Assigning the Human Wealth of Nations

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Abstract

We develop a simple general equilibrium Roy model, in which a set of workers with different human capital levels is assigned to a set of different occupations. Our goal is to study how the distribution of human capital of countries changes the comparative advantage of workers and allocation of the different types of human capital.

We calibrate the model to assess the contribution of human capital growth and differences to explain growth and cross-country income differences for a group of 10 developed and developing countries. We decompose the impact of changes/differences in human capital in explaining growth and cross-country income in: 1) changes/differences in average human capital, as done traditionally in development and growth accounting; 2) changes/differences in the composition of human capital of workers, that is, changes in the share of workers with different educational attainments; and 3) changes/differences in the relative value of occupations, that is, changes in the average potential productivity of workers with certain human capital in the different occupations.

Finally, we perform policy counterfactual exercises to quantify the gains in the accumulation of different levels of human capital. In particular, we study whether developing countries should expand human capital on the low end of the distribution (primary education) or in the high-end, elite education groups (higher education).

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1 Introduction

When analyzing cross-country data, two facts emerge: significant differences in the distribution of human capital (that is, the share of workers with different human capital types -schooling levels) and significant differences in the human capital allocation of workers across occupations (that is, differences on how occupations are filled with workers with different absolute and relative skills). In particular, in countries with low stock of human capital (few average years of schooling), there are relatively more people working in low-skill occupations. We also observe low-human capital individuals (in absolute and relative terms) working in high skill occupations. In contrast, in countries with higher abundance of human capital, we observe relatively more workers in higher skill occupations, but low-skill occupations are occupied by workers with (absolute and relative) more human capital.

We develop a simple general equilibrium Roy model, in which a set of workers with different human capital levels is assigned to a set of different occupations, to study how the distribution of human capital of countries changes the comparative advantage of workers and allocation of the different types of human capital. We calibrate the model to assess the contribution of human capital growth and differences to explain growth and cross-country income differences for a group of 10 developed and developing countries.

Then, we decompose the impact of changes/differences in human capital in explaining growth and cross-country income in: 1) changes/differences in average human capital, as done traditionally in development and growth accounting; 2) changes/differences in the composition of human capital of workers, that is, changes in the share of workers with different educational attainments; and 3) changes/differences in the relative value of occupations, that is, changes in the average potential productivity of workers with certain human capital in the different occupations. The model uses two different forces in explaining the impact of changes/differences in human capital: i) Comparative advantage for workers of different schooling levels for different occupations and ii) Complementarities across the output of the different occupations. These two forces can reinforce or dampen each other depending on the expansion in the accumulation of human capital and in the changes in relative advantage of education groups.

Finally, we perform policy counterfactual exercises to quantify the gains in the accumulation of different levels of human capital. For example we study whether developing countries should expand human capital on the low end of the distribution (primary education) or in the high-end, elite education groups (higher education).

The rest of the paper is as follows: Section 2 explores the patterns in the accumulation of education across countries. Section 3 focuses on 10 developed and developing countries, exploring in more detail relationships such as eductaion patterns, workers‘allocation and income. Section 4 develops a theoretical framework to study how the distribution of human capital of countries changes the comparative advantage of workers and allocation of the different types of human capital. Section 5 presents the calibration and some policy counterfactuals. Section 6 discusses the implications of different types of human capital distributions on workers‘s allocatation and income per capita. Section 7 presents some concluding remarks.

2 Exploring patterns in the accumulation of education across countries

Over the past decades, there has a been a massive shift in the distribution of educational endowments across the world. Schooling indicators, such as average years of schooling, enrollment rates at different education level, or the share of college graduates, have improved significantly for almost countries of the world. The average worker in any given country now has more formal education than at any point in history. These changes have not only been dramatic in magnitude, but have also happened over a relatively short time span. In roughly two generations, the characteristics of workers in the economy, and the set of skills they bring to the labor market, has improved enormously.

