my findings indicate, that basic and medium level degrees might not be directly beneficial, but indirectly by elevating the probability of finding an occupation as employee which comes along with a higher income. Surprisingly, graduates with two years of PSE benefit less than those with only one year. For the whole unit of analysis I find 32% higher hourly incomes for 3 to 4 years of PSE (superior level) and 99% higher hourly incomes for university graduates in comparison to the incomes of individuals without PSE.

Concerning income differences between fields of study, my findings suggest that engineers (besides lawyers and physicians) benefit most at the university level. Even though, there is high demand in this field, engineers at the superior level only range in the upper half of income returns in comparison to other fields of study. Pedagogues have the highest income returns at the superior level and are the only ones which can - just like that - compete with incomes from university graduates. The field of administration only rises chances of higher incomes at the superior level. At the university level those graduates have the significantly lowest returns, together with graduates from the related field of economics.

1 Introduction and research question

Perú is since the early 2000s in a transformation process. The country made a "considerable socioeconomic progress [due to] sound domestic policies and favourable external conditions" (OECD, 2015, p. 22). Perú reduced its poverty rate from around "60% in 2004 to less than 24% in 2013" (ibid.) and was able to make "remarkable advantages in providing health coverage to the most disadvantaged" (ibid.). However, in the second half of the current century, Perú is confronted with increasing slowdowns in economic growth. This is moreover highly relevant due to the countries high share of young citizens (about half of them are below 24 years (McCarthy and Musset, 2016, p. 86)). Cardenas et al. (2015, p. 9) suggest, that high birth rates in combination with "unused" human capital can have long lasting negative effects for a countries economic growth (so called middle-income-trap). The main driver for improvements in human capital is the educational system. Although the country faced an expansion in schooling (at both, general and postsecondary levels), the quality remains very heterogeneous and often poor. The Peruvian government seems aware of this and started diverse efforts to enhance this situation: "While educational reform efforts were geared primarily toward the traditional primary and secondary education sector, the quality discussion turned to the VET and tertiary sector in the mid-2000s, amid growing evidence of skill gaps and labour market shortages." (McCarthy and Musset, 2016, p. 54).
This research project wants to contribute to the current process of change and ask for the benefits of its graduates in 2017. What are the protrude features of postsecondary returns? Who benefits most of postsecondary education? Who benefits least? And what is the system‘s contribution to reduce social inequality?

I want to investigate those questions by analysing hourly income returns to Perú’s four different levels of postsecondary education and different fields of study for the highest two levels. The theoretical background is the human capital theory and assumptions about labour market wage formation mechanisms of supply and demand. I use Perú’s most extensive dataset, the ENAHO survey and the methodological approach is a OLS regression and a Heckman-two-stage regression due to selectivity bias in the data structure.

2 Theoretical background, Perú's economy and educational system

Human capital theory and labour market wage mechanisms The theoretical foundation of the research project is the *human capital theory* developed by Gary Becker (1993)[1]. Human capital can be defined as:

> [T]he skills, knowledge, and capabilities of the workforce of a firm, or of the population of a country, as well as the organizational arrangements and networks of relationships those people have formed that enable them to be more innovative and productive (Blair, 2011, p. 49).

Human capital is gained by "resources spent on education, training, [and] team-building [...] and can be analysed and understood [...] similar to the way economists [...] understand investments in physical capital" (ibid.). The main statement of the human capital theory is that different levels of knowledge and skills lead to different levels of productivity and therefore workers earn "different rates of compensation [*i.e. wages, own remark*] according to their skill level."(ibid., p. 50). Mainly[2] three factors determine the level of human capital somebody can accumulate: 1) Time someone spends to achieve specific skills and knowledge, 2) the quality of schooling (institutes) (i.e. infrastructure, teacher quality and a accountable, evaluable schooling structure (Burgess, 2016, p. 3)) and 3) the motivation and ability somebody has.

The theoretical assumption concerning the quality of schooling is that high quality schooling allows students to acquire more (and more labour market related) skills in the same amount of time, compared to schools of lower quality. Subsequently they earn higher wages because they are more productive. Concerning different *fields of study*, human capital theory states that different economic sectors generate products with differing monetary values. This means that, for example, graduates from engineering schools can transform their human capital into more valuable goods than e.g. graduates from the service sector. This subsequently leads to higher wages for engineers. Moreover, in some sectors high human capital is complementary to technology what might additionally increase productivity for high skilled workers (Gasparini et al., 2011, p. 17).
On-the-job training and experience are besides formal education the second constituting factor of human capital:

[1] The human capital theory is tested over a quarter-century and in "over one hundred countries with different cultures and economic systems" (Becker, 1993, p. 17) and also was applied in previous research about educational returns in Perú (e.g. Yamada (2007)).

[2] Becker (1993, p. 15) also states that health is a fundamental factor for the development of human capital, see also OECD (2015, p. 58).

> [O]n-the-job-training is an important source of the very large increase in earnings as workers gain greater experience at work. And recent bold estimates by Jacob Mincer suggest that the total investment in on-the-job-training may be almost as large as the investment in education (Becker, 1993, p. 20).

Besides the human capital theory, *labour market wage formation mechanisms of supply and demand* also influence incomes. The supply side idea is, that if the supply of a specific type of labour increases, the number of potential workers with low(er) reservation wages also increases. Because employees select those workers with the lowest reservation wages, this eventually leads to decreasing wages. Empirically, on the supply side the most important notification is the Peruvian expansion of PSE institutes and enrolment rates (see e.g. McCarthy and Musset (2016, p. 20)). However, previous research showed, that "the expansion of workers with secondary and tertiary education [...] played a very limited role in explaining the drastic changes in labour market returns to education in Latin America" (Gasparini et al., 2011, p. 16). In section 3 we will see, that for Perú this is generally, but not always the case.
The labour demand side has a bigger impact on wages: "[E]ngineers and philologists might have studied the same number of years, but if the demand for skills from engineers is higher, then they can push trough higher wages than philologists." (Anger et al., 2010, 8, *own translation*).

Perús ecomomy Perú has with about 60 to 70% one of the largest informal sectors in Latin America and - despite its economic growth - it has not declined in recent years (McCarthy and Musset, 2016, p. 23). Usually incomes in the informal sector are lower due to own-account workers/self-employment and unpaid family workers in the agricultural or manufacturing sector (OECD, 2015, p. 33; Aslam, 2007, p. 4). And SINEACE (2015, 30, *own translation*)[3] proves those international findings also for Peru: "independet workers had about 50% of the income compared to employees in firms with 10 to 49 workers". Moreover, it finds that a "major attribute of VET graduates is that a big share of them work independently or in small companies [...]." (ibid., 8, *own translation*). Small companies (called "MYPE", "micro y pequeñas empresas") and independent workers hold a big share of Perú's produtivity. This might be one reason why Perú's economic productivity is lower in comparison to other countries in Latin America and its OECD productivity benchmark positioning "has worsened over the past two decades" (OECD, 2016, p. 19). But not only the big share of independent and informal occupation shapes Perú's productivity:

[3] A Peruvian governmental institution for evaluation of postsecondary education.

> "Most of Peru's jobs are concentrated in the most unproductive sectors. More than half of all workers were in Peru's two most unproductive sectors: retail and restaurants, and agriculture [...]. This picture is even more striking for the most productive sectors. Together, mining, finance, energy and water, and telecommunications represent less than 4% of total employment. [...] While these findings seem to imply a misallocation of labour, they also present enormous potential for growth-enhancing structural transformation." (OECD, 2015, p. 103).

Therefore, the OECD (2016, p. 19) suggests that to maintain current levels of economic growth, Perú's economy needs a structural change through "the expansion of high demand sectors and the shifting of workers into more productive areas of the economy".
Concerning mismatch rates, SINEACE (2015, p. 23) found in 2011, that less than 15% of superior VET graduates had jobs in occupations which matched with their career type and level[4]. And on the other hand, only half of the employees working at the level of VET graduates actually had such a diploma (ibid., p. 8).
To put it in a nutshell, Perú's labour market is characterized by high levels of informality and low productivity compared to other countries in Latin America (OECD, 2016, p. 19). High mismatch rates emerge from this situation.

Perús (postsecondary) educational system Perú faced a tremendous increase of its postsecondary educational sector[5] due to a law from 1996 ("Decreto Legislativo 882") which liberated the educational market (Chacaltana et al., 2015, p. 28). In 2014 the share of the population in labour with postsecondary education was 31%[6] (ibid., 27, *own translation*). Half of them with university degrees (ibid.). With the expansion of Perús educational sector, in 2011, 58% of all young adults reported that they had "studied something" for their current occupation (ibid., 21, *own translation*). This young generation is heavily confronted with skills mismatch: *60%* of the graduates, who "studied something" reported problems of "inappropriate" or "underutilization" of their skills they learned in postsecondary education[7] (ibid., 21, *own translation*).

