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What drives cross-country differences in average earnings: occupational structure or within-occupation wage levels?

Bakalářská práce

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Abstrakt

Tato práce se zabývá rozdíly v průměrných mzdách mezi zeměmi a zkoumá, jestli jsou způsobeny rozdílným ohodnocením porovnatelných povolání nebo rozdílnou strukturou povolání. K oddelění těchto dvou vlivů používá myšlenkový experiment, který se skládá z nahrazení struktury nebo platů země za strukturu nebo platy jiné země a měření rozdílu v průměrné mzdě, který toto nahrazení způsobí. K tomuto myšlenkovému experimentu používá data poskytnutá organizací International Labour Organisation, která obsahují jak struktury povolání, tak platy pro srovnatelné pracovní pozice pro mnoho zemí. Výsledky svědčí o tom, že většina rozdílu v průměrných mzdách je způsobena jinou úrovní mezd pro srovnatelná povolání a jen menší část jinou strukturou povolání. Struktura mezd má relativně větší vliv na málo rozvinuté země.

Abstract

This thesis analyses differences in average earnings across countries, and examines whether they are due to different wages for comparable occupations or to different occupational structure. To separate the effect of these two factors, I use a thought experiment consisting of replacing a country´s structure or wages by those of another country and observing the percentage change in the implied average earnings. For the thought experiment, I use data on occupational structure and wages for 26 countries from the International Labour Organisation. The results suggest that most of the difference in average earnings across countries is due to within-occupation differences in wage levels and only a smaller part of them is due to different occupational structure. The structure has a relatively higher impact in countries at low levels of economic development.

Klíčová slova

ekonomický rozvoj, strukturální transformace, mzdy, průměrné platy

Keywords

economic development, structural transformation, wages, average earnings

Rozsah práce: 60 012 znaků

Prohlášení

1. Prohlašuji, že jsem předkládanou práci zpracovala samostatně a použila jen uvedené prameny a literaturu.
2. Prohlašuji, že práce nebyla využita k získání jiného titulu.
3. Souhlasím s tím, aby práce byla zpřístupněna pro studijní a výzkumné účely.

V Praze dne 18. 5. 2012 Marie Kubíková

Poděkování

Na tomto místě bych ráda poděkovala Matěji Bajgarovi, M.Sc. za vedení, pomoc a cenné rady při psaní této práce.

Institut ekonomických studií
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Předběžná náplň práce:

V mé práci bych chtěla zkoumat, čím jsou způsobeny rozdíly v průměrných mzdách ve světě. Je to tím, že v chudších zemích jsou stejné pracovní pozice ohodnoceny hůř než v bohatších a nebo tím, že v chudších zemích pracuje více lidí v hůř placených (méně kvalifikovaných) pozicích než v bohatších? K analýze tohoto problému bych chtěla použít metodologii přejatou ze článku Globalization, Structural Change, And Productivity Growth (Dani Rodrik a Margaret McMillan, 2011) spočívající v odhadu vlivu odlišné struktury pracovního trhu a odlišných platů pro stejné pracovní pozice na rozdíl v průměrné mzdě. Budu k tomu používát data z International Labour Organisation a pokusím se srovnat co nejvíc co nejrozdílnějších zemí, pro která bude dost dostupných dat.

Předběžná náplň práce v anglickém jazyce:

In my thesis I would like to examine, what is the cause of different average earnings around the world. Is it because in poorer countries people have lower wages than in richer countries for comparable jobs, or because in poorer countries more people work in worse paid occupations (less qualified) than in richer countries? To analyse this problem I would like to use the methodology from the paper Globalisation, Structural Change, And Productivity Growth (Dani Rodrik a Margaret McMillan, 2011) that consists of estimating the impact of different structure of labour market and different wages for comparable occupations on differences in average earnings. I will use data from the International Labour Organisation and I will try to compare as diverse a set of countries as my dataset allows.

Seznam odborné literatury:

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Contents

Introduction

The most evident reason why some people are poor and some are rich is that they have different incomes. From this point of view finding the cause of different wage levels across countries seems to be the central question for development economists (Teal 2011).

Everyone would agree with a simple fact that people in Germany earn on average many times more than people in Zambia, and what is more, that there are also huge differences between occupational wages within both countries. In my thesis I would like to find out what the cause of different average earnings is[1]. Does a labourer in Zambia earn less than his colleague in Germany? And what about automobile mechanics, fire fighters, general physicians, teachers and others? Or is the difference in average earnings caused by a larger share of labourers and other worse paid occupations in Zambia and a higher share of qualified workers in Germany? To separate the influence of different wages for comparable occupations and different occupational structure on average earnings, I use a thought experiment that consists of two steps. Firstly, I change the structure of a poor country for that of a rich country and observe what happens to average earnings if wages remain the same. This change should show how much of the difference between the average earnings of a poor and a rich country is caused only by different structures of occupations. And secondly, I change the wages for those of a rich country, but leave the original structure of a poor country. Now I can see how much of the difference is caused by different wages for comparable occupations. By comparing each combination of two countries out of my sample of 26 countries at diverse levels of economic development, it should be possible to reveal some generally valid patterns of differences in average earnings.

The core question of my thesis, what influences the average earnings more, different wages for comparable occupations or different occupational structure, has also another interpretation focused on individual behaviour. For an individual in a poor country the implication is: Can I do something to get rid of poverty by myself (increase education, qualification or skills)? Or am I trapped in poverty because I live in a country where everyone is poor independently on his effort?

[1] Whenever I use the term average earnings in this thesis, I refer to the computation from the section 4.1.

A possible interpretation of comparing people with identical occupations is comparing people with similar skills (Levenson and Zoghi 2010). Even though a labourer in Germany is very likely to be more educated than a labourer in Zambia, what they both have in common is that they are among the people with the lowest skills in their country. Taking occupations as proxies for skills would mean that I compare the return to skills across countries. The higher the return to skills, the more incentive a worker has to improve his skills. Especially for poor people their own labour is often the only asset they have. Therefore it is very important to understand to which extent a worker can improve its value (Fields 2011).

Using the thought experiment described above I find that the main driver of differences in average earnings is different wages for comparable jobs. At the same time, the occupational structure also has an impact, but of a much smaller size. An interesting result is that the structure influences average earnings relatively more in less developed countries. This is because most of the structural transformation takes place at low level of income and as economies become richer their structures become more similar.

The paper proceeds as follows: the first chapter summarises related literature, the second chapter describes the data and some limitations they have. Then there are two chapters analysing the problem from different points of view. Both of them also describe the employed methodology. The third chapter observes how the occupational structure changes with economic development, specifically with increasing GDP per capita. The fourth chapter uses a thought experiment to separate the influence of different wages and different occupational structures and compares all the countries in pairs using this experiment. And finally a conclusion follows.

1 Literature review

To the best of my knowledge no researchers have tried to answer exactly the same question as I want to answer, but of course there exist many related pieces of research. First, there is a theory of estimating wage equations founded by Jacob Mincer that tries to find the causes of different earnings by estimating the impact of education, experience and other variables. Then there are other ways of measuring income differences among countries, such as direct comparisons of narrowly specified occupations that is described in the second part. The third part summarizes the literature on structural change and finally, many researchers focus on labour markets in developing countries and their specifics, comparing them to those of developed countries.

1.1 Earnings functions

My initial question, whether the differences in average earnings are caused by different wages for comparable occupations or by a different occupational structure can also have an alternative interpretation already mentioned in the introduction. That is, to what extent is a worker capable to influence his wage by improving his skills and qualification? The theory of earnings functions developed by Jacob Mincer (Heckman et al. 2003) tries to answer this by measuring the impact of education and experience on earnings. The Mincerian regression used by many economists is as follows:

$$\ln Y_i(t) = a_0 + a_1 S_i + a_2 t_i + a_3 t_i^2 + \varepsilon \quad (1.1)$$

where $Y_i(t)$ are the earnings of an individual i in time t, and the logarithm of earnings is a quadratic function of experience (t). The second independent variable is schooling (S) and the coefficients are a_0, a_1, a_2 and a_3 which respectively represent initial earnings capacity, return to education and the return to experience t_i, which is assumed to be declining in time, therefore captured in quadratic form. (Polachek 2008) Often more variables are added to the equation besides schooling and experience in order to explain more of the variation in income. These can be race, ethnicity, gender,

regional dummy, health status, marital status, number of children, dummy for rural or urban areas and many others. These variables, indicating how much earnings of otherwise similar individuals differ thanks to one of them, are sometimes called discrimination coefficients (Polachek 2008).

Many economists estimate earnings function for one country, for instance: Teal (2001), Paul and Assadzadeh (2001), Machado and Mata (2000) or Chamberlain and Van der Berg (2002). Some also estimate earnings functions for more countries that allows cross-country comparisons, for example: Psacharopoulos and Patrinos (2004), Surydama (2010) or Kuepie et al. (2008). The papers estimating earnings functions are most often interested in return to education or in differences in earnings between some specific groups of people. Especially the paper by Chamberlain and Van der Berg (2002) is interesting for my topic as they use occupational dummies in their earnings regression and these dummies are basically the same as my sorting into occupational structure, but they are also mostly interested in return to education.

A wage equation with individuals from multiple countries would be another way of exploring the question I have on mind. I would need to find out whether the differences between individual´s earnings across countries are more influenced by the country where he or she lives or by his or her individual characteristics. This could be done by adding a dummy variable for every country and some more characteristics than education (such as skills, qualification) to an equation explaining individual incomes. However, I have used a different approach. I did so mainly for two reasons. For one thing, I have some doubts about how much of the variation in income could be explained using in this way. For example, Teal (2011) states that the link between income and education is weaker than usually thought, and that even when you add a wide range of human capital characteristics, most of the variation in earnings remains unexplained (partly because many important variables such as intelligence or productivity are difficult to observe). One of possible explanations is that income is more correlated with where the person lives than with their knowledge measured by education (Teal 2011). However this might be to some extent captured by country dummies. But there is still the second reason why I could not use this approach which is the unavailability of data as I would need a similarly constructed micro data set covering multiple countries on very different income levels. Such dataset that is not

available to me.

1.2 Other ways of measuring income differences

Many researchers study income differences using methods other than wage equations. They cover many topics such as comparing wages across various countries, for various groups of people in various sectors of economy etc. Most relevant to my analysis are comparisons of specific occupations across countries. Although they only give evidence about one occupation, the occupation examined is usually well defined and comparable and therefore makes an easy way how to estimate the relative relation of wage levels.

If one wants to compare earnings across very different countries, it is an excellent idea to collect wages for the basic entry-level job at McDonald´s restaurants (Ashenfelter and Jurajda 2004). They can serve as a substitute for low-skilled wage levels as they reflect identical jobs in identical firms producing identical products. An advantage of such a comparison I should not forget is the low cost of data collection and consequently a large sample of countries. The authors have also avoided many measurement errors that might occur when comparing income or wage rates in a wide variety of countries (Freeman and Oostendorp 2000). For their comparison, Ashenfelter and Jurajda have used either real wage rates (wages expressed in PPP US $ or in units of Big Macs[2]) which reflect the level of well-being within the country and also the labour´s productivity, or nominal wage rates (wages expressed in US dollars at current exchange rates) which represent the labour costs (Ashenfelter 2012) and are interesting in connection with trade economics. The result of the study is a relative ranking of countries according to the level of McDonald´s wages.