In addition to this overall trend, a closer look at the distribution of human capital and its evolution across time, both within and between countries, reveals several additional interesting facts.These facts can helps us to shed light on

This section uses the Barro-Lee education database to present stylized facts about the distribution of human capital for a large sample of countries. These facts stress out how average measures of human capital hide a significant amount of information that can only be recovered by decomposing the aggregate data. These facts showcase the enormous changes in human capital measures from 1960 to 2000, not only in terms of average attainment, but in the relative and absolute abundance of workers with different skills

- Stylized Fact 1: There are significant differences in the distribution of human capital across countries. These differences have persisted over time, as shifts in the distribution of human capital have not been homogeneous across countries

Table 1 presents the 1960 distribution of educational attainment for the complete population over 25 years old across different country groups. The analysis includes 7 education categories, from the share of population with no schooling in the bottom of the distribution, to the share of population with completed tertiary in the top. In average across all countries, 46% of the population had no schooling, and, strikingly, less than 2% had complete tertiary. While there are immense differences across regions in the lower tail of the education distribution (share of population with no formal schooling varies immensely across country groups (the share of the population with no formal schooling goes from more than 70% in Africa and Asia to less than 10% in the developed world), the most striking fact is in the upper tail. Completed tertiary, which now seems to be a minimum standard for multiple occupations in the developed world, was still a rarity until recently. In fact, in 1960 none of the country groups had more than 4% of their population with completed tertiary.

Table 2 presents the same information for 2000. The comparison to Table 1 comparison highlights the enormous progress in educational attainment across all regions . The share of unschooled population fell almost by half across all regions, while the average share of workers with completed tertiary expanded by a factor of 5, albeit from very a low base. However, there are significant differences in the way human capital has expanded across regions. We provide a more formal assessment of this expansion below.

- Stylized Fact 2: Differences in human capital distribution across regions are not associated to differences in age composition

One concern in the cross country comparisons is that differences in the age composition of workers across countries or time might make looking at the overall population misleading and not representative of the relevant labor force. Tables 3 and 4 address this issue by presenting the distribution of human capital for the population between 25 and 35 years old. The patterns are very similar to those presented using the aggregate population. More than of 60% of the world population in this age range had not even completed primary school, a figure that was large (25%) even in Advanced economies. By 2000, the share of young population with little or no education had fallen to 25%Highly educated young workers were very scarce in 1960, even for advanced economies. In the world average, the share of young workers with complete secondary or more went from 10% in 1960 to more than 40% in 2000. The increase in that segment is particularly remarkable in East Asia and the Pacific and Eastern Europe.

- Stylized Fact 3: Differences in educational attainment by gender have fallen over time, but remain large in certain regions

Tables 5 and 6 look at educational attainment in 1960 and 2000 for female and male population aged between 25 and 35 years old. In 1960, there are important differences in attainment between men and women. In the upper tail, 8% of women had completed secondary or more, compared to 12% of men. In the lower tails, 67% of women had not completed primary. By 2000, the gap was almost completely closed on the upper tail (43.6% for young females, 44.4% for young males), but remained larger in the lower tail (27% of young women had not completed primary, compared to 22% of men). The evolution of these gaps is presented in Figure 1. There is large variation in the gap across regions. In 2000, the share of young women with tertiary education was 5% larger than the share of young men in Europe and the developed world, while it lagged 4% behind in South Asia. A similar story holds for the lower tail, with a much larger share of women relative to men with less than primary education in South Asia and Sub-Saharan Africa.

- Stylized Fact 4: There is large heterogeneity in the distribution of human capital within country regions

Figures 2 and 3 show the histograms of the share of population with less than complete secondary across countries in 1960 and 2000, for each country group. In 1960, there is significant dispersion within each country group, which is specially large for countries in the advanced economies group. Dispersion is still significant and large in 2000, but the change in the histograms shows that the evolution of humn capital across countries within each group was far from homogeneous.

- Stylized Fact 5: There is large heterogeneity in the expansion of human capital between 1960 and 2000 across regions

The overall expansion in human capital in country c from 1960 to 2000 can be defined as :

$$TEHK^c = \int_0^\infty \left[F_{1960}^c(z) - F_{2000}^c(z)\right] dz \tag{1}$$

where $F_t^c(z)$ is the cdf of human capital levels in period t in country c.

This measure is positive if the countries have improved overall the human capital, i.e. if $F_{2000}^c(z)$ dominates $F_{1960}^c(z)$ in the first order stochastic sense.