Besides some general schools and companies which also provide vocational education (McCarthy and Musset, 2016, p. 10), the actual postsecondary educational system is constituted by four levels:

[4] However, mismatch measurements are not always consistent between approaches (e.g. between objective and subjective measurements) and have to be treated with caution.
[5] So did the number of universities from 2001 to 2013 almost double to 140. IEST (see below) slightly increased in this period by about 12% to 742 institutes (Chacaltana et al., 2015, 29, own calculation).
[6] 27% with primary and 43% with secondary general education (ibid., p. 27).
[7] Yamada, Lavado, et al. (2015) report for college graduates an underemployment rate of about 40%. They see the increasing supply of low quality universities as a major factor of this situation.

1. *Basic level postsecondary education*
   It provides students education of at least one year (INEI, 2014, p. 15). Basic education is teached in "centros de educación técnico-productivo" (CETPRO). Over the country there exist over 1800 institutes. Basic PSE is also accessible for students that did not complete secondary education (about one third of Peruvians between 18 and 19 (McCarthy and Musset, 2016, p. 29)). Graduates receive the title "auxiliar técnico" - "assistant technician" (the term "technician" refers in Perú to VET in general, not only in the field of engineering). CETPRO institutes are public and privately by the same proportion (ibid., p. 28). The basic level refers to the ISCED level 3 (INEI, 2014, p. 29).

2. *Medium level postsecondary education*
   It provides students education of at least two years. This level is provided by over 700 institutes called "institutos de educación superior tecnológico" (IEST). Unlike the official governmental classification INEI (ibid.), McCarthy and Musset (2016, p. 10) suggest, that CETPRO also provide graduation on the medium level. Graduates receive the title "técnico"- "technician" (INEI, 2014, p. 14). The majority of IEST institutions is private with about 70% (McCarthy and Musset, 2016, p. 28). Medium level postsecondary education refers to the ISCED level 4 (INEI, 2014, p. 29).

3. *Superior - non-university*
   This level is called "educaćion superior non-universitaria", which means not university higher education. This level is also provided by IEST and other institutes in the fields of art, pedagogy and defence (ibid., p. 14). The courses duration is between three and four years and leads to the title "profesional técnico" - "professional technician" or just "professional" (ibid., p. 15). It refers to the ISCED level 5 (ibid., p. 29).

4. *Universitiy*
   The "universidad" level refers to the ISCED level 6 for bachelor, 7 for master and 8 for promotion (ibid., p. 23). From 140 universities about 65% are private (OECD, 2015, p. 61; Chacaltana et al., 2015, p. 28).

About 40%, or 600.000 students, of all postsecondary enrolments can be found in the first three levels, thus, the majority of postsecondary students enrol in universities (McCarthy and Musset, 2016, p. 33).

Concerning human capital in Perú Although Perú has faced a drastic increase in the number of educational institutes for both, general and postsecondary education, "[t]he quality of Perú's education system remains poor at all levels of education"

(OECD, 2015, p. 63). Perú has one of the lowest human capital indices in Latin America (ibid., p. 58) and "the performance of Peruvian students is generally lower than that of other countries with similar levels of development[8] (ibid., p. 63). Recently, Perú's government raised investments in primary education to tackle this issue and first studies from 2014 show positive effects for pupil's reading test scores (ibid., p. 63).
Concerning the quality of postsecondary education, the OECD finds that it is "far below international standards and highly fragmented." (ibid., p. 63). Rivero (2010, p. 1) finds that "[s]pecialists, as much as ordinary citizens of Peru, recognize that their country's problematic teaching profession is one of the most important factors affecting the quality of [all levels of the educational system]". Perú's government started diverse efforts to enhance this situation[9].
Concerning the access to postsecondary education, the OECD finds that "the higher the level of education the wider the [socio-economic] gap becomes."(OECD, 2015, p. 65). But not only access, also performance is "closely linked to different socioeconomic factors" in Perú (ibid., p. 66).
Furthermore, the correlation between the pupils socioeconomic status and the "educational resources of his or her school [...] is the highest among the Latin American countries participating in PISA" (ibid., p. 66). Although only 8 of 33 countries participated (Vegas and Zoido, 2017) and the results are only valid for general education, similar findings can be assumed for postsecondary education as well:

> "TVET system in Peru is of poor quality and is in many cases considered as inferior relative to university studies. Around 70% of students who finish secondary education and want to continue into higher education prefer to do so at university rather than within the TVET system. They consider university to be more complete and to offer a better quality education that is better connected to labour market demands" (OECD, 2015, p. 70).

In a study conducted by Chacaltana et al. (2015, 21, *own translation*) only 21% of all graduates assessed their postsecondary institute as of "good quality".
But not only is the subjective assessment of Perú's vocational education and training (VET) poor, also objective facts raise concern: "Some schools had clearly integrated academic learning and technical training while others, particularly among the CETPRO [...], appeared to focus almost exclusively on a narrow set of occupational skills." and

[8] For example ranked Peruvian pupils last of 65 participating countries in PISA 2012 (OECD, 2015, p. 63).

[9] E.g. the increase of governmental expenditures on education from currently 3% to the goal of 6% in 2020 (ibid., 61f), a law from 2014 to "strengthen the quality of [...] higher education" (ibid., p. 65) by supervising educational institutes by new formed institutions such as SUNEDU and MINTRA-MINEDU (Lavado et al., 2015, p. 24) and the foundation of SINEACE, a governmental evaluation institute which provides accreditation for high quality postsecondary educational institutes (SINEACE, 2019; Chacaltana et al., 2015, p. 25)

"through our site visits and expert interviews, we learned that many programmes offered through public institutions lack the equipment necessary to teach relevant occupational skills, including modern machinery, computers, software, etc." (McCarthy and Musset, 2016, p. 55). Another side concerning differences in the quality of different levels of postsecondary education are internships:

> Some schools have very strong linkages with relevant employers, in areas like financial services or commercial exports[...]. But many others are not [...]. Public school students may face the greatest challenges, as the schools have limited resources to devote to developing partnerships with employers and students are also likely to be from low-income households. [...] Students in CETPROs appear even less likely to participate in structured work-based learning opportunities. Internships are not a required component of these programmes." (ibid., p. 64).

McCarthy and Musset (ibid., p. 12) suggest that this lack of quality is rooted in the institute's financial dependencies:

> "The heavy reliance on tuition-dependent private providers, who enrol 70 percent of all VET students, presents special challenges, since it aligns the supply of programmes to the demand of students, rather than the demands of the labour market. The lack of institutional accountability for outcomes further aggravates alignment challenges, since schools have little incentive to focus on what happens to students after graduation."

Concerning wage formation mechanisms in Perú "In Peru, employment is concentrated in low and medium-skilled sectors, with only 18.6% of jobs requiring high skills and around 15% of the employed equipped with these" (OECD, 2015, p. 69). Employers reported for a World Bank survey in 2011, that not technical, but so called "soft skills" are "particularly scarce in the country" (ibid., p. 70) and those are the main reason why available positions stay unoccupied. SINEACE (2015, 32, *own translation*) find the same when citing an employer: "You have to get along with the people, the human factor is the most important and if that doesn't go well, the company won't progress".
The economic growth between 2004 and 2013 led to an increase of demand for graduates from higher education (superior and university level) by 52% while the demand for workers with primary and secondary education only rose by around 6% (OECD, 2015, p. 69). Especially firms from the technical sector (such as textile industry, food and chemical industry) have problems finding skilled workers" (ibid., p. 68), whereas "[f]ields like law, administration and accounting receive a large share of students"(ibid., p. 70). This situation should affect wage generating mechanisms by benefiting highly

skilled workers in the technical sector and punish those of the administrative fields of study. Gasparini et al. (2011, p. 28) investigate the change of the proportion of the GDP for different economic sectors. They find an expansion in the mining and construction sector of about 7 percentage points (pp)[10]. All other sectors they investigated had an decrease in their proportion of the GDP. McCarthy and Musset (2016, p. 12) name over- and undersupplied fields of study (FOS) in the labour market:

> "Specifically, the system is under-supplying graduates from science, maths, and engineering fields and oversupplying graduates in fields like accounting and administration, and many students in these fields work in jobs that are low skilled and do not require technical expertise."

The field of occupations in the administrative sector at the level of a technician is very heterogenous: 2011, $1/3$ of them worked independently , $1/3$ of them worked as employees in companies with more than 50 workers (SINEACE, 2015, p. 30). Although mismatch rates are low for administrative technicians ($2/3$ of them work in adequate positions), unfortunately, for administrative workers which studied at universities (professionals) the mismatch rates are one of the highest in comparison to other fields of study (ibid.). So, SINEACE (ibid., p. 31) find, that "the high levels of independent work and the decreasing rate of income increases" indicate a relatively low demand for administrative graduates from universities.
SINEACE (ibid., p. 56) conclude with a ranking of demand by different fields of study and level of PSE (based on ENAHO 2011). They find high demand for high levels of PSE in the fields of engineering (especially in the industrial and mining sector). Moreover, they find high demand for lower levels of PSE graduates in the fields of administration and the construction sector. They found low demand in the non-universitarian medical sector.