Similarly to comparing wages at McDonald´s which could account for earnings of low skilled workers, a recent paper has examined wages of health workers that, on the other hand, represent qualified labour. The paper is also interesting for us because it mostly uses the same data as I do[3]. In this paper, two issues are analysed. First, the relationship between health workers´ wages to GDP per capita (PPP) and second,

[2] How many Big Macs can you buy for an hourly wage
[3] The Occupational Wages around the World database which is an adjusted version of the ILO October Inquiry, an older version of that, which I use

comparison of wage differentials between health workers and other comparable occupations[4]. The authors have found that wages increase with GDP per capita and also estimated the relative position of health workers´ wages to comparable occupations. (Dräger et al. 2006)

Remco Oostendorp together with Richard B. Freeman (2000) analyse the same data on wages as I use[5] and also search answers to similar questions as mine. Their main idea is that there are three kinds of differences in wages. The first one is the skill differential, which can be found if you compare wages of more and less skilled workers within one country. This represents the return to human capital and also the inequality in the country. It is the same as if I ask how much the wages are influenced by one´s skills and how much the average earnings are influenced by the structure of occupations. The second one is the cost differential that describes the differences in wages of workers in the same occupations across countries in a common currency using exchange rates and reflects different costs of labour. The last one, the living standard differential, compares wages for workers in the same occupation across countries, when measured in purchasing power parity units. The last differential corresponds to my question how much of the difference in average earnings is caused by different wages for comparable occupations. As their subject of interest is so similar, it is obvious that the results of their analysis are important for us. By analysing data for 161 occupations for many countries in a period of fifteen years[6] they have found that skill differentials decrease with increasing gross domestic product per capita. Cost as well as living standard differentials are huge across countries and moreover, the cost differentials have increased over time (Oostendorp and Freeman 2000).

1.3 Structure of economy

Finally, some researchers are interested in changes in the structure of labour market with economic growth. It is widely accepted that economic development is connected with a structural change, usually from agriculture and other traditional sectors to industry, services and other modern economic activities. The faster the change

[4] General physicians are compared to engineers and nurses to teachers
[5] The Occupational Wages around the World database, an older verion of that, which I use
[6] 1983-1998

occurs, the more successful the countries are (McMillan and Rodrik 2011). Also economists modelling dual or multi-sector labour market models recognise than an economy is composed of distinct parts try to explain what affects wages (Fields 2005). However, the structure is usually considered as a structure of the economy, this is as divided to various industries or sectors not according to occupations as it is in my case. The reason why I mention this literature is that even though the meaning of the word structure differs, it is logical that when more advanced industries replace the less advanced or traditional ones, there is also higher need for qualified labour.

For my thesis, the paper Globalization, Structural Change, and Productivity Growth by Margaret McMillan and Dani Rodrik is highly relevant, because I derive my methodology from theirs. The structure of the problem is similar, but they want to decompose the cause of differences in average productivity among countries to different productivities of comparable sectors and different structures of sectors in the countries. They divide economy into 9 sectors according to where the activity occurs (e.g. agriculture, manufacturing or services). The paper states that the change in average labour productivity can be either caused by change of the structure of sectors in the economy (this means that labour can move from less productive to more productive sectors or the other way around) or by change of within sector productivity (one or more sectors can become more productive or less productive). The paper further suggests a related thought experiment that measures the change in average productivity if you input a structure of a developed economy to a developing one using its original inter-sectoral productivity. The productivity of course increases and the authors state that on average in developing countries about a fifth of the productivity gap to advanced economies would disappear if such a change of structure occurred. (McMillan and Rodrik 2011)

1.4 Specific characteristics of labour market in developing countries

As I mentioned in the introduction, low wages are what makes the poor people poor. In developing countries the problem is not that the people are unemployed (Fields 2011) but that they work, sometimes hard, but still their income is low. Unemployment is really not a basic issue in dealing with poverty as 85% of the world´s poor live in

working families (Fields 2011). It is basically because in the poor countries there are no unemployment benefits, so everyone is trying to do at least something to survive. A paper by Falco et al. (2011) discusses earnings differentials in Ghana and Tanzania and finds differences between the earnings of self-employed and wage employees and also the impact of the enterprise size on the earnings.

Another specific feature that gets smaller with increase of wealth is the fear of specializing. The extremely poor usually have occupations that do not need any qualification because they do not have any and because they are afraid of putting too much effort into one occupation which they might loose. They rather have multiple low qualified occupations at one time to spread the risk of loosing one of them. A related fact is that the poorest people most often work as entrepreneurs which has different meaning than the one usually understood in developed countries. It is mainly caused by unavailability of salaried jobs. (Banerjee and Duflo 2007)

2 Data

In this thesis I use two datasets: one that captures occupational structures and one that contains wages for comparable occupations. They are both provided by The International Labour Organisation (ILO)[7]. I use the second one in an adjusted version as described later.

2.1 Data for occupational structure

The first dataset is called *Main statistics (annual): employment general level, by occupation* and divides occupations in many countries into ten groups according to the type of work (not according to the industry where the work is performed as is the case of a similar dataset also provided by ILO[8]). I have chosen this one as it reflects the qualification and skills of individual workers. The classification of occupations is based on the International Standard Classification of Occupations ISCO-88 or ISCO-68 or both (for a better comparability I only use those based on ISCO-88, which is the most frequent). The ten groups are the following:

1. Legislators, senior officials and managers
2. Professionals
3. Technicians and associate professionals
4. Clerks
5. Service workers and shop and market sales workers
6. Skilled agricultural and fishery workers
7. Craft and related trade workers
8. Plant and machine operators and assemblers
9. Elementary occupations
10. Armed forces

For detailed description of occupations included in these categories see

[7] Available online at http://laborsta.ilo.org/
[8] *Main statistics (annual): Total employment, by economic activity*

Appendix (A 1). It makes the differences between individual categories obvious. In addition to the ten categories, for some countries another one is reported, called *Not classifiable by occupations*. As it usually includes only a very small share of employment, I do not use this one. As the tenth category, *Armed forces*, is reported only for some countries, I do not use it either.

The data provided to the ILO by national offices of participating countries usually come from Labour force surveys or Population censes. It could be questioned whether such data are good for comparison as they come from diverse sources. This problem is to a large extent eliminated by the use of the classification ISCO-88. A more complicated problem could be that the ILO defines employment as both paid employment and self-employment. However, it also acknowledges the fact that some countries may understand that differently, sometimes report data for both types of employment and sometimes not. This might cause troubles. If in some countries self-employment would not occur in all the occupational categories more or less equally, but be more concentrated in some of them, and if in such countries the data were reported differently, sometimes with self-employment and sometimes without it, it would influence my results negatively. But as I have no better data available, I will suppose that this does not affect my analysis and that the errors caused by different ways of reporting data are negligible. For every country there are data available for different number of years (from 1969 to 2008), the years are not the same for all the countries. As my analysis will consist of pairwise comparisons I will only need to have comparable data available for each pair of countries. Usually I use the data from years 2006 or 2007, only in a few cases the data are older (the oldest are from 2000), which does not make any significant difference. If I look at the data it is obvious that they change very slowly in time. The data are reported for men and women together, sometimes also for men and women separately. I use those for men and women together as they are reported for most countries.

2.2 Data for wages of comparable occupations

The second dataset I use is the *Standardized ILO October Inquiry 1953-2008*[9] that includes hourly wages for 159 occupations (see table A 2 in the Appendix) across many countries. This dataset is an adjusted version of another one, *Wages and hours of work in 159 occupations* (ILO October Inquiry) which is provided by the ILO. By using the standardized version I avoid many imperfections that are present in the original one. The need for further adjustment as well as adjustment methods are explained in detail in Oostendorp and Freeman (2000). Among the most important facts is the removal of out-layers and unification of units of measurement, because in the original dataset some wages are reported as monthly, weekly, daily or hourly, then some are reported as average, some as prevailing, maximum or minimum wages, some are for men only, some for men and women or only for women. The newest version of the *Standardized ILO October Inquiry* provides hourly average adult wages[10] (e.g. representing the mean wage for both sexes) in local currencies and in US $. The final dataset includes 7 versions of wages with different correction factors used, and all of them are reported in local currencies and in US$, so together there are 14 figures reported for each occupation in every country. I decided to use the *hw3wlus* version, that includes country-specific and uniform calibration, is in US$ and has the wages reported for most of the occupations and countries. The choice of the version used is not crucial as "the different standardization methods give similar results, with correlations above 0.99. The same result holds for the correlations between wages converted to US$. This is reassuring as a high correlation suggests that the choice of the exact standardization procedure has little effect on the outcome." (Oostendorp 2005) The same holds for the newest version of Standardized ILO October Inquiry.

Similarly to the previous dataset with the occupational structure, there are not all the wages for all the countries for all the years available. Again thanks to pairwise comparisons, I only need to have enough data to compare each two selected countries. The purpose of selecting exactly these 159 occupations for the original dataset was to

[9] This is the newest version which is not publicly available by now (11 May 2012); the former version can be found online at http://www.nber.org/oww/. Thanks to kindness of Mr Remco H. Oostendorp I have obtained the newest version in advance before it is made available on the internet. Otherwise I would have to use the second newest version, that included only the period 1983-2003

cover as much of the labour force as possible and also some groups of workers that were of interest to ILO. I also prefer the maximum possible amount of workers to be included. The October ILO Inquiry is conducted with assistance of national governments, the ILO send them a questionnaire with some instructions and ask them to fill in all data already available, but not to conduct any special surveys because of that. Therefore there are many sources of data in this dataset and also many items missing. Among other instructions ILO sends a detailed description of the 159 occupations because the understanding of a title of an occupation may differ, and what is important here is the actual activity performed. This also ensures a better comparability of the data although they come from diverse sources.

2.3 Combining both datasets

In order to compare two datasets with different classification of occupations, I will use a conversion table prepared by the ILO[11] matching the ISCO-88 classification of occupations with the 159 occupations from the ILO October Inquiry (see table A 2 in the Appendix). The distribution of the 159 occupations in the ten categories is as follows:

Table 1: The distribution of 159 occupations in the nine ISCO-88 categories

ISCO-88	Number of 159 occupations in this category	Percentage of total
1. Legislators, senior officials and mangers	1	0.63%
2. Professionals	19	11.95%
3. Technicians and associate professionals	13	8.18%
4. Clerks	23	14.47%
5. Service workers and shop and market sales workers	10	6.29%
6. Skilled agricultural and fishery workers	10	6.29%
7. Craft and related trade workers	34	21.38%
8. Plant and machine operators and assemblers	35	22.01%
9. Elementary occupations	14	8.81%
Total	159	100.00%

[10] This is an advantage of the newest version, because the older ones reported monthly wages (which are worse for comparison as work hours differ in different countries) and for men only (the wages for both men and women are better for the comparison with the other dataset

[11] Available online at http://laborsta.ilo.org/applv8/data/to1ae.html#22

Although wages are often reported for less than the number of occupations in Table 1, there are always at least some in categories 2-9. Because of the data unavailability, I have to neglect the first category (Legislators, senior officials and managers) in my analysis, as there is often unfortunately no occupation reported. If there were such data available, I could add them and make the analysis more precise.

3 Occupational structure and GDP per capita

The first part of the analysis is focused on how the occupational structure changes with economic development, specifically with increasing GDP per capita (in this thesis I always use GDP per capita expressed in US$ adjusted to purchasing power parity from 2006[12], even if I do not mention it), which also in a simplified way represents different wage levels.

As I am now looking for some generally valid patterns, I will take the largest sample possible, including countries that I can not use for the pairwise comparisons. I take all countries that have data for their structure available at least for one of the years from 2005 to 2008[13]. It together makes 76 countries.