The overall expansion can then be split into three components. In particular, define z_L as complete primary and z_M as complete secondary. Given that, we can decompose overall gains as changes in primary schooling, changes in secondary schooling and changes in tertiary schooling. The change in primary schooling (movements from no schooling to incomplete primary, or from incomplete primary to complete primary) can be written as:

$$LEHK^c = \int_0^{z_L} \left[F_{1960}^c(z) - F_{2000}^c(z)\right] dz$$

The change in secondary schooling (movements from complete primary schooling to incomplete secondary, or from incomplete secondary to complete secondary) can be written as:

$$MEHK^c = \int_{z_L}^{z_M} \left[F_{1960}^c(z) - F_{2000}^c(z)\right] dz$$

Analogously, the change in tertiary schooling is defined as:

$$HEHK^c = \int_{z_M}^\infty \left[F_{1960}^c(z) - F_{2000}^c(z)\right] dz$$

Results across country groups are presented in Table 7. To get a sense of the magnitudes, as there are seven education categories, the largest possible expansion (going from 100% population without schooling to 100% population with complete tertiary would imply a total change of 700. Overall changes were the largest in Middle East and North Africa, with a very large expansion in primary schooling. Expansions in primary schooling were the most important source of variation for all regions except the advanced economies. Expansions in secondary schooling were particularly large in Eastern Europe and the Advanced Economies. Expansions in tertiary schooling are much more modest, being the largest in the Advanced Economies and the smallest in Sub-Saharan Africa.

3 Some stylized facts on workers's allocation, educational outcomes, and per capita income

This section uses the IPUMS International database to present some *Stylized Fact*s about the characteristics of occupations in terms of allocation, type of human capital (educational attainment), dispersion of human capital (within an occupation), and the evolution of these characteristics over time.

We focus on six representative countries that differ in per capita income and human capital distribution. We observe these countries in two periods: 1960 and 2000, or the nearest available date. The six countries (and periods of time available) correspond to Brazil (1960, 2000), Chile (1960, 2002), France (1962, 2002), India (1983, 1999), Mexico (1960, 2000) and the United States (1960, 2000). As Table 1 shows, GDP per capita (GDP per person employed) ranges from 321 (883) constant 2005 US dollars for the case of India 1983 to 40,946 (83,500) constant 2005 US dollars for the case of the United States in the year 2000.

We analyze nine broad occupations. Occupations ordered from low to high intensity of human capital are as follows (we present labels as used in the tables in parentheses): Elementary occupations (Elementary), plant and machine operators and assemblers (Operators), skilled agricultural and fishery workers (Agriculture), crafts and related trades workers (Traders), service workers and shop and market sales (Service), clerks (Clerks), legislators, senior officials, and managers (Managers), technicians and associate professionals (Technicians), professionals (Professionals). We rank them according to the average years of schooling of the workers in each occupation in the United States in 2010[1]. We considered data for all working people (complete population) in any of the nine occupations.

The facts that we present in the following paragraphs highlight the huge differences in human capital allocation across countries and how these allocations have evolved over time. We relate the changes in these allocations to the distribution of human capital in the economy.

Stylized Fact 1: There are significant differences in the allocation of workers across occupations and across countries. These differences have persisted over time.

Table 8 presents the 1960 and 2000 allocation of workers to the nine occupations in the sample considered. The share of workers in the different occupations varies from a minimum of 0.85% for Managers in Mexico in 1960 to a maximum of 57% in the case of Agriculture in Brazil in 1960. When looking within occupations, we again observe

[1]The ranking is maintained if 1960 is used as base year, with the exceptions of Agriculture and Managers that go down one place

huge differences among countries. On average shares differ by 20 percentage points, being higher in low-human capital occupations compared to high ones. For instance, Elementary occupations show the largest participation range, fluctuating between 2% and 35% while the smallest differences arise in Professionals that vary 3% and between 13%.

Table 8 also reports the change in the relative size of the various occupations over time. For each country, the size of the less human-capital-intensive occupations has fallen in favor of more human-capital-intensive ones. In 1960 (or nearest available date), the three less intensive human capital occupations absorbed 66% of the workforce; in 2000 (or nearest available date), this figure dropped to 40%. Similarly, in 1960, 15% of the workforce was allocated to the three occupations with higher human capital intensity, a figure that doubled in the year 2000.

Stylized Fact 2: Occupations and schooling: Same occupations show significant differences in average years of schooling between countries. In countries with low average years of schooling relatively more people work in low-skill occupations. As better educated human capital becomes more abundant, the share of workers increases towards occupations with higher intensity of human capital.

The comparative advantage of an individual depends on the entire distribution of human capital in the country. In countries with low average years of schooling, low-human capital individuals in absolute - but not in relative - terms work in high-skill occupations. Low-human capital individuals in absolute and relative terms work in low-skill occupations. In countries with higher levels of average schooling, the contrary is true: low-skill occupations are occupied by workers with high human capital in absolute, but not relative terms, and high