An investigation from Gamero Requena (2015, p. 29) interviewed employers and asked them about their demand of workers differentiated by their level of PSE. They found that in every sector the *demand for workers without PSE was the highest*. This might refer to the low levels of productivity over all sectors in Perú. The demand for workers without PSE was in the industrial and construction sector with 70% and 66% (of all levels of PSE in the industrial/construction sector) the highest compared to other sectors. In the tourism sector the demand for workers without PSE was the lowest with 42.5%. In almost every sector the demand decreased the higher PSE became. In the trading sector, the demand for workers with superior non-university PSE was relatively high with 28%. The highest demand of university graduates was in the mining sector with about 14%.

[10] He suggests that this is due to China's increasing demand of natural resources in this region.

Hypotheses From the previous theoretical assumptions concerning human capital theory and labour market wage formation mechanisms I derive the following hypotheses. The higher the level of postsecondary education is, the longer the duration of the course. That means that individuals with high PSE have more time to accumulate human capital which eventually leads to higher wages. Therefore I suggest:

HYPOTHESES IA: *The higher the level of postsecondary education, the higher future hourly incomes.*

Moreover, I want to test a hypotheses concerning the quality of basic and medium level PSE. I assume, that the low quality of those institutes leads to lower human capital which eventually affects wages. Because vocational education and training is "of poor quality"...

HYPOTHESES IB: *... the effects of basic and medium PSE on hourly incomes are much lower than for superior and university education.*

Different fields of study contain information about their sector related level of productivity and labour market supply and demand. Due to complexity reduction and because the fields of "engineering" and "administration" have high enrolment rates (Gamero Requena, 2015, p. 25), I want to focus on them for my analysis. Based on the arguments in the last section, predominantly the projections from SINEACE (2015, p. 56), I derive the following:

HYPOTHESES IIA: *Graduates at both levels, superior and university, have the most positive hourly income effects in the fields of engineering compared to other fields of study (and besides administration, law and medicine).*

HYPOTHESES IIB: *Graduates of superior non-university institutes in the field of administration have behind the field of "engineering" the most positive hourly income effects compared to other fields of study.*

HYPOTHESES IIC: *Graduates from universities in the field of administration have the lowest income effects compared to other fields of study.*

3 Previous research about income returns to postsecondary education

Although there is plenty of research concerning the returns to *college and university graduates* all around the world[11], Burgess (2016, p. 45) finds, that vocational education is "not [...] always [...] high up the agenda" of social research. One major cause is that (besides for "western" countries) the vocational educational sector is very heterogenous or non-existent at all (ibid.). It is no surprise, that also deeper analysis like comparing different levels and fields of study are "scarse [...] at global level." (Petek and Jagric, 2017, p. 62).
I found a few studies for the Peruvian case which investigated the field of interest of this research project and which were not outdated (crucial due to Perú's transformation process in the last two decades).

Lavado et al. (2015) analysed income differences between universities and superior institutes with special regard to their quality[12] and field of study. They used ENAHO data from 2012 which only *included respondents in full time occupation in urban areas*. They find high financial disparities between institutes of high and low quality. High quality university graduates do earn by mean 80% more than graduates from low quality universities, independent of their chosen field of study (ibid., p. 23). This is important to notice, because it characterises a major feature of Perú's postsecondary educational system. Research in high-productivity countries shows only small differences in future incomes concerning school quality. Card and Krueger (1996b, p. 177) find in a meta analysis a relatively small effect: "a 10 percent increase in school expeditures is associated with a *1 to 2 percent increase in annual earnings for the students later in life*." (ibid., 177, *own remark*). Although both studies use very different approaches to measure school quality, this might indicate that school characteristics in Perú determine to a much higher level future pathways than in high-productivity countries.

Lavado et al. (2015, p. 23) investigated hourly incomes of for different levels and fields of study. Besides law (13.6 ns) and medicine (15.2 ns) Lavado et al. find the highest incomes for both, university and superior institutes, in the fields of "engineering and other science" with 12.5 ns respective 6.8 ns. The lowest university incomes do have pedagogues with 7.9 ns, the lowest superior institute incomes do have graduates from the field "medicine others" with 4.9 ns.

[11] For an overview see Petek and Jagric (2017).

[12] Although the quality measure for universities is derived by an external benchmark, they measure the quality of superior institutes by differentiating between incomes: They assume that graduates with high income did graduate at an institute of high quality. It seems, that they entangle expanans and explanandum (Lavado et al., 2015, p. 5).

They also estimated income changes on base of logarithmic hourly incomes. Their reference group was the population with accomplished secondary education. The coefficient for superior institutes (of high quality) was highly significant with $\hat{\beta}_{IEST,high} = 0.782$ and for low quality superior institutes $\hat{\beta}_{IEST,low} = 0.109$. The university coefficients were for high quality universities $\hat{\beta}_{Uni,high} = 1.249$ and for low quality $\hat{\beta}_{Uni,low} = 0.304$, both significant. Their coefficient for females was $\hat{\beta}_{Female} = -0.256$ (Lavado et al., 2015, p. 12).

Yamada and Castro (2010, p. 15) found a significant increase of incomes by 10% for both, public and private superior institutes[13]. Public/private university graduates had an income increase of 18/15% Their gender penalty was higher than in Lavado et al. (2015, p. 12) with $\hat{\beta}_{Gender} = -0.36$ for women - this refers to their wider unit of analysis which contained the population without any schooling. Concerning the field of study, like Lavado et al. (ibid.), Yamada and Castro (2010, 15ff) unfortunately only focus on universities. Moreover, they did not consider the administrative FOS. They find the most positive effects (besides medicine with 18%) in the fields of economy and engineering with both 16%. Pedagogues had the lowest income benefits with 11%. "Medicine others" had an positive effect of 15%.

4 Data, operationalization and data restrictions

ENAHO 2017 The data were taken from the Peruvian national household survey "ENAHO", the "encuesta nacional de hogares sobre condiciones de vida y pobreza" in 2017[14]. The dataset is representative for Perú's 24 districts (INEI, 2017, p. 3) and contains 36.996 households with 132.657 individuals (ibid.). The data were only available in modules separated by topics (e.g. education, health, occupations, poverty, democratic participation) and had to be united for the analysis. The unit of analysis consists of the economically active population between 14 and 70 years[15]. Not part of the unit of analysis are respondents currently studying or which dropped postsecondary education

[13] They used pooled ENAHO data from 2007 to 2009. It has to be considered that they are about 10 years old and therefore at the edge of being outdated. Moreover it has to be considered, that their reference category for education was the group of Peruvians *without any schooling* which leads to higher effects than comparing with the group without PSE.

[14] Besides Perú's biggest survey ENAHO, McCarthy and Musset (2016, p. 11) state that the country has "demonstrated an impressive capacity for data collection and analysis". Many data are open access and can be found at the webpage of the ministry of statistics INEI.

[15] 70 years is in Perú the mandatory retirement age.

in their past[16]. The final dataset contains *65.615* individuals, 53% of them are female. The mean age was 42 years. Almost half of the respondents stated to be "mestizos" (offspring of an European and American Indian), about 30% reported to be American Indians. The population is over the regions almost equaly distributed with each $\frac{1}{3}$ for regions with less than 2000 inhabitants, regions between 2000 and 100.000 inhabitants and metropolitan regions with more than 100.000 inhabitants. Half of the respondents had completed secondary education, about 21% did not complete primary school.
22%, or 14.300 individuals, were unemployed. 41% of the working population reported to work as self-employed. 19% were workers, 19% were working as employees. 16% worked without payment for their families. From the working, 21% reported to have a second occupation. 17.802 individuals had completed PSE (26% of the unit of analysis) and informed about it. 20.370 individuals reported their incomes.