3.1 Methodology

I will start the analysis of the behaviour of individual categories of the occupational structure by using a simple OLS method[14]. I will regress the shares of the labour force in occupational categories on a natural logarithm of GDP per capita. The relation I am looking for could be expressed by the following formula:

$$\text{var } j = \alpha + \beta_1 \ln GDP + \varepsilon \quad (3.1)$$

where $\text{var } j$ stands for the share of population in j-th category, α is the intercept, β_1 the slope coefficient, GDP is GDP per capita and ε is the error term. I will also estimate the quadratic relationship expressed by the following formula:

$$\text{var } j = \alpha + \beta_1 \ln GDP + \beta_2 (\ln GDP)^2 + \varepsilon \quad (3.2)$$

[12] Available at http://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD
[13] If they have data available for more than one year, we have the following preferential order: 2006, 2007, 2005, 2008
[14] In this section I use the OLS method as a summary statistics without infering cauality

3.2 Results

According to my data, there is a very clear impact of the level of GDP per capita on the shape of occupational structure or at least on some occupational categories. I have found a linear relationship between all the categories but for the 6th (Skilled agricultural and fishery workers), 7th (Craft and related trade workers) and 8th (Plant and machine operators and assemblers) as can be seen in Table 2. The low p-values in all regressions give evidence for the estimated coefficients. For the 1st to the 5th categories (Legislators, senior officials and managers, Professionals, Technicians and associate professionals, Clerks, Service workers and shop and market sales workers), the positive slope coefficients imply increasing shares of these categories with increasing GDP per capita. The share of the 9th category (Elementary occupations) on the contrary decreases with increasing GDP per capita. When I look at the R-squared, it is obvious, that GDP per capita explains about one half of the variation of shares in the 2nd to the 4th categories, nearly one third in the 9th category, about one quarter in the 1st category, and only about 15% in the 5th.

For the 6th (Skilled agricultural and fishery workers) and 8th (Plant and machine operators and assemblers) category, the quadratic relationship explains the variation in these categories better than the linear one, for the 6th category, the slope is decreasing and convex and for the 8th category it is concave, first increasing and then decreasing. Instead of a linear relation between GDP per capita and the 7th category (Craft and related trade workers) I have found a quadratic one, which gives a concave plot also first increasing and then decreasing. All the estimated coefficients have p-values very close to zero. The R-squared is 0.568 for the 6th category, but less for the 7th (0.206) and the 8th (0.321), which indicates that not much of the variation in the share in the 7th and 8th category is explained by GDP per capita.

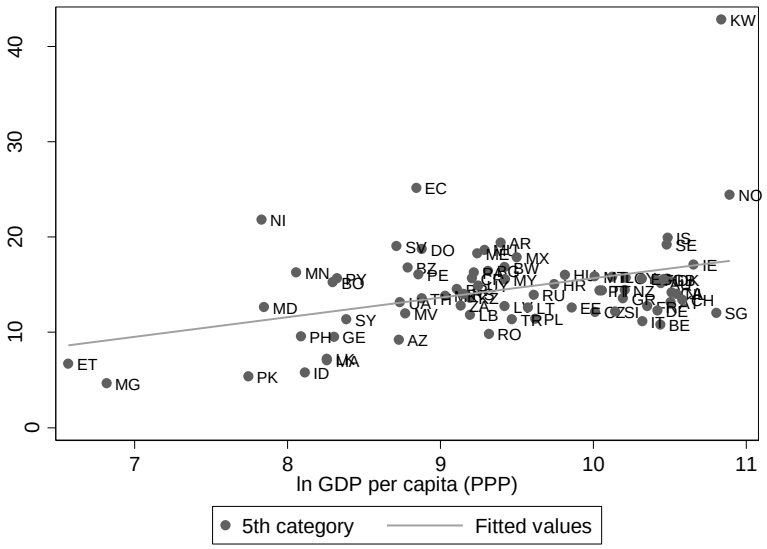
Table 2: The estimated results of regressions of occupational structure in 76 countries on GDP per capita (PPP) in 2006

	(1) ln GDP	(2) ln GDP squared	(3) Constant	R^2
1. Legislators, senior officials and managers	1.879***		-11.22**	0.242
	(0.387)		(3.663)	
2. Professionals	3.699***		-24.55***	0.470
	(0.457)		(4.323)	
3. Technicians and associate professionals	4.294***		-29.27***	0.548
	(0.453)		(4.288)	
4. Clerks	2.853***		-18.79***	0.456
	(0.362)		(3.426)	
5. Service workers and shop and market sales workers	2.053***		-4.846	0.151
	(0.567)		(5.363)	
6. Skilled agricultural and fishery workers	-66.52***	3.055**	364.9***	0.568
	(17.37)	(0.950)	(78.92)	
7. Craft and related trade workers	28.22***	-1.551***	-113.4***	0.206
	(6.533)	(0.357)	(29.68)	
8. Plant and machine operators and assemblers	21.04***	-1.074***	-93.68***	0.321
	(4.974)	(0.272)	(22.60)	
9. Elementary occupations	-7.553***		87.30***	0.282
	(1.402)		(13.27)	

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The decreasing shares of the 6th (Skilled agricultural and fishery workers) and of the 9th (Elementary occupations) categories are not surprising. The 6th category mainly includes people working in agriculture, which is a sector that employs less people with economic development (labour force moves to manufacturing and services). The 9th category includes occupations that are to a large extent replaced by machinery in developed countries (such as manufacturing labourers, street vendors or garbage collectors). The increasing shares in the first four categories (Legislators, senior officials and managers, Professionals, Technicians and associate professionals and Clerks) is also consistent with the common sense that the share of qualified occupations increases with GDP per capita. The variation in the 5th category (Service workers and shop and market sales workers) is not explained by GDP per capita much and it increases with GDP per capita very slightly. In fact, if I look at Figure 1, it seems that the share does not change much with GDP per capita and the increasing slope is influenced by one outlayer (Kuwait). If I look at the occupations included, it is obvious, that the share of people in this category does not change much with increasing GDP per capita, the occupations are for example shop salespersons, housekeeping workers or travel attendants.

Figure 1: The share of labour force in the 5th category and ln GDP



In the case of the 7th (Craft and related workers trade workers) and 8th (Plant and machine operators and assemblers) categories, it is hard to say why their share first increases and then decreases (see Figure 2 and Figure 3). If I look at their p-values

(0.206 and 0.321) a possible explanation is that the share is not related to GDP per capita.

Figure 2: The share of labour force in the 7th category and ln GDP

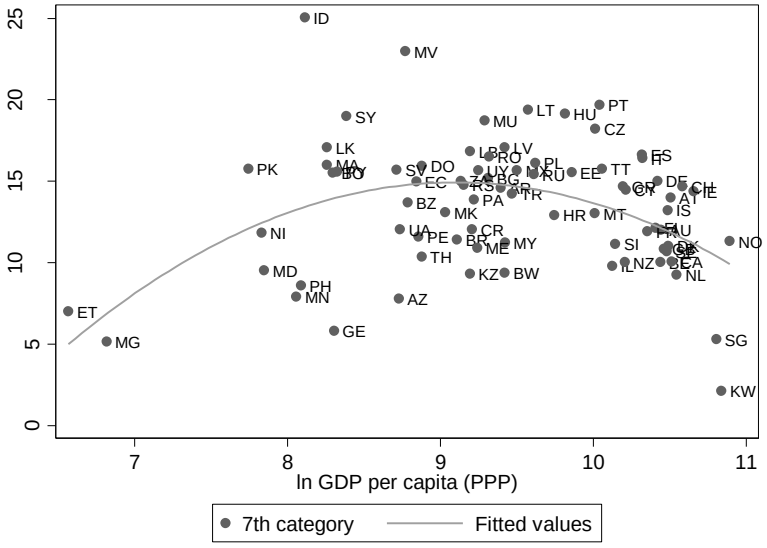
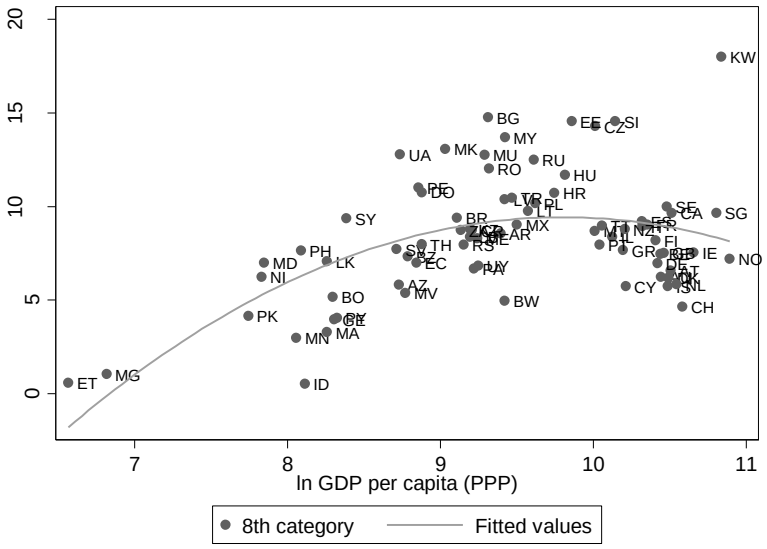


Figure 3: The share of labour force in the 8th category and ln GDP



In further analysis, I will be interested in the question whether these tendencies are also valid in my sample. One reason is because it should show that the sample of 26 countries is a representative sample. Another reason is that I will take the differences in the shares of categories in the sample of 26 countries as indicators of economic development. For example a small share in the 6th category (Skilled agricultural and

fishery workers) should indicate a high level of economic development.

4 Pairwise comparisons

The second part of my analysis compares 26 countries in pairs using the methodology described in the following section. As I need countries that are present in both datasets and I also require them to have wages reported for enough occupations, I finally get 26 countries. They represent a wide variety of economic conditions, from Madagascar and Zambia to advanced economies such as for example Germany. A complete list of these countries can be found in appendix (table A 3).

4.1 Methodology

The method employed in the main part of the analysis, the pairwise comparisons, has been inspired by the paper *Globalization, Structural Change, and Productivity Growth* (2011) written by Margaret McMillan and Dani Rodrik already mentioned in the literature review. Even though they have examined a different issue (not average earnings, but average productivity), the structure of their problem as well as the data used are similar and their method is perfectly suited to my problem and my data. The idea is to explain aggregate average earnings in a country as a sum of average earnings within occupational categories weighted by the size of these categories[15], shortly expressed by formula (4.1):

$$average\ earnings = \sum_i average\ earnings_i * share\ of\ \ category_i\ ,\ \ i = 1,...9 \quad (4.1)$$

If the preceding formula holds, then I have to assign each change in aggregate average earnings to either a change in average earnings in any category (some people receive different wage for the same work as done before) or to a change in the share of categories (i.e. caused by a move of the labour force to a category with different average earnings).

McMillan and Rodrik also suggest a thought experiment connected with formula (4.1) that consists in computing average earnings of a country retaining its own average

[15] In the case of McMillan and Rodrik it is not average earnings but average productivity and also the meaning of structure is different as mentioned in the literature review

earnings within respective categories but at the same time replacing in the computation its own occupational structure by an occupational structure of another country. The change of average earnings (that can be measured in percentage terms) shows, how much average earnings could change if wages remained the same but the labour force would be distributed across sectors differently. A similar thing can be done by leaving the country´s own occupational structure but changing the wages for those of another country. According to McMillan and Rodrik, this experiment in their setting of productivity reveals "how much of the income gap between rich and poor countries is accounted for by differences in economic structure as opposed to differences in productivity levels within sectors." (McMillan and Rodrik 2011). In my case it can be interpreted as follows: how much of the income gap is caused by differences in occupational structure and how much by the differences in average earnings within occupational categories?

I will carry out the thought experiment for each pair of countries in the sample. As I had data only for some occupations (maximum 159 occupations for each country, but usually less) I will try to use for comparison as many occupations as possible. Therefore when comparing each pair of countries, I will use all the occupations whose wages have been reported by both countries. Then I will break their respective wages into the 9 occupational categories and compute the average earnings within these categories for both countries using the median value (which neglects extreme values that might be caused by some imperfection in the data). The wages are reported as hourly wages in current US$ so I further adjust them to purchasing power parity[16]. Now I have average earnings for each category as well as the shares of categories within both countries, so I can easily exchange occupational structures and then wages between both countries and observe what happens to their average earnings. Then I will compute the percentage changes caused by adopting another occupational structure or wages and compare their magnitude.