Operationalization The variables "Level of PSE" and "Field of study" were generated by a numeric code variable in the dataset which contained those two information (variables *p310c1* and *p301a1*) and an Excel-document from INEI which provided the decoding of this variables. The variable "Level of PSE" had to use the code variables because basic and medium PSE was not asked explicitly in the self-reporting question about highest achieved schooling level (p301a)[17]. "Level of PSE" only reports the highest achieved level of PSE[18]. Unfortunately, PSE droppers were only identified for superior and universtiy graduates. The variable "Level of PSE" contains 5 values: no PSE, basic, medium, superior and university PSE. The variable "field of study" was generated with the same raw code variable. It includes the following fields of study: "Medicine others" (mostly pharmacy and nursing), "Administration", "Economics", "Law", "Exact science others" (e.g. physicists and chemists), "Engineering", "Pedagogy", "Medicine (physicians)", "Service" and "Others". The category "others" contains the fields of "humanities", "arts", "journalism", "agriculture" and "police and military". The variable hourly income was generated by the question of the income last day/week/two weeks/month and the hours worked last week. It only includes data of the primary occupation[19].
Concerning the control variables: Occupational experience was measured with the question "How many years do you work in this occupation?". For ethnicity an available self-reported variable was chosen containing the most common ethnicities in Perú. Because

[16] Although, because of data restrictions it was not possible to filter droppers from basic and medium PSE. This is not a bigger issue because the schooling lasts short in those courses and the number of cases was small, see section 5.

[17] This variable was further used for consistency checks.

[18] 1.174 individuals had completed several PSE degrees, 345 of them on different levels.

[19] Although, income data were available for secondary occupations, considering them for the analysis was not possible due to lacking data about working hours.

the quality of PSE fluctuates between public and private institutes, a binary variable containing those information had to be generated. This information was found in a numeric code variable which contained those information (variables *p310e1* and *p301b1*)[20].

Models Jacob Mincer (1974) developed an empirical method to test the human capital theory. It will serve in a slightly adapted form for our analysis in section 5: Anger et al. conclude from previous research, that educational certificates have "a much higher impact on incomes than the number of years spent in education" (Anger et al., 2010, 10, *own translation*). Therefore, I will only include respondents with completed PSE tracks using dummy variables. Concerning experience, incomes first rise, but fall at a specific experience maximum [21]. This can also be shown in my data and therefore I include a squared term into the model. Control variables are ethnicity, gender and region.
I logarithmize the dependent variable "hourly income" to reduce heteroskedasticity[22]. A minor drawback is, that the coefficients now represent a percentage change in the geometric mean which is always below the arithmetic mean. The amount of explained sum of squares and therefore R^2 is much higher in the logarithmic model by almost the factor of 3. Multicollinearity was tested with the variance inflation factor. It won't be an issue in the following analysis.
James Heckman (1977) stated in the 1970s that dealing with income data in social science must consider selectivity bias. This is because of implicit conditioning on specific attributes by excluding social groups in the data generating process. In the Peruvian case, as stated in section 4, 41% of the working population is self-employed (see table 3). They usually have lower and harder to measure incomes than employees have. The ENAHO dataset makes no exception. Almost all income data emerge from the two groups "employees" and "workman" (each representing about 19% of all working individuals in the dataset). Therefore, only focussing on the group of employees would overestimate the effects of PSE on incomes. Heckman's approach allows to correct for this selectivity bias.
The regression model concerning income differences for different levels of postsec-

[20] Other approaches approximating PSE quality were part of the project but had to be dropped. One approach was to approximate school quality by measuring current student's costs in specific institutes. Another approach was to use teacher incomes. A third approach is also restricted to younger generations: SINEACE provides accreditation for high quality PSE (since a few years). Future research could merge those data with ENAHO to investigate if accreditation indicates higher incomes. However, all approaches were dropped due to the theoretical assumption, that *current* quality approximations would not cover the quality of institutes over several decades where respondents were actually enrolled. Further research could use those approaches to analyse the association between PSE quality and its returns of younger graduates in Perú.

[21] Yamada (2007) showed this for Perú.

[22] A Breusch-Pagan/Cook-Weisberg test scored very high with a χ^2 value of over 18000 without, and insignificantly low with 2.6 with the logarithmized dependent variable.

ondary education (HYPOTHESES I) will look the following way, including several control variables C (gender, region and ethnicity) and a calculated inverse mill's ratio = λ[23] for correcting for selectivity bias:

$$log(\hat{Y}_i) = \hat{\beta}_{cons} + \sum_{j=1}^{4}(\hat{\beta}_j PSE_{ij}) + \hat{\beta}_{exp} exp_i + \hat{\beta}_{exp^2} exp_i^2 + \sum_{k=1}^{7}(\hat{\beta}_k C_{ik}) + \lambda_i$$

The regression model concerning income differences for different fields of study will contain 7/9 (superior level/university level) fields of study as dummy variables and one reference category ("medicine others"). The control variables are experience and C, containing if the respondent visited a public or private institute, ethnicity, gender and the region the respondent lived. The model concerning HYPOTHESES II will look the following way:

$$log(\hat{Y}_i) = \hat{\beta}_{cons} + \sum_{j=1}^{7/9}(\hat{\beta}_j FOS_{ij}) + \hat{\beta}_{exp} exp_i + \hat{\beta}_{exp^2} exp_i^2 + \sum_{k=1}^{4}(\hat{\beta}_k C_{ik})$$

Data restrictions The available survey data did not contain some crucial variables which inevitably will lead to biased estimates. The most important might be some kind of measure for *social origin*. Social origin (approximated trough e.g. parental education, parental income or parental job prestige) is crucial for financial resources and therefore for decision making which PSE is accessible (e.g. private or public institutes). As stated in section 2, for Perú this is strongly the case. Therefore, this factor might cause confounding bias which can't be controlled in this project[24]. Another violation of the exogeniety assumption concerns *ability and motivation*. Those individual attributes can also influence both, decision making with regards to the type of PSE and also job-performance which affects incomes. As already stated in section 4, *schooling quality* is also not measured in depth (for further research see Card and Krueger (1996b, p. 165)). ENAHO unfortunately does not contain information if university graduates actually finished a *bachelor or masters degree*. This also might bias the estimate of university graduates, because in Perú many individuals work with a bachelors degree. However, table 3 shows a quiet similar standard deviation between university and superior graduate's incomes. That indicates that this restriction is no major issue. There might be a bias because of internal migration due to PSE. It could be argued, that performative students move to urban areas which might cause a reduction of productivity in rural areas (so called *"brain drain"*) which also might cause confounding bias. Finally, I was not able to predict a selection model for a Heckman-regression for the effects of

[23] For the prediction model of λ, see table 6.

[24] Because of the household survey structure of ENAHO, some data about parental background are available, but considering them in the analysis would lead to a strongly reduced dataset containing only young Peruvians who still live at their parents home.

fields of study on hourly incomes. This problem emerged due to a lack of theoretical assumptions, which graduates choose to work independently or as employees.

In ENAHO 2017, graduates from the first two levels of PSE (basic and medium) are concentrated in only a few fields of study. Thus, regression analysis of fields of study on incomes would violate positivity. Further research could pool ENAHO data from other years to tackle this issue. In this research project I will only make descriptive statements considering the fields of study for basic and medium PSE and focus on superior and university graduates for my analytical approaches.

5 Results

Bivariate results As we can see in table 1 and figure 1, genders are not equally distributed over different levels of PSE. In basic and medium PSE more than $\frac{2}{3}$ are women. Genders are almost equally distributed in superior (55% women), university (50% women) and no PSE (52% women). The majority of PSE graduates lives in areas

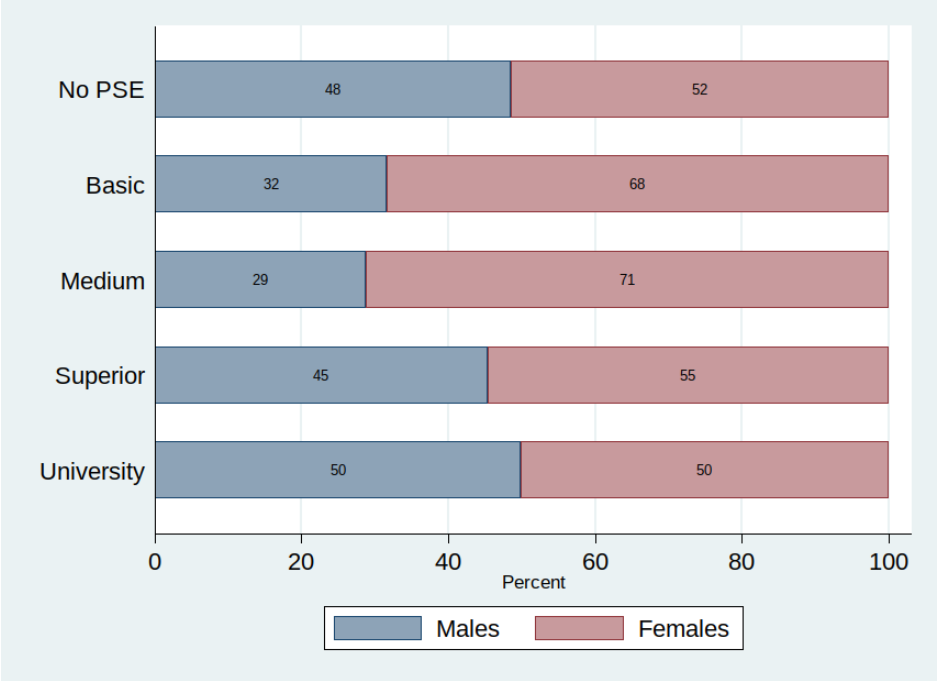

Figure 1: Distribution of gender by postsecondary education.

with more than 2000 inhabitants (villages and urban areas). Table 2 shows that university graduates are sparse in rural areas (6%) and the majority lives in urban areas

(66%). On the other hand, 46% of all individuals without PSE live in areas with less than 2000 inhabitants (rural) and only 27% of them live in urban areas. The map in

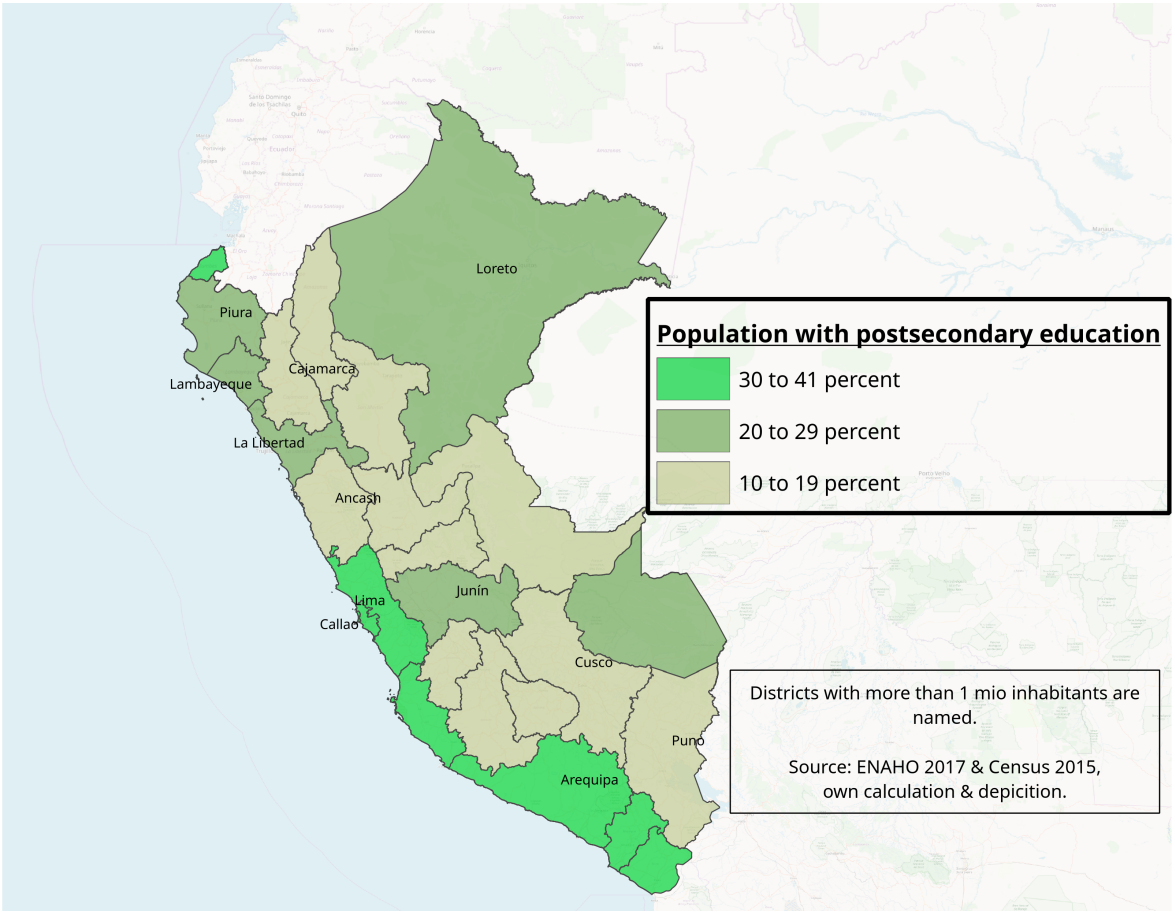

Figure 2: Population with postsecondary education. Source: ENAHO 2017 and Census 2015. Own depiction with QGIS.

figure 2 shows the distribution between rural and urban areas separated by Perú's 24 districts. Mostly, rural areas have a lower share of inhabitants with PSE (bright green). One exception is the populated north, where in most districts the share of inhabitants with PSE does not exceed 30%. The districts of Lima (18%), Tacna and Arequipa (both 16%) have the highest share of university graduates in their population (not depicted). The highest share of inhabitants without PSE have the districts of Cajamarca, Apurimac (both 87%) and Huancavelica (88%). Table 3 and figure 3 show the distribution of PSE by occupational type. We see that the majority of individuals without PSE refer themself to self-employment (46%) or working for their families (19%). As theoretically expected, the higher PSE gets, the higher the share of individuals working as employees. Only 6% of individuals without PSE work as employees whereas 73% of university

Figure 3: Distribution of occupational type by postsecondary education.

graduates work in this occupational type.

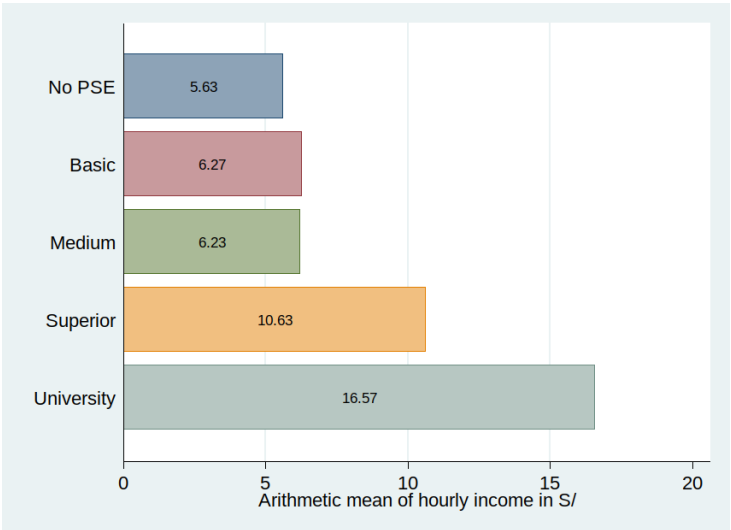

Figure 4: Mean hourly income by postsecondary education in nuevo soles.

Table 4 and figure 4 show the hourly income distribution between different levels of

PSE and no PSE at all. Income data about the first two levels of PSE are relatively small because the majority works self-employed or within their families. Employed Peruvians without PSE have a mean income of 5.63 nuevo soles (S/). The mean income increases slightly for graduates from basic and medium PSE with 6.27 S/ and 6.23 S/. Already here we find a surprising decrease in the hourly income mean for medium level graduates - although they have one additional year of education employers seem not to reward it. Employed superior PSE graduates have a hourly mean income from 10.63 S/. University graduates have the highest hourly mean income with 16.57 S/. But both upper PSE levels also have the highest variance in their incomes with a standard deviation of 19.60 (superior) and 21.37 (university).

Table 5 and figure 5 show a summary of hourly income statistics for each field of study