But there are some assumptions that have to be made and that might influence the outcomes. First, no occupations are reported for the first category in all the countries. Therefore I have ignored the impact of the size of the first category as well as

[16] To do that I use the coefficients from the World Bank available at: http://data.worldbank.org/indicator/PA.NUS.PPPC.RF

of its average earnings in my computation. This means that I assume that the first group has no significance in my analysis, which is surely not true, especially as the first category probably includes highly qualified and also highly paid workers. On the other hand, as I have no better data for such a large sample of countries, I have to neglect the importance of the first category. Secondly, as in each pairwise comparison a different set of comparable occupations (i.e. those reported by both countries) is used, the exact figures of average earnings are often slightly different, depending on countries compared. Therefore, one of the limitations of this methodology is that exact figures cannot be considered as really representing the country´s average earnings. They much more represent the relative difference between the two countries in wages for comparable occupations. This is why I will focus in the final part of the analysis on percentage changes rather than on exact absolute figures.

4.2 Results

I compared 26 countries in pairs, which makes together 325 pairwise comparisons. There is not space here to present all of these comparisons and at the same time it is not necessary, many of them have very similar characteristics. Therefore I divided all the countries into 4 groups according to their HDP as they are divided by The World Bank[17]. I slightly changed the original division so that I merged two groups and divided one in order to capture specific features of the comparisons. These groups are 1) low-income and lower-middle-income economies, 2) upper-middle-income economies, 3) high-income economies with GDP per capita (PPP)[18] lower than $30000[19] and 4) the rest of high-income economies. The countries included in these 4 groups can be found in Table 3. The reason why I divide the countries into the four categories is mainly because they represent different levels of average earnings, which is of the main interest in this thesis. However, to simplify things I divide them according to GDP per capita, as it is a quite accurate proxy for average earnings and I do not have a single number of average earnings for each country that I could use for listing them.

[17] Available at http://data.worldbank.org/about/country-classifications/country-and-lending-groups#Low_income
[18] In 2006
[19] I use the treshold of $30000 because the large group of high-income countries differ a lot in their average earnings and I want to find out why

Table 3:Four groups of countries

	1st group	2nd group	3rd group	4th group
	low-income and lower-middle income economies	upper-middle income economies	high-income economies with GDP per capita <$30000	high-income economies with GDP per capita >$30000
1	Guyana	Chile	Cyprus	Canada
2	Indonesia	Costa Rica	Czech Republic	Germany
3	Madagascar	Latvia	Hungary	Italy
4	Moldova	Mauritius	Korea, Rep.	United Kingdom
5	Philippines	Mexico	Poland	
6	El Salvador	Peru	Portugal	
7	Zambia	Romania	Slovak Republic	
8		Turkey		

The average earnings for each country differ slightly according to with which country it is beeing compared, which is a consequence of the methodology used. In Table 4 you can see the averages of average earnings and also their medians throughout all the comparisons for the four groups.

Table 4: Average and median hourly earnings in $US (PPP) in the 4 groups of countries

	1st group	2nd group	3rd group	4th group
Average	1.54	4.03	8.27	16.83
Median	1.51	3.85	6.87	16.28

4.2.1 Ranking of occupational categories according to their average earnings

One of the important results of the analysis revealed by pairwise comparisons is finding out which occupational categories are paid relatively better or worse in various groups of countries at different levels of development. I have seen that there are clear tendencies of occupational categories to change, decline or increase, with increasing GDP per capita. The question is whether particular tendencies are positive or negative in terms of average earnings. Are the 6th (Skilled agricultural and fishery workers) and 9th (Elementary occupations) categories those, that have the lowest wages in every country and therefore when they decline average earnings increase? Or does the relative position of occupational categories according to their average earnings differ in the four groups of countries? To find that out, I ranked the occupational categories according to their average earnings in every pairwise comparison and made an average ranking within each group of countries, as indicated in Table 5. It is obvious that on average in all the groups, the 2nd category (Professionals) is the best paid, the next one is the 3rd

(Technicians and associate professionals) and the 4th category (Clerks) is in the third place. The 9th (Elementary occupations) and 6th (Skilled agricultural and fishery workers) categories are the worst paid ones for all groups of countries except the 3rd group. But even in the 3rd group of countries, the 9th is the worst paid category and the 6th is among the second worst paid ones. Somewhere in between are categories 5 (Service workers and shop and market sales workers), 7 (Craft ad related trade workers) and 8 (Plant and machine operators and assemblers).

Table 5: Median ranking of occupational categories according to their average earnings in the four groups of countries

	low-income and lower-middle income economies	upper-middle-income economies	high-income economies with GDP per capita <$30000	high-income economies with GDP per capita >$30000
2. Professionals	1	1	1	1
3. Technicians and associate professionals	2	2	2	2
4. Clerks	3	3	3	5
5. Service workers and shop and market sales workers	6	5	5	6
6. Skilled agricultural and fishery workers	8	6	7	8
7. Craft and related workers trade workers	4	5	6	4
8. Plant and machine operators and assemblers	5	5	5	5
9. Elementary occupations	7	8	8	7

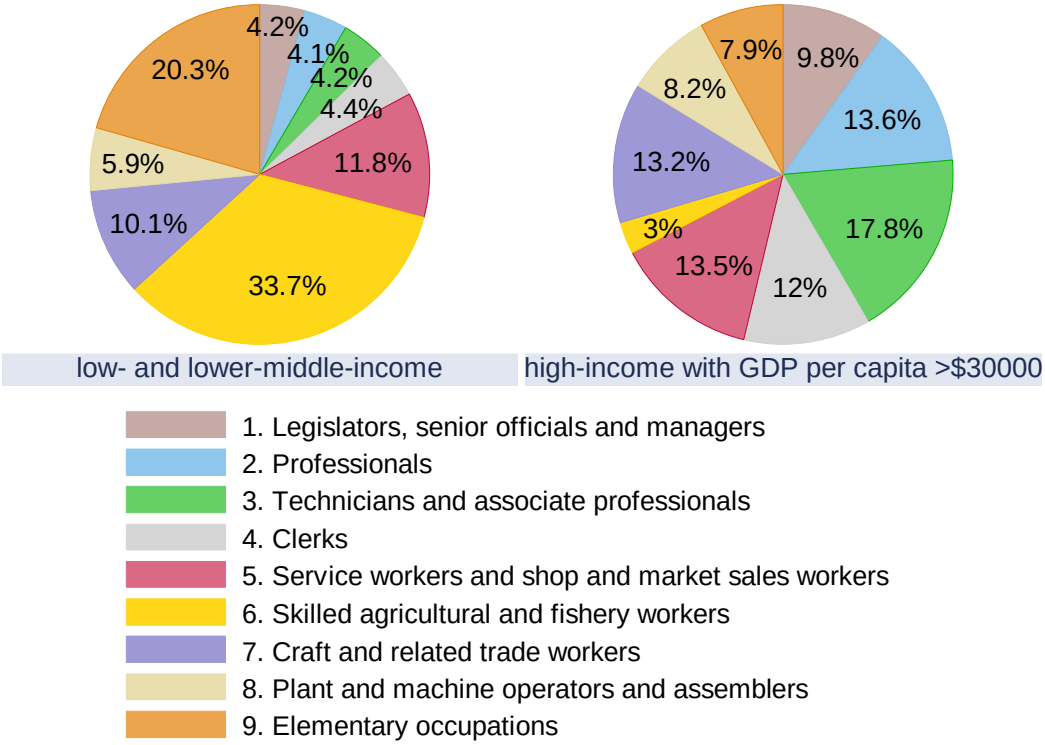
The findings are that the ranking is more or less the same. And further that those categories that gain importance with economic growth are paid better, while those that decline are paid worse, which implies that the change in occupational structure itself causes an increase of average earnings even when wage levels remained the same.

4.2.2 High-income economies (with GDP per capita >$30000) versus low-income and lower-middle-income economies

One would naturally expect the largest difference in income and the occupational structure to be between the poorest and the richest group. This hypothesis is correct as we will see. If I look at first at the average occupational structures in these two groups of countries in Chart 1, there are huge differences in the 6th (Skilled

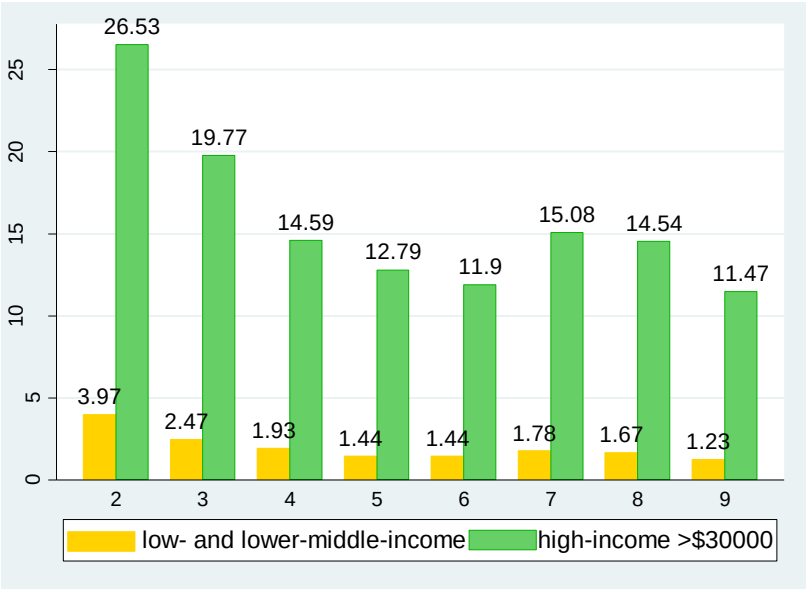
agricultural and fishery workers) and the 9th (Elementary occupations) categories. In the case of the 6th category, the average value might be misleading, because the high share in the 6th category for the low- and lower-middle-income countries (33.7%) is strongly influenced by two countries, Zambia and Madagascar, which belong to the poorest ones in my sample and both have more than 70% of workers in the 6th category. The median value of shares in the 6th category gives only 18% which much more expresses the rest of the low- and lower-middle-income countries. On the other hand, it seems that those poor countries that have a smaller share in the 6th category have a higher share in the 9th one. Basically, a characteristic feature of this group of countries is that a huge share of the labour force is concentrated in one of both categories (at least 38%, but usually more). On average, the first four categories (Legislators, senior officials and managers, Professionals, Technicians and associate professionals and Clerks) that significantly increase with GDP per capita (as was shown in chapter 3) represent only 17% of workers in the low-income and lower-middle-income countries. On the contrary, in the high-income economies with GDP per capita >$30000, that is in the richest countries of my sample, the share of workers in the 6th category (Skilled agricultural and fishery workers) is negligible, on average 3%, but the share in the 9th category (Elementary occupations) remains around 8% which is less than in the majority of the poor countries but not inconsiderable. In the high-income countries with GDP per capita >$30000, more than 50% of people work in the first four categories (Legislators, senior officials and managers, Professionals, Technicians and associate professionals and Clerks). The decline of shares in the 6th and 9th categories as well as the increase in the first four is consistent with the expectations of how the occupational structure changes with increasing GDP per capita as described in chapter 3.

Chart 1: Average shares in occupational categories in the 1st and 4th group



The differences in earnings have a similar character in all the pairwise comparisons between these two groups, the average earnings per hour can be seen in Chart 2. The earnings in the high-income economies with GDP per capita >$30000 are much higher for all the categories. In both groups of countries moving to a better paid occupational category improves the wage a lot.

Chart 2: Average hourly earnings in $US (PPP) in the 2nd and 4th group



Now I can look at the numbers of main interest in Table 6, which contains mean values of all the pairwise comparisons. The third column includes the mean of average earnings after accepting a structure of the other group, the fourth captures the mean percentage difference between the changed and original average earnings and the fifth and sixth columns capture the same for the exchange of wages. As I have already mentioned, the differences in wages are huge and the same holds for average earnings. For all the pairwise comparisons between these two groups of countries it is true that the differences in average earnings are mainly caused by different wage levels for comparable occupations. If both the groups had their own occupational structure and the wages of the other group, they would nearly get to the level of average earnings of the other group of countries. If they only had occupational structure of the other group but their own wages, the change in average earnings would not be so huge, but still significant.

Table 6: Average relative differences between the 1st and 4th group, standard deviations in parentheses

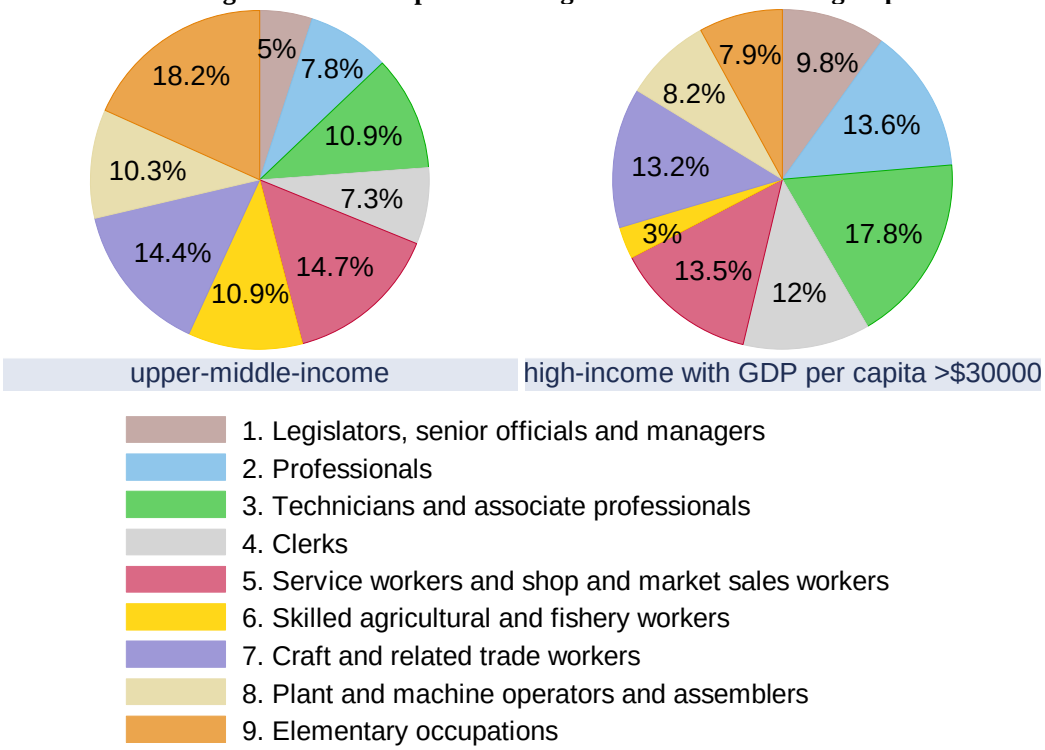
	average earnings	own wages + other structure	% change	own structure + other wages	% change
Low- and lower-middle-income	1.52	2.13	43.2%	13.75	1155.1%
	(0.84)	(1.16)	(28.0%)	(2.79)	(801.0%)
High-income with GDP >$30000	16.81	13.75	-17.6%	2.13	-87.0%
	(3.61)	(2.79)	(8.5%)	(1.16)	(7.5%)

4.2.3 High-income economies (with GDP per capita >$30000) versus upper-middle-income economies

The occupational structures of this pair of groups of countries are more similar than when comparing the poorest group to the richest one as can be seen in Chart 3. In particular, the share of the 6th (Skilled agricultural and fishery workers) category covers on average 11% of the labour force in the upper-middle-income countries, while only 3% on average in the high-income countries with GDP per capita >$30000. The average share in the 9th group (Elementary occupations) is 18% and 8% for the upper-middle-income and the high-income countries respectively. The share of people working in the first four categories (Legislators, senior officials and managers, Professionals, Technicians and associate professionals and Clerks) is on average 31% for the upper-

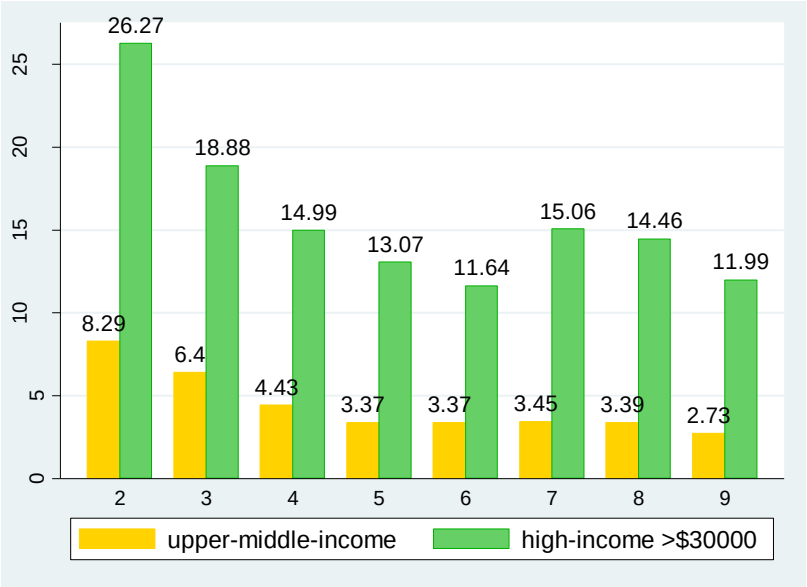
middle-income and 53% for the high-income countries. These numbers suggest, together with the preceding comparison that the occupational structure converges to the one of rich countries with increasing GDP per capita.

Chart 3: Average shares in occupational categories in the 2nd and 4th group



The differences in earnings decreased when compared to the previous pair of groups as can be seen in Chart 4. This fact not surprisingly suggests that wages do increase with an increasing level of economic development.

Chart 4: Average hourly earnings in $US (PPP) in the 2nd and 4th group



Now if I look at Table 7, I can see that retaining its own occupational structure and adopting wages of a country from the other group of countries again moves a country almost to the level of average earnings of the other group of countries. At the same time, the change of occupational structure still has a significant impact but smaller than when comparing the poorest to the richest group. Basically the results have a similar character only the changes both absolute and relative are smaller, which corresponds to the fact that also the differences in average earnings are smaller than in the preceding comparison.

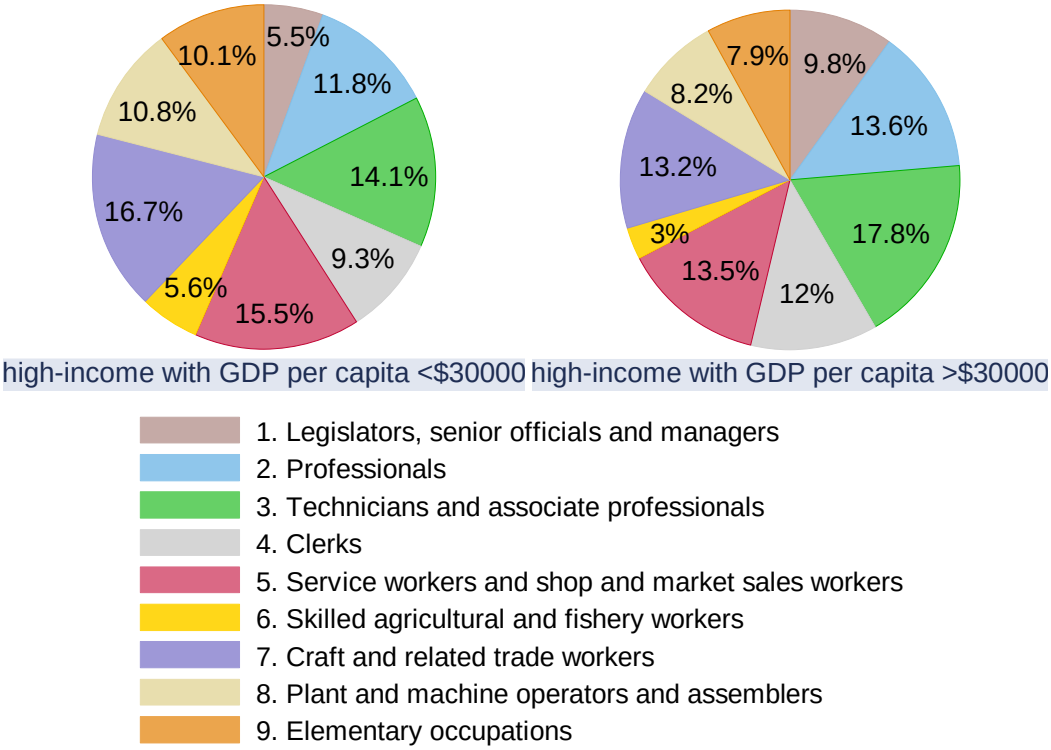
Table 7: Average relative differences between the 2nd and 4th group, standard deviations in parentheses

	average earnings	own wages + other structure	% change	own structure + other wages	% change
Upper-middle-income	4.03	4.81	20.2%	14.99	321.8%
	(1.15)	(1.22)	(11.1%)	(2.96)	(195.4%)
High-income with GDP >$30000	16.72	14.99	-10.1%	4.81	-70.2%
	(3.37)	(2.98)	(4.3%)	(1.50)	(10.8%)

4.2.4 High-income economies (with GDP per capita >$30000) versus high-income economies (with GDP per capita <$30000)

All the countries in both groups are classified as high-income. The reason why I further divided them into two groups was that there are still huge differences between their average earnings when compared to other groups of countries, and more importantly, I also wanted to find the cause of the difference in their average earnings. If I look at Chart 5 I can see that occupational structures of both groups are very similar. Also average shares in the first four categories (Legislators, senior officials and managers, Professionals, Technicians and associate professionals and Clerks) which are 41% and 53% for the high-income countries with GDP per capita <$30000 and >$30000 respectively, in the 6th category (Skilled agricultural and fishery workers) and in the 9th one (Elementary occupations), imply that the differences in average earnings cannot be caused by the differences in occupational structure to a large extent.

Chart 5: Average shares in occupational categories in the 3rd and 4th group



The differences in earnings (see Chart 6) are still noticeable, even though much smaller than in the preceding two comparisons.

Chart 6: Average hourly earnings in $US (PPP) in the 3rd and 4th group

As I have observed that both groups have similar occupational structures, it is not surprising that changing their structures vice versa does not nearly make any

difference (the changes 4.8% and -3.7% are very small when compared to the preceding comparisons). This suggests that the difference must be caused mainly by different wage levels. As can be seen in Table 8, the exchanged wages again cause a much higher difference and also get the average earnings to the level of the other group of countries. Therefore the differences in average earnings between both groups of the high-income countries cannot be attributed to a different distribution of jobs between those more and less qualified (and consequently more or less paid), but rather by different wages for comparable jobs.