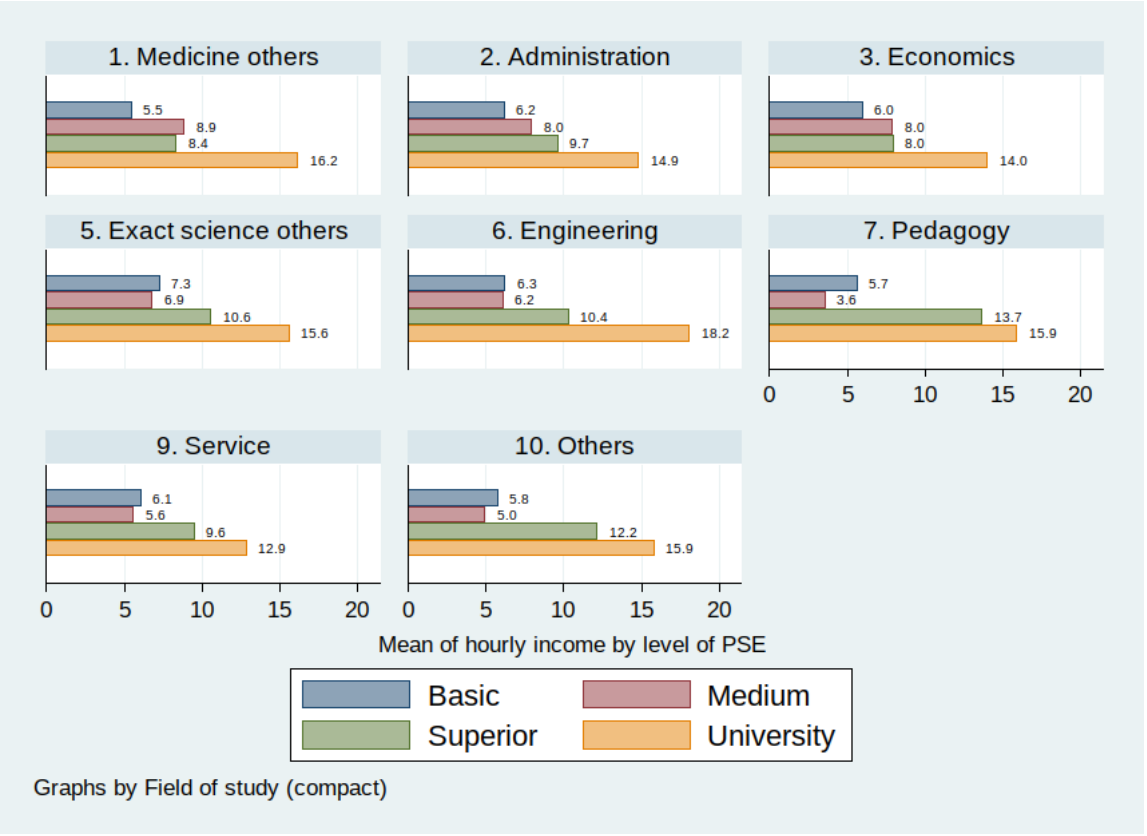

Figure 5: Mean of hourly income by level and field of study of PSE. Mind that for some FOS basic and medium level PSE contain very few cases, see table 5.

and level of PSE[25]. Table 5 shows, that the majority in basic and medium PSE only

[25] Differences between table 4 without, and table 5 with fields of study emerge because not all individuals who informed about their level, also informed about their studied field.

graduated in the fields of "exact science others", "engineering" and "service"[26]. I will now summarize shortly my findings concerning the most rewarding and less rewarding FOS.
The field of "exact science others" seems - besides the medium level - a rewarding FOS over all levels of PSE in comparison to other FOS. Comparing with the mean hourly incomes within each level, basic level graduates in "exact science others" have the highest mean incomes (7.33 S/ to 6.31 S/), on the medium level the reward (6.87 S/ to 6.23 S/) is higher than for engineering graduates and also at the superior level the mean income ranges in the upper half with 10.62 S/ (to 10.63). University graduates in "exact science others" range in the lower half of hourly mean incomes (15.64 S/ to 16.58 S/) in comparison to other university FOS. Over all levels "service" graduates seem to have the lowest rewards compared with the mean income of each level. They only earn 6.13 S/ at the basic, 5.64 S/ at the medium, 9.57 S/ at the superior and 12.89 S/ at the university level.
Pedagogy graduates at the superior level are the only group which can surpass a university graduate's income with 13.72 S/. And this is only the case for university graduates from the service FOS (12.89 S/). All other mean incomes are at the superior level below the university level with a difference of (overall) 6 S/.
"Engineering" is at the basic level the second most rewarding field of study with a hourly mean income of 6.28 S/. Although, the majority of employed graduates at the medium level graduated in "engineering", the reward is in the lower half on incomes with 6.18 S/. For superior and university graduates, "engineering" is a rewarding field of study with a hourly mean income of 10.36 S/ and 18.16 S/. Thus, the gap between the incomes of superior and university graduates is very high (only for "medicine others" the gap between superior and university level is comparable). Moreover, the SD is below the level's SD for engineers. This might indicate relatively high and stable hourly incomes for engineers in the two upper levels of PSE. University graduates in this field have even the highest hourly incomes besides "medicine" and "law" graduates. This descriptive findings, especially the hughe income increase for university graduates, could imply a recommendation to choose university in favour of superior education, if a young individual is aiming for a career in engineering in Perú.
For our second group of interest, graduates from the administrative field, we find the following: Their mean hourly income is at the basic level relatively low with 6.24 S/. But it increases for graduates at the medium level to 8.04 S/ (even though there are only 8 cases, a low SD of 2.46 indicates homogenous incomes) and is therefore in this field the second highest behind "medicine others". Administrative graduates at the superior level earn 9.68 S/ by mean and thus they are about 1 S/ below the levels mean of 10.63. Graduates from university in this field are in the bottom group of incomes with 14.83 S/, together with economics (14.04 S/) and service graduates (12.89 S/).

[26]This restricts my following data analysis, see *"Restrictions"* in section 4.

Multivariate results

Results concerning hourly incomes of different levels of PSE Concerning HYPOTHESES IA, that a higher level of PSE leads to a higher hourly income, table 6 and the coefficient plot in figure 6 show that all four models (restricted (1) and (2), and unrestricted (3) and (4)), OLS and Heckman, imply a falsification of HYPOTHESES IA. I find a lower effect for the medium level PSE in comparison to the basic level of PSE.

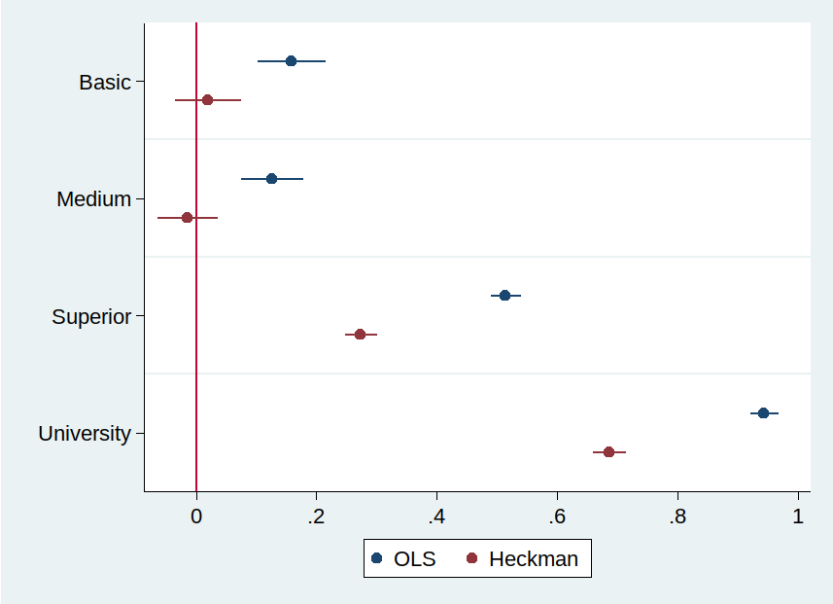

Figure 6: Coefficient plot of unrestricted OLS and Heckman regression coefficients over different levels of PSE on hourly incomes. The reference group are individuals without PSE. Controlled for experience, ethnicity, region and gender.

This is astonishing because graduates from this level not even benefit from the additional year of PSE, but employers seem to punish the extra year. The significant positive effects of the OLS models ((1) and (3)) for basic and medium PSE vanish when considering selectivity bias in the Heckman models ((2) and (4)). This findings correspond to table 3, which shows that basic and medium level graduates have a much higher chance to work as a employee (about 20%) in comparison to individuals without PSE (6%). As the Heckman regression corrects for that selectivity, the findings indicate no significant (direct) effect of the level of PSE on hourly incomes for the lower two levels. Not considering selectivity bias but controlling for ethnicity, experience, gender and region,

model (3) implies an increase in hourly incomes by $e^{\hat{\beta_{PSE=2}}} = e^{0.159} = 1.172 = 17\%$[27] for basic, and 13% for medium level PSE in comparison to individuals without PSE. However, HYPOTHESES IB can not be falsified. In model (4) I find a much smaller and insignificant effect (2%) for basic and even a negative effect (-1.4%) for medium PSE, which I considered both as of "poor quality". Here human capital theory comes to its limits. One assumption might be, that medium level graduates have a worse reputation than basic level graduates in terms of signalling theory. Or a (uncontrolled) confounding effect of socioeconomic background might explain these findings. As stated in section 2, students who enrol in the lower levels of PSE usually lack skills and knowledge of general education. Juveniles without completed secondary education only can access basic and medium level PSE. On top comes the low quality and connectivity to labour market relevant skills in basic and medium PSE. Besides those human capital drawbacks, as Gamero Requena (2015, p. 29) states, employers have the highest demand for workers without PSE and moreover Perú's sector of high productivity is very small with about 4% (OECD, 2015, p. 103). Basic and medium level graduates have to compete with workers without PSE. However, my findings show an indirect positive effect for low levels of PSE on incomes. Those levels might increase the chance of finding an occupation as employee (see table 3). Within the group of employees (and workers) graduates with basic and medium level PSE do have higher incomes of 17% for basic and 13% for medium level graduates (see model 6: (3)) in comparison to the hourly incomes of employees and workmen without PSE.