Table 8: Average relative differences between the 3rd and 4th group, standard deviations in parentheses

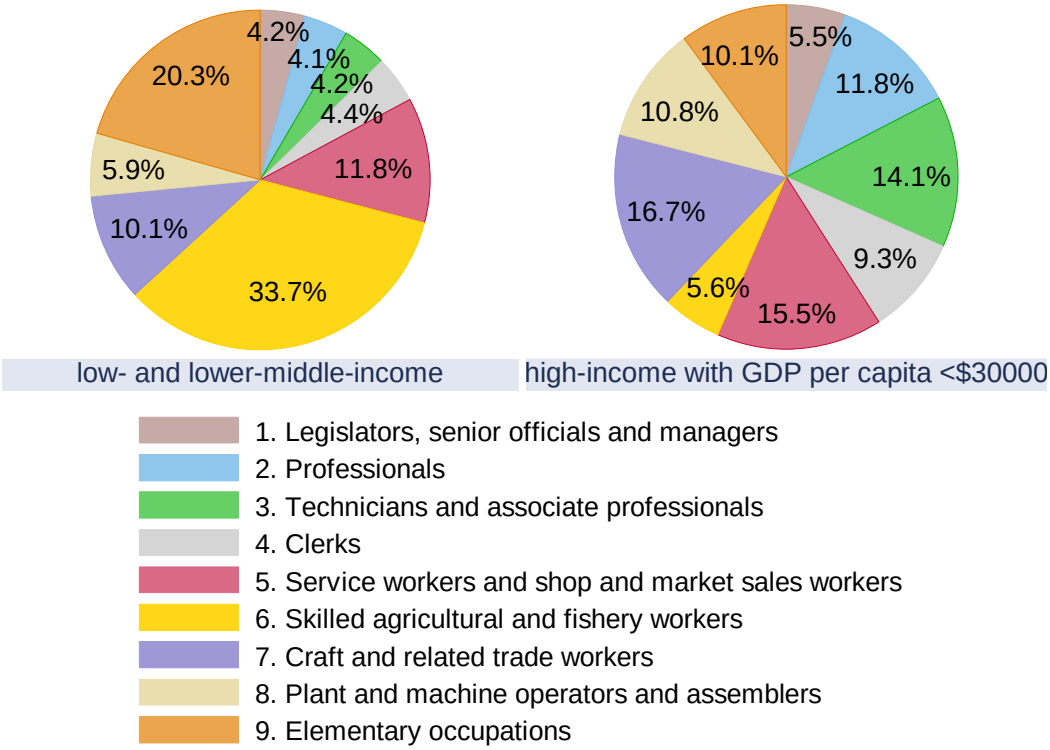
	average earnings	own wages + other structure	% change	own structure + other wages	% change
High-income with GDP <$30000	8.33	8.74	4.8%	16.24	132.3%
	(3.70)	(3.92)	(8.0%)	(3.15)	(108.0%)
High-income with GDP >$30000	16.9	16.24	-3.7%	8.74	-46.3%
	(3.42)	(3.15)	(3.5%)	(3.92)	(26.5%)

This, together with the preceding comparisons, suggests that with increasing GDP per capita, the occupational structure improves (that is, it yields higher average earnings) in the beginning more and gradually less and less, while the impact of exchanged wages grows with increasing GDP per capita all the time.

4.2.5 High-income economies (with GDP per capita <$30000) versus low-income and lower-middle-income economies

The comparison of these groups is nearly of the same nature as the one of the lo-income and lower-middle-income and the high-income economies with GDP per capita >$30000. Especially the differences in their occupational structure as can be seen in Chart 7 are almost the same, which could be expected as the high-income economies do not differ much in their structure irrespective of the fact whether their GDP per capita is above or below $30000.

Chart 7: Average shares in occupational categories in the 1st and 3rd group



The differences in wages are indicated in Chart 8 are contrarily different than those of the poorest and the richest group with smaller differences.

Chart 8: Average hourly earnings in $US (PPP) in the 1st and 3rd group

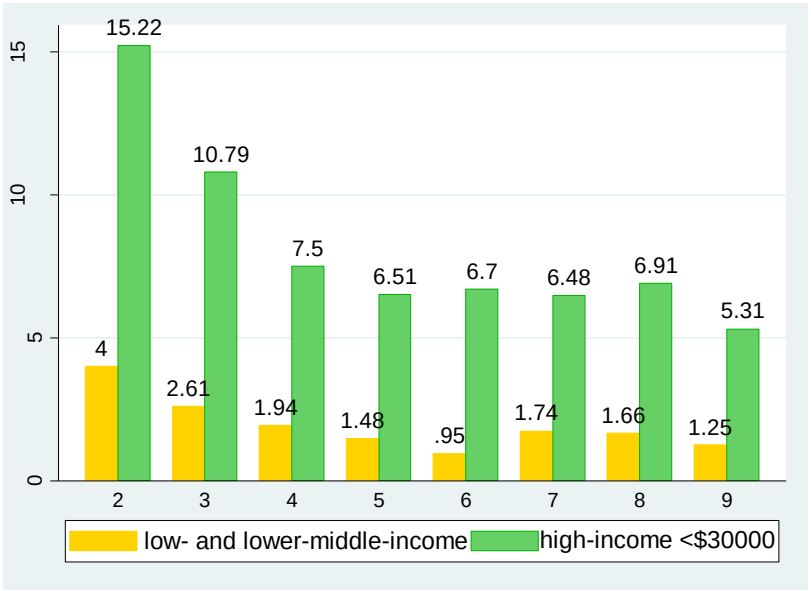


Table 9 implies in accordance with the previous pairwise comparisons that exchanging existing wages for those of a country at a very different level of development would move average earnings nearly to the level of the other country. At

the same time, as both groups of countries differ a lot in their occupational structures, the impact of exchanging their occupational structures is also significant, even though much smaller than that of exchanging wages. The relative changes caused by exchanged occupational structure are of a similar size as those when comparing the poorest to the richest group of countries.

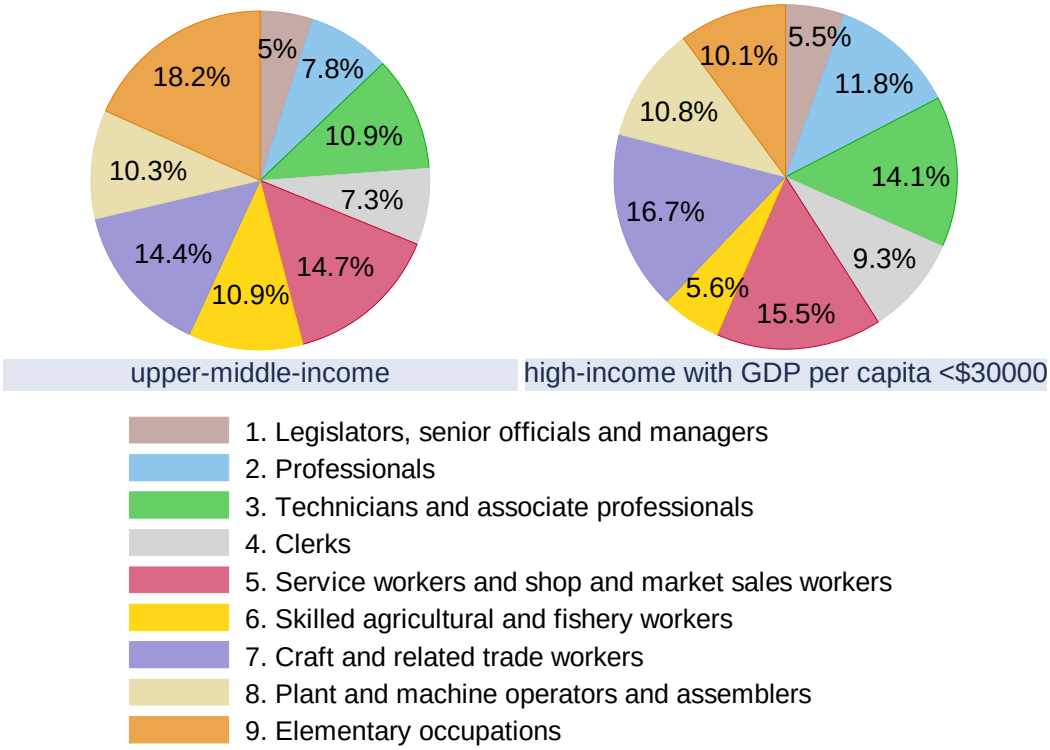
Table 9: Average relative differences between the 1st and 3rd group, standard deviations in parentheses

	average earnings	own wages + other structure	% change	own structure + other wages	% change
Low- and lower-middle-income	1.54	2.02	33.0%	7.04	557.0%
	(0.48)	(0.62)	(16.7%)	(3.33)	(569.2%)
High-income with GDP <$30000	8.31	7.04	-16.0%	2.02	-71.1%
	(3.74)	(3.46)	(13.9%)	(1.11)	(21.4%)

4.2.6 High-income economies (with GDP per capita <$30000) versus upper-middle-income economies

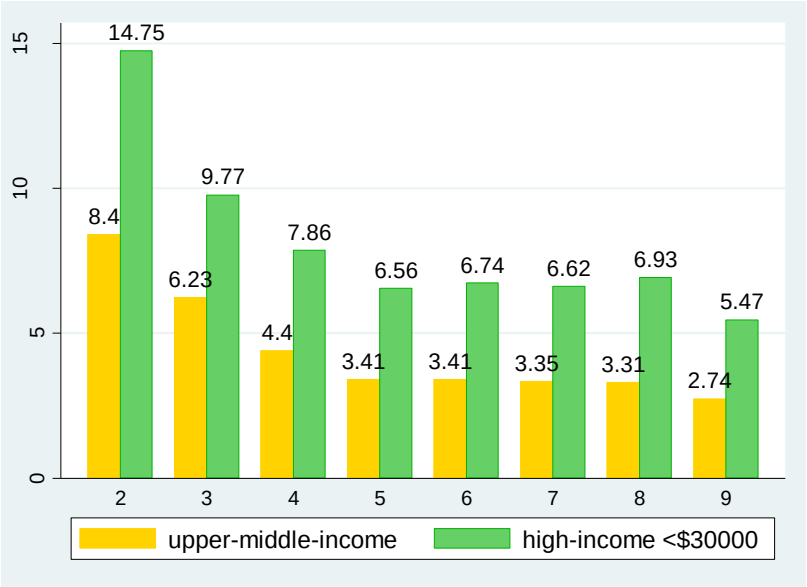
When comparing the high-income economies with GDP per capita <$30000 to the upper-middle-income economies, it is obvious that their occupational structures do not differ as much as when comparing the high-income (with GDP per capita <$30000) and the poorest group, as both are closer to each other in terms of their development (see Chart 9). The cumulative share in the 6th (Skilled agricultural and fishery workers) and 9th (Elementary occupations) categories differs by 13% (29% in the high-income (<$30000) and 16% in the upper-middle-income economies), and the cumulative share in the first four categories (Legislators, senior officials and managers, Professionals, Technicians and associate professionals and Clerks) differs by 10%, it is 31% in the upper-middle-income and 41% in the high-income economies (<$30000).

Chart 9: Average shares in occupational categories in the 2nd and 3rd group



The differences in wages are of a similar size as all those of comparing two categories next to each other (see Chart 10).

Chart 10: Average hourly earnings in $US (PPP) in the 2nd and 3rd group



If I look at the results of the though experiment, I can see that the results of exchanged wages are very similar in relative terms to those obtained when I compared the two groups of high-income countries. At the same time, the exchanged occupational

structure influences on average the wages more than when I compared the two groups of high-income countries. This indicates that the difference in structure between the upper-middle-income and the high-income economies with GDP per capita <$30000 is larger than between the two groups of high-income countries.