For the two upper levels of postsecondary education, superior and university, HYPOTHESES IA can not be falsified. All models find a significant increase in hourly incomes. The OLS model, as assumed, overestimates the income benefit. Thus, *employees and workman* with superior level degrees earn about $e^{0.515} = 1.673 = 67\%$ higher incomes, university graduates about $e^{0.945} = 2.573 = 157\%$ higher incomes than employees and workmen without PSE. Considering selectivity, the Heckman model (4) predicts an income increase of 32% for superior graduates and a 99% income increase for university graduates *in comparison to the working population* without PSE.
Controlling for ethnicity, region and gender increased the income effect of PSE in the two upper levels slightly. We see in model (4), that both control variables, female (11% lower incomes than men) and urbanity (1.3% lower income the more populated the region (8 semimetric values)) have a significantly negative impact on hourly wages. I did not expect the latter negative effect of urbanity. This might be due to holding constant different levels of PSE, within those rural inhabitants might have (slightly) higher in-

[27] The coefficients in regression models with logarithmized dependent variables can't be - as usually falsly done -directly interpreted as percentage change of the dependent variable. IDRE (2018) states, that the coefficient $\hat{\beta}_k$ powered to the base of e, i.e. $e^{\hat{\beta}_k}$, is the correct percentage change in the *geometric mean* of Y. Using directly $\hat{\beta}_k$ is an approximation of $e^{\hat{\beta}_k}$ as they only differ slightly. The geometric mean is always below the arithmetic mean. It is calculated as $\sqrt[n]{\prod_{i=1}^{n} x_i}$.

comes. I find a significant effect for job experience. Until the age of about 35 years, each year in the same occupation increases the hourly income[28]. After 35 years in the same occupation hourly incomes decrease. Concerning the ethnic background, fortunately the Heckman model does not show significance for any ethnicity. This might be due to already controlling for region, indigenous groups as the Aymara and Amazonian tribes live mostly in rural areas. The unrestricted OLS model (3) has an adjusted R^2 of 39% (not shown in table 6). All predictor variables in the first step selection models are highly significant, the adjusted R^2 is 13.3% (not shown in table 6). Mill's inverse ratio (λ) in the second step regression is also highly significant with the expected sign which indicates negative selection bias.

Results concerning hourly incomes of different fields of study Table 7 and the coefficient plot in figure 7 refer to differences in the geometric mean hourly income for different fields of study of employees and workmen[29]. Concerning HYPOTHESES IIA which states that engineering graduates have the highest income benefits on the two upper levels of PSE, the coefficient plot in figure 7 shows clearly, that this is only partially the case. After controlling for experience, public/private institutes, ethnicity, gender and region, studying engineering at the superior level leads to significantly positive income effects. Their hourly income is about $e^{0.172} = 1.189 = 19\%$ higher than for "medicine others" graduates (reference group). Graduates in "service" also have a high effect of 19% which might refer to the high demand of superior graduates in the tourism sector. Also pedagogues surpass engineers with a very high income increase of 56%, which is in line with the findings of previous research in section 3. Therefore, surprisingly superior level engineering graduates only range in the upper midfield of hourly incomes and their high labour demand at the superior level as stated by SINEACE (2015, p. 56) can not completely supported by analysing their income returns. However, university graduated engineers do have the highest income benefits with an coefficient of 9% in comparison to "medicine others" (besides law and medicine). Surprisingly, the related FOS "exact science others" does have an insignificant lower income effect in comparison to "medicine others" and is not as expected from the projections from SINEACE (ibid.). The bivariate (section 5) big income gap for engineers between superior and university level graduates can not hold when controlling for several covariates. This might be due to almost double the effect of region between the levels with 2.4% for superior

[28] Note, that the coefficient can not be interpreted as the additional effect "per year" because the relationship with log(hourly income) is squared (concave) and not linear.

[29] I also calculated Heckman regression models for the analysis of FOS on hourly incomes. Unfortunately, I found no good prediction variables to *predict the occupational type of graduates*. The selection models had very low explanatory power with R^2 = 3% and they changed the coefficients only marginally (downwards).

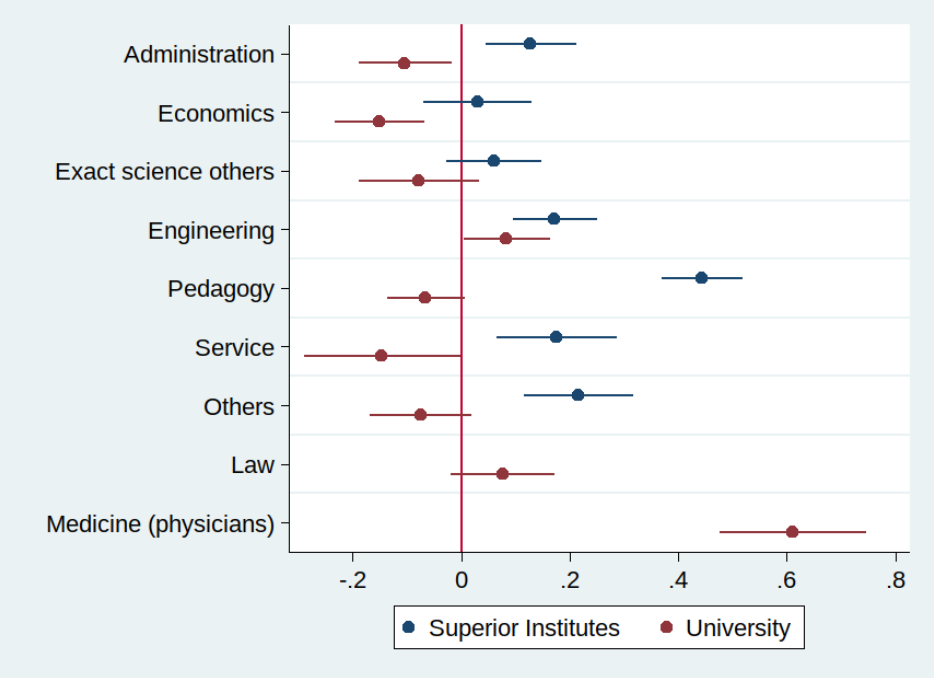

Figure 7: Coefficient plot of fields of study on log(hourly income). Reference group are individuals with the FOS "medicine others". Controlling for public/private institute, ethnicity, gender and region.

and 4.6% for university graduates. Meaning that the bivariate gap may be caused more by regional differences (more rural superior institutes) than for the actual field of study. The coefficient plot in figure 7 shows moreover, that "medicine others" at the university level ranges in the upper income groups and is therefore not comparable to its superior counterpart. The stated low demand for medical technicians (Gamero Requena, 2015, p. 29; SINEACE, 2015, p. 42) can not be proved on the university level in my findings. Investigating HYPOTHESES IIB, that superior graduates in the field of administration have the second highest income effects behind engineering, follows the falsification of IIA: I also have to falsify HYPOTHESES IIB. As we can see in the coefficient plot in figure 7, the effect of administration ranges with 14% in the upper half, pedagogy, service and "other" graduates surpass administrative graduates in terms of hourly incomes. The theoretically stated high demand for administrative employees on the superior level (Gamero Requena, 2015, p. 29) seems not to increase their incomes strongly. However, engineering, administration, service and other FOS range at a relatively high level of hourly incomes at the superior level. The gaps between administration and engineering might be surprising because human capital theory states that fields with higher productivity generate higher incomes. The data, however, show only small gaps between the administrative and the engineering FOS. This might be due to Perú's labour market

structure where many individuals face occupational mismatch and chances of getting a job in the right sector is low. Further research could control for horizontal mismatch rates to prove this assumption. Data to measure it are available in ENAHO.
HYPOTHESES IIC which states the lowest income effects for administrative graduates on the university level can partly verified in the sample with a negative effect of -11%. Only the related FOS "economics" has a lower income effect with -16%. Moreover, inferring to the unit of analysis, only those two fields have significantly lower hourly incomes than "medicine others". Those were the only strong significantly fields which differed from the reference group at the university level. Those empirical findings support strongly the predictions made for demand and supply for university graduates in the field of "administration".
Experience has a slightly stronger effect for university graduates with about 5.3% to 5.0% for each additional year in the same occupation (until the maximum of about 35 years). Women have a higher gender penalty when studied at the superior level with a negative income effect of -18% in comparison to university graduates with -14%. Mention, that the effects of gender are robust concerning FOS and working hours.

6 Conclusion

This research project aimed to answer the question who benefits most from postsecondary education in Perú. My findings were in line with previous research and I described the income situation for postsecondary graduates in 2017. This investigation is the only known to me which shows income returns to postsecondary education of a duration with less than three years in Perú.

So, who benefits most? University graduates in general (except in the field of "service"). Besides medicine and law, engineers benefit most at the university level and therefore have the highest hourly incomes in Perú. Surprisingly this is not the case for engineers at the superior level. Although, their incomes range in the upper half, they are not higher than for example for superior graduates in the field of "service". As companies in the "engineering" sector state high demand of skilled labour and human capital theory also predicts high returns for those graduates, this finding seems puzzling and can only be partially explained with the high demand for superior graduates in other fields (e.g. tourism). Graduates at the superior level have the highest hourly incomes if they studied pedagogy. Studying administration rises the chance of higher incomes only at the superior level.
And who benefits least? Unfortunately, the data indicate that studying at a basic or medium level institute has - *by mean* - no direct effect on hourly incomes. Social disadvantages from general schooling continue at those levels and additionally the demand

for those graduates is very low. The worst income effects have graduates at the medium level. Why exactly the labour market punishes an extra year of PSE remains unclear. However, if graduates from the lower two levels of PSE attain an occupation as employee or worker, their incomes increase in comparison to those without PSE. Thus, those graduates might benefit indirectly from PSE.

The data show that education functions strongly as a tool of labour market integration in Perú. Improving education at the lower levels seems therefore especially important. It might help to reduce income inequality, as individuals without PSE earn almost 100% less than university graduates. By developing lower levels of PSE the Peruvian society could take the second chance which was missed by general schools to include disadvantaged social groups into the labour market. On the long run this is not only charitable but might increase Perú's overall human capital potential which eventually could help to overcome the hazards of the middle-income-trap (see also McCarthy and Musset (2016, p. 23) and McCarthy and Musset (2016, p. 61)). The demand is there: 28% of employers reported that "inadequate education was a serious or very serious problem for the companies actions" (Lavado et al., 2015, 2, *own translation*).

Further research could take advantage of the huge potential of the annual structure of ENAHO and pool data to get deeper insights in basic, medium PSE and higher fragmented fields of study[30]. Moreover, a lack of measurements for social origin, abilities and "quality of PSE institutes" could not be tackled here and needs further research. Concerning the drawback of a measure of "quality": data about evaluation results of PSE institutes are recently available (SINEACE, 2019) and could be implemented in further research about returns of postsecondary education in Perú.

[30] Some projections (SINEACE, 2015) focus on narrow sectors. E.g. "Engineers" could be split up into the construction, electronic, industrial and even mining sectors.

7 Tables and figures

Table 1: Postsecondary education by gender (%)

	Gender		
Postsecondary education	Man	Woman	Total
No PSE	48	52	100
Basic	32	68	100
Medium	29	71	100
Superior	45	55	100
University	50	50	100
Total	47	53	100

Source: ENAHO 2017

Table 2: Postsecondary education by rural/urban (%)

	Rural/Urban			
Postsecondary education	Rural	Villages	Urban	Total
No PSE	46	27	27	100
Basic	14	31	55	100
Medium	13	35	52	100
Superior	13	39	48	100
University	6	28	66	100
Total	37	29	35	100

Source: ENAHO 2017

Table 3: Postsecondary education by type of occupation (%)

	Type of Occupation							
PSE	Employer	Self-e.	Employee	Workman	Family w.	Home w.	Others	Total
No PSE	4	46	6	22	19	2	0	100
Basic	3	42	22	21	8	4	0	100
Medium	4	45	19	20	8	3	0	100
Superior	4	25	50	13	5	1	0	100
University	5	16	73	2	3	0	0	100
Total	4	41	19	19	16	2	0	100

Source: ENAHO 2017

Table 4: Postsecondary education by hourly income in nuevo soles (S/)

Postsecondary education	**n**	**Mean**	**SD**
No PSE	11875	5.63	7.15
Basic	501	6.27	4.20
Medium	596	6.23	4.80
Superior	3315	10.63	19.60
University	4084	16.57	21.37
Total	20371	8.67	14.27

Source: ENAHO 2017

Table 5: Postsecondary education by field of study and hourly income in nuevo soles (S/)

	Basic			Medium			Superior			University		
Field of study	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Medicine others	22	5.51	2.79	6	8.89	10.43	557	8.41	17	399	16.23	12.32
Administration	66	6.24	3.77	8	8.03	2.46	389	9.68	18.75	430	14.89	12.03
Economics	1	6.04	.	26	7.95	4.81	212	8.02	5.89	487	14.04	12.50
Law	1	1.25	.							275	19.16	18.99
Exact science others	80	7.33	4.98	99	6.87	5.36	333	10.62	41.07	181	15.64	12.19
Engineering	143	6.28	4.49	256	6.18	4.37	730	10.36	15.95	690	18.16	15.33
Pedagogy	10	5.71	2.53	2	3.64	0.38	695	13.72	13.20	1102	15.94	32.94
Medicine (physicians)										108	32.43	18.66
Service	135	6.13	4.15	192	5.64	4.91	157	9.57	11.56	86	12.89	10.47
Others	36	5.82	3.09	7	5.01	1.10	241	12.23	16.94	320	15.86	17.66
Total	494	6.31	4.21	596	6.23	4.80	3315	10.63	19.60	4078	16.58	21.38

Source: ENAHO 2017

Table 6: Regression table on log(hourly income) with OLS and Heckman two-stage regression

	(1) OLS	(2) Heckman	(3) OLS	(4) Heckman
No PSE	Ref.	Ref.	Ref.	Ref.
Basic	0.164***	-0.0242	0.159***	0.0202
	(5.57)	(-0.86)	(5.57)	(0.72)
Medium	0.132***	-0.0557*	0.126***	-0.0144
	(4.85)	(-2.17)	(4.81)	(-0.56)
Superior	0.533***	0.244***	0.515***	0.274***
	(41.78)	(17.89)	(41.10)	(19.85)
University	0.995***	0.646***	0.945***	0.688***
	(83.68)	(47.76)	(78.22)	(49.97)
Experience	0.0373***	0.0227***	0.0330***	0.0226***
	(25.27)	(16.18)	(23.17)	(16.18)
Experience ^{2}	-0.000637***	-0.000313***	-0.000528***	-0.000322***
	(-13.34)	(-6.96)	(-11.48)	(-7.20)
European			Ref.	Ref.
Mestize			-0.00360	-0.0132
			(-0.18)	(-0.68)
Indigenous			-0.0505*	-0.0245
			(-2.36)	(-1.20)
African			-0.0507	-0.0258
			(-1.91)	(-1.03)
Others			-0.0498	-0.0267
			(-1.74)	(-0.99)
Female			-0.284***	-0.116***
			(-31.44)	(-9.96)
Rural to Urban (8 scales)			0.0550***	-0.0130***
			(26.70)	(-4.14)
Constant	1.371***	2.288***	1.238***	2.404***
	(202.35)	(119.01)	(54.88)	(61.26)
Selection model				
No primary school		Ref.		Ref.
Primary school		0.228***		0.228***
		(12.49)		(12.49)
Secondary School		0.581***		0.581***
		(32.31)		(32.31)
Female		-0.215***		-0.215***
		(-17.88)		(-17.88)
Rural to Urban (8 scales)		0.0824***		0.0824***
		(29.88)		(29.88)
Formal sector		0.642***		0.642***
		(42.61)		(42.61)
Constant		-1.732***		-1.732***
		(-76.41)		(-76.41)
λ		-0.882***		-0.877***
		(-51.61)		(-37.45)
Observations	20370	52014	20370	52014

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: Regression table on log(hourly income) by fields of study

	(1) Superior Institutes	(2) University
Medicine others	Ref.	Ref.
Administration	0.128**	-0.103*
	(3.00)	(-2.35)
Economics	0.0302	-0.151***
	(0.59)	(-3.58)
Exact science others	0.0605	-0.0784
	(1.36)	(-1.39)
Engineering	0.172***	0.0843*
	(4.35)	(2.06)
Pedagogy	0.445***	-0.0655
	(11.74)	(-1.79)
Service	0.176**	-0.146*
	(3.10)	(-1.98)
Law		0.0765
		(1.55)
Medicine (physicians)		0.611***
		(8.85)
Others	0.216***	-0.0743
	(4.20)	(-1.55)
Experience	0.0484***	0.0515***
	(12.52)	(16.29)
Experience^2	-0.000890***	-0.00105***
	(-6.95)	(-10.19)
Public institute	-0.0229	0.0160
	(-0.93)	(0.77)
European	Ref.	Ref.
Mestize	0.0871	-0.0703
	(1.62)	(-1.56)
Indigenous	0.0111	-0.0878
	(0.19)	(-1.77)
African	0.00790	-0.211**
	(0.11)	(-2.76)
Others	-0.0838	-0.0823
	(-1.07)	(-1.19)
Female	-0.167***	-0.133***
	(-6.57)	(-6.42)
Rural to Urban (8 scales)	0.0238***	0.0454***
	(4.02)	(7.26)
Constant	1.584***	2.184***
	(22.22)	(31.27)
Observations	3044	3961

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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