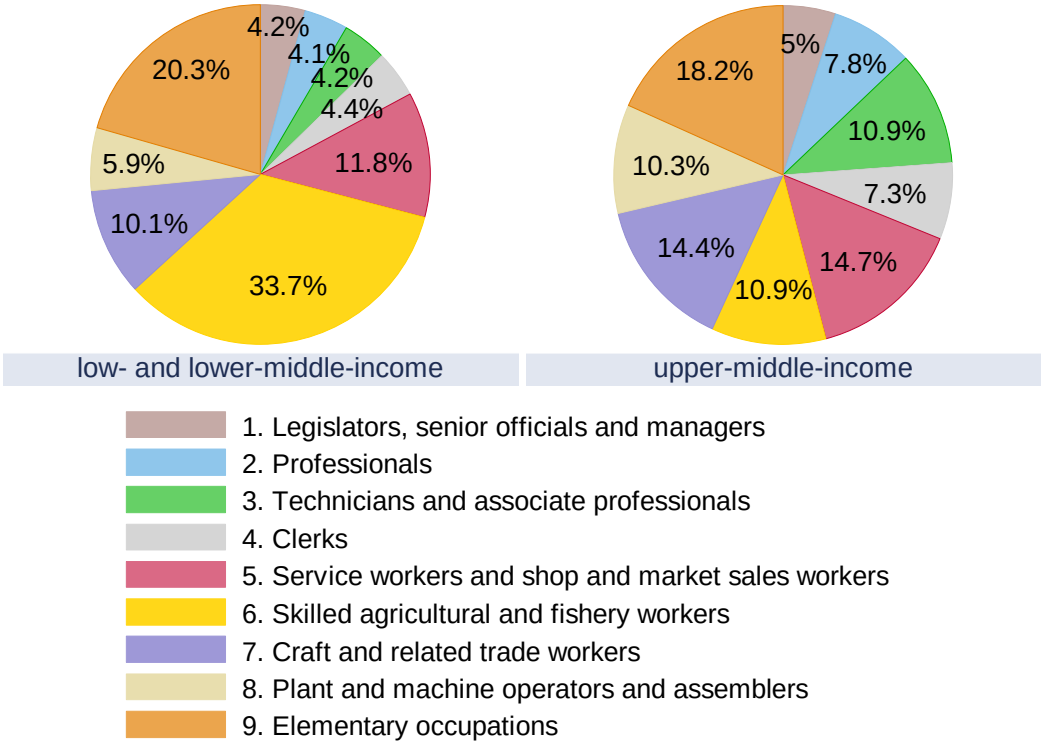
Table 10: Average relative differences between the 2nd and 3rd group, standard deviations in parentheses

	average earnings	own wages + other structure	% change	own structure + other wages	% change
Upper-middle-income	4.01	4.45	11.8%	7.55	113.0%
	(0.65)	(0.71)	(11.7%)	(3.31)	(134.3%)
High-income with GDP <$30000	8.20	7.55	-8.1%	4.45	-35.7%
	(3.63)	(3.38)	(6.6%)	(1.36)	(33.6%)

4.2.7 Upper-middle-income economies versus low-income and lower-middle-income economies

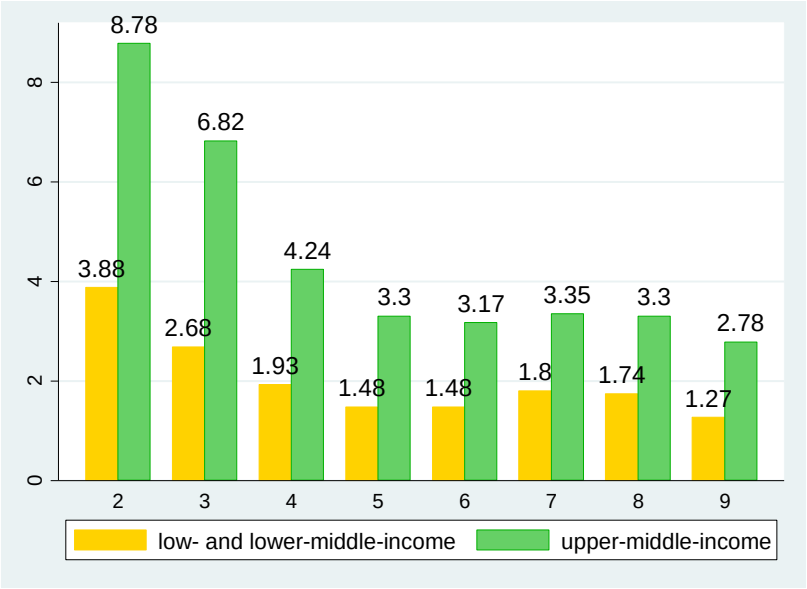
In the last comparison of two groups of countries, their occupational structures differ more than those of the upper-midle-income and high-income (<$30000) as can be seen in Chart 11. The shares of workers in the first four categories (Legislators, senior officials and managers, Professionals, Technicians and associate professionals and Clerks) differ by about 24% (31% in the poorest and 17% in the upper-middle-income countries), the shares of the 6th together with the 9th category (Skilled agricultural and fishery workers and Elementary occupations) differ by 25% (54% in the poorest and 29% in the upper-middle-income countries). The 34% of workers in the 6th category (Skilled agricultural and fishery workers) in the poorest group of countries is influenced by the two countries (Madagascar and Zambia) as already mentioned. The difference in median of shares of the 6th and the 9th categories would be 18% (43% and 25% for the poorest and upper-middle-income countries respectively), which is still more than when I compared the high-income (<$30000) to the upper-middle-income countries.

Chart 11: Average shares in occupational categories in the 1st and 2nd group



The differences in wages are summarized in Chart 12.

Chart 12: Average hourly earnings in $US (PPP) in the 1st and 2nd group



From Table 11 it is obvious that the occupational structure has a higher impact on differences between these two groups than between the upper-middle-income and high-income (<$30000) economies. At the same time, the impact of exchanged wages is higher than in the comparisons between these two groups of countries or between the

two groups of high-income economies.

Table 11: Average relative differences between the 1st and 2nd group, standard deviations in parentheses

	average earnings	own wages + other structure	% change	own structure + other wages	% change
Low- and lower-middle income	1.55	1.82	19.2%	3.60	229.0%
	(0.48)	(0.58)	(11.6%)	(1.15)	(224.0%)
Upper-middle-income	4.09	3.60	-10.5%	1.82	-49.7%
	(1.47)	(1.09)	(12.7%)	(1.02)	(35.3%)

To summarize all the previous comparisons, there are huge differences in average earnings due to exchanged wages between all the groups. The differences due to exchanged structure are the largest between the first two groups, but they remain large between the upper-middle-income and the high-income (<$30000) countries. Between both groups of high-income countries differences due to exchanged structure are much smaller.

Conclusion

In my thesis I wanted to find an answer to the question about the cause of different average earnings across countries. Specifically, I wanted to find out, whether the difference is caused by different wages for comparable occupations, or by different distribution of occupations (the occupational structure). To do so I compared 26 countries at different levels of economic development measured by GDP per capita (PPP), using two datasets, one for occupational structures and one for wages of comparable occupations. First I examined how occupational structure differs for countries with different levels of GDP per capita. Then I compared all the countries in pairs, focusing on their occupational structures and also earnings within the occupational categories. I carried out a thought experiment that consists of replacing a country´s structure (of wages) by one (or ones) of another country and observing what impact this had on average earnings. Thanks to it I was able to compare the relative impact of different structure and different wages on differences in average earnings.

The answer I have found is that the differences in average earnings are mainly caused by different wages for comparable occupations and that the size of the differences due to exchanged wages between two countries depends on the relative difference between their GDP per capita and not on the level of their development. Then I found that the differences in average earnings are also caused by different occupational structures, even though the magnitude of the impact of occupational structures is much smaller than that of wages. In addition the impact of different structure is higher between less developed countries, because their structures differ more.

From the individual´s point of view, the results suggest that a worker can improve his wage by moving to another occupational category (if there were more such workers also the average earnings would change), but even if he does, he will be unlikely to be paid as much as an individual living in a more developed country.

The method I have used has some crucial limitations, for example the missing wages for the 1st category (Legislators, senior officials and managers) of high qualified workers, or the fact that the occupational categories are often represented only by a few

occupations that might not be representative. Even more seriously, the broad occupational categories I use do not perfectly capture the structure because they simplify the real one. Having a more detailed data on occupational structures might increase the impact of different structures on average earnings. Therefore it would be interesting to do the analysis again with data on more occupations to see whether the structure would influence average earnings more than my results suggest.

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Appendix

A 1: The ISCO-88 classification of occupations
(source: http://laborsta.ilo.org/applv8/data/isco88e.html)

Major Group 1 Legislators, senior officials and managers

11. Legislators and senior officials
    - 111. Legislators
    - 112. Senior government officials
    - 113. Traditional chiefs and heads of villages
    - 114. Senior officials of special-interest organisations

12. Corporate managers [1]
    - 121. Directors and chief executives
    - 122. Production and operations department managers
    - 123. Other department managers

13. General managers [2]
    - 131. General managers

Major Group 2 Professionals

21. Physical, mathematical and engineering science professionals
    - 211. Physicists, chemists and related professionals
    - 212. Mathematicians, statisticians and related professionals
    - 213. Computing professionals
    - 214. Architects, engineers and related professionals

22. Life science and health professional
    - 221. Life science professionals
    - 222. Health professionals (except nursing)
    - 223. Nursing and midwifery professionals

23. Teaching professionals
    - 231. College, university and higher education teaching professionals
    - 232. Secondary education teaching professionals
    - 233. Primary and pre-primary education teaching professionals
    - 234. Special education teaching professionals
    - 235. Other teaching professionals

24. Other professionals
    - 241. Business professionals
    - 242. Legal professionals
    - 243. Archivists, librarians and related information professionals
    - 244. Social science and related professionals
    - 245. Writers and creative or performing artists
    - 246. Religious professionals

Major Group 3 Technicians and associate professionals

31. Physical and engineering science associate professionals
    - 311. Physical and engineering science technicians
    - 312. Computer associate professionals
    - 313. Optical and electronic equipment operators
    - 314. Ship and aircraft controllers and technicians
    - 315. Safety and quality inspectors

32. Life science and health associate professionals
    - 321. Life science technicians and related associate professionals
    - 322. Modern health associate professionals (except nursing)
    - 323. Nursing and midwifery associate professionals
    - 324. Traditional medicine practitioners and faith healers

33. Teaching associate professionals
    - 331. Primary education teaching associate professionals

332. Pre-primary education teaching associate professionals
333. Special education teaching associate professionals
334. Other teaching associate professionals

34. Other associate professionals
341. Finance and sales associate professionals
342. Business services agents and trade brokers
343. Administrative associate professionals
344. Customs, tax and related government associate professionals
345. Police inspectors and detectives
346. Social work associate professionals
347. Artistic, entertainment and sports associate professionals
348. Religious associate professionals

Major Group 4 Clerks

41. Office clerks
411. Secretaries and keyboard-operating clerks
412. Numerical clerks
413. Material-recording and transport clerks
414. Library, mail and related clerks
419. Other office clerks

42. Customer service clerks
421. Cashiers, tellers and related clerks
422. Client information clerks

Major Group 5 Service workers and shop and market sales workers

51. Personal and protective services workers
511. Travel attendants and related workers
512. Housekeeping and restaurant services workers
513. Personal care and related workers
514. Other personal service workers
515. Astrologers, fortune-tellers and related workers
516. Protective services workers

52. Models, salespersons and demonstrators
521. Fashion and other models
522. Shop salespersons and demonstrators
523. Stall and market salespersons

Major Group 6 Skilled agricultural and fishery workers

61. Market-oriented skilled agricultural and fishery workers
611. Market gardeners and crop growers
612. Market-oriented animal producers and related workers
613. Market-oriented crop and animal producers
614. Forestry and related workers
615. Fishery workers, hunters and trappers

62. Subsistence agricultural and fishery workers
621. Subsistence agricultural and fishery workers

Major Group 7 Craft and related trade workers

71. Extraction and building trade workers
711. Miners, shotfirers, stone cutters and carvers
712. Building frame and related trades workers
713. Building finishers and related trades workers
714. Painters, building structure cleaners and related trades workers

72. Metal, machinery and related trades workers
721. Metal moulders, welders, sheet-metal workers, structural-metal preparers, and related trades workers
722. Blacksmiths, tool-makers and related trades workers

723. Machinery mechanics and fitters
724. Electrical and electronic equipment mechanics and fitters

73. Precision, handicraft, printing and related trades workers
731 Precision workers in metal and related materials
732. Potters, glass-makers and related trades workers
733. Handicraft workers in wood, textile, leather and related material
734. Printing and related trades workers

74. Other craft and related trades workers
741. Food processing and related trades workers
742. Wood treaters, cabinet-makers and related trades workers
743. Textile, garment and related trades workers
744. Pelt, leather and shoemaking trades workers

Major Group 8 Plant and machine operators and assemblers

81. Stationary plant and related operators
811. Mining and mineral-processing-plant operators
812. Metal-processing-plant operators
813. Glass, ceramics and related plant-operators
814. Wood-processing-and papermaking-plant operators
815. Chemical-processing-plant operators
816. Power-production and related plant operators
817. Automated-assembly-line and industrial-robot operators

82. Machine operators and assemblers
821. Metal-and mineral-products machine operators
822. Chemical-products machine operators
823. Rubber- and plastic-products machine operators
824. Wood-products machine operators
825. Printing-, binding-and paper-products machine operators
826. Textile-, fur-and leather-products machine operators
827. Food and related products machine operators
828. Assemblers
829. Other machine operators and assemblers

83. Drivers and mobile plant operators
831. Locomotive engine drivers and related workers
832. Motor vehicle drivers
833. Agricultural and other mobile plant operators
834. Ships' deck crews and related workers

Major Group 9 Elementary occupations

91. Sales and services elementary occupations
911. Street vendors and related workers
912. Shoe cleaning and other street services elementary occupations
913. Domestic and related helpers, cleaners and launderers
914. Building caretakers, window and related cleaners
915. Messengers, porters, doorkeepers and related workers
916. Garbage collectors and related labourers

92. Agricultural, fishery and related labourers
921. Agricultural, fishery and related labourers

93. Labourers in mining, construction, manufacturing and transport
931. Mining and construction labourers
932. Manufacturing labourers
933. Transport labourers and freight handlers

Major Group 0 Armed forces

01 Armed forces
011 Armed forces

A 2: The matching table of the 159 occupations to the ISCO-88 clasification (the first figure of the ISCO-88 is the number of the occupational category (source: http://laborsta.ilo.org/applv8/data/to1ae.html#22)

The 159 occupations	ISCO-88
AGRICULTURAL PRODUCTION (FIELD CROPS)	
1. Farm supervisor	6111
2. Field crop farm worker	6111
PLANTATIONS	
3. Plantation supervisor	6112
4. Plantation worker	6112
FORESTRY	
5. Forest supervisor	6141
6. Forestry worker	6141
LOGGING	
7. Logger	6141
8. Tree feller and bucker	6141
DEEP-SEA AND COASTAL FISHING	
9. Deep-sea fisherman	6153
10. Inshore (coastal) maritime fisherman	6152
COALMINING	
11. Coalmining engineer	2147
12. Miner	7111
13. Underground helper, loader	9311
CRUDE PETROLEUM AND NATURAL GAS PRODUCTION	
14. Petroleum and natural gas engineer	2147
15. Petroleum and natural gas extraction technician	3117
16. Supervisor or general foreman	8113
17. Derrickman	8113
OTHER MINING AND QUARRYING	
18. Miner	7111
19. Quarryman	7111
SLAUGHTERING, PREPARING AND PRESERVING MEAT	
20. Butcher	7411
21. Packer	
(a) Hand packer	9322
(b) Machine packer	8290
MANUFACTURE OF DAIRY PRODUCTS	
22. Dairy product processor	8272
GRAIN MILL PRODUCTS	
23. Grain miller	8273
MANUFACTURE OF BAKERY PRODUCTS	
24. Baker (ovenman)	7412
SPINNING, WEAVING AND FINISHING TEXTILES	
25. Thread and yarn spinner	8261
26. Loom fixer, tuner	7432
27. Cloth weaver (machine)	8262
28. Labourer	9322

MANUFACTURE OF WEARING APPAREL (EXCEPT FOOTWEAR)	
29. Garment cutter	7435
30. Sewing-machine operator	8263
MANUFACTURE OF LEATHER AND LEATHER PRODUCTS (EXCEPT FOOTWEAR)	
31. Tanner	8265
32. Leather goods maker	7442
MANUFACTURE OF FOOTWEAR	
33. Clicker cutter (machine)	7442
34. Laster	7442
35. Shoe sewer (machine)	7436
SAWMILLS, PLANING AND OTHER WOOD MILLS	
36. Sawmill sawyer	8141
37. Veneer cutter	8141
38. Plywood press operator	8141
MANUFACTURE OF WOODEN FURNITURE AND FIXTURES	
39. Furniture upholsterer	7437
40. Cabinetmaker	7422
41. Wooden furniture finisher	7422
MANUFACTURE OF PULP, PAPER AND PAPERBOARD	
42. Wood grinder	8142
43. Paper-making-machine operator (wet end)	8143
PRINTING, PUBLISHING AND ALLIED INDUSTRIES	
44. Journalist	2451
45. Stenographer-typist	4111
46. Office clerk	412/3/4/9
47. Hand compositor	7341
48. Machine compositor	
(a) Linotype operator	7341
(b) Monotype keyboard operator	7341
(c) Computer keyboard operator	7341
(d) Typewriter keyboard operator	7341
(e) Filmsetter keyboard operator	7341
49. Printing pressman	
(a) Cylinder pressman	8251
(b) Platen pressman	8251
(c) Rotary pressman	8251
(d) Offset pressman	8251
(e) Direct lithographic pressman	8251
(f) Rotogravure pressman	8251
50. Bookbinder (machine)	8252
51. Labourer	9322
MANUFACTURE OF INDUSTRIAL CHEMICALS	
52. Chemical engineer	2146
53. Chemistry technician	3111
54. Supervisor or general foreman	815/822
55. Mixing- and blending-machine operator	8151/8221/8222/8229
56. Labourer	9322

MANUFACTURE OF OTHER CHEMICAL PRODUCTS	
57. Mixing- and blending-machine operator	8151/8221/8222/8229
58. Packer	
(Hand packer)	9322
(Machine packer)	8290
59. Labourer	9322
PETROLEUM REFINERIES	
60. Controlman	8155
IRON AND STEEL BASIC INDUSTRIES	
61. Occupational health nurse	2230
62. Blast furnaceman (ore smelting)	8121
63. Hot-roller (steel)	8122
64. Metal melter	8122
(a) Metal-melting furnaceman (except Cupola)	8122
(b) Cupola furnaceman	8122
65. Labourer	8122
MANUFACTURE OF METAL PRODUCTS (EXCEPT MACHINERY AND EQUIPMENT)	
66. Metalworking machine setter	7223
67. Welder	7212
MANUFACTURE OF MACHINERY (EXCEPT ELECTRICAL)	
68. Bench moulder (metal)	7211
69. Machinery fitter-assembler	8281
70. Labourer	9322
MANUFACTURE OF ELECTRONIC EQUIPMENT, MACHINERY AND SUPPLIES	
71. Electronics draughtsman	3118
72. Electronics engineering technician	3114
73. Electronics fitter	7242
74. Electronic equipment assembler	8283
SHIPBUILDING AND REPAIRING	
75. Ship plater	7214
ELECTRIC LIGHT AND POWER	
76. Power distribution and transmission engineer	2143
77. Office clerk	412/3/4/9
78. Electric power lineman	7245
79. Power- generating machinery operator	8161
(a) Steam power-plant operator	8161
(b) Hydroelectric station operator	8161
(c) Power-reactor operator	8161
80. Labourer	9322
CONSTRUCTION	
81. Building electrician	7137
82. Plumber	7136
83. Constructional steel erector	7214
84. Building painter	7141
85. Bricklayer (construction)	7122
86. Reinforced concreter	7123
87. Cement finisher	7123

88. Construction carpenter	7124
89. Plasterer	7133
90. Labourer	9312/9313
WHOLESALE TRADE (GROCERY)	
91. Stenographer-typist	4111
92. Stock records clerk	4131
93. Salesperson	5220
RETAIL TRADE (GROCERY)	
94. Book-keeper	3433
95. Cash desk cashier	4211
96. Salesperson	5220
RESTAURANTS AND HOTELS	
97. Hotel receptionist	4222
98. Cook	5122
99. Waiter	5123
100. Room attendant or chambermaid	9132
RAILWAY TRANSPORT	
101. Ticket seller (cash desk cashier)	4211
102. Railway services supervisor	4133
103. Railway passenger train guard	5112
104. Railway vehicle loader	9333
105. Railway engine-driver	8311
106. Railway steam-engine fireman	8162
107. Railway signalman	8312
PASSENGER TRANSPORT BY ROAD	
108. Road transport services supervisor	4133
109. Bus conductor	5112
110. Automobile mechanic	7231
111.Motor bus driver	8323
FREIGHT TRANSPORT BY ROAD	
112. Urban motor truck driver	8324
113. Long-distance motor truck driver	8324
MARITIME TRANSPORT	
114. Ship's chief engineer	3141
115. Ship's steward (passenger)	5111
116. Able seaman	8340
SUPPORTING SERVICES TO MARITIME TRANSPORT	
117. Dockworker	9333
AIR TRANSPORT	
118. Air transport pilot	3143
119. Flight operations officer	4133
120. Airline ground receptionist	4221
121. Aircraft cabin attendant	5111
122. Aircraft engine mechanic	7232
123. Aircraft loader	9333
SUPPORTING SERVICES TO AIR TRANSPORT	
124. Air traffic controller	3144

125. Aircraft accident fire-fighter	5161
COMMUNICATION	
126. Post office counter clerk	4212
127. Postman	4142
128. Telephone switchboard operator	4223
BANKS	
129. Accountant	2411
130. Stenographer-typist	4111
131. Bank teller	4212
132. Book-keeping machine operator	4114
INSURANCE	
133. Computer programmer	2132
134. Stenographer-typist	4111
135. Card- and tape-punching machine operator	4113
136. Insurance agent	3412
ENGINEERING AND ARCHITECTURAL SERVICES	
137. Clerk of works	3112
PUBLIC ADMINISTRATION	
138. Computer programmer	2132
139. Government executive official:	
(a) Central government	
(b) Regional or provincial government	
(c) Local authority official (middle level)	
140. Stenographer-typist	4111
141. Card- and tape-punching machine operator	4113
142. Office clerk	412/3/4/9
143. Fire-fighter	5161
SANITARY SERVICES	
144. Refuse collector	9161
EDUCATION SERVICES	
145. Mathematics teacher (third level)	2310
146. Teacher in languages and literature (third level)	2310
147. Teacher in languages and literature (second level)	2320
148. Mathematics teacher (second level)	2320
149. Technical education teacher (second level)	2320
150. First-level education teacher	2331/3310
151. Kindergarten teacher	2332/3320
MEDICAL AND DENTAL SERVICES	
152. General physician	2221
153. Dentist (general)	2222
154. Professional nurse (general)	2230
155. Auxiliary nurse	3231
156. Physiotherapist	3226
157. Medical X-ray technician	3133
158. Ambulance driver	8322
REPAIR OF MOTOR VEHICLES	
159. Automobile mechanic	7231

A 3: 26 countries used in pairwise comparisons

Country	Country code	GDP per capita (PPP) in $US in 2006
Canada	CA	$36 862.95
Costa Rica	CR	$ 9 987.44
Cyprus	CY	$27 272.97
Czech Republic	CZ	$22 358.30
El Salvador	SV	$ 6 093.83
Germany	DE	$33 547.35
Guyana	GY	$ 2 745.54
Hungary	HU	$18 298.77
Chile	CL	$13 004.28
Indonesia	ID	$ 3 340.95
Italy	IT	$30 399.03
Korea, Rep.	KR	$24 284.16
Latvia	LV	$12 365.07
Madagascar	MG	$ 914.33
Mauritius	MU	$10 819.71
Mexico	MX	$13 392.40
Moldova	MD	$ 2 562.35
Peru	PE	$ 7 026.72
Philippines	PH	$ 3 255.47
Poland	PL	$15 073.22
Portugal	PT	$22 967.25
Romania	RO	$11 135.98
Slovak Republic	SK	$18 381.24
Turkey	TR	$12 961.44
United Kingdom	GB	$34 991.89
Zambia	ZM	$ 1 238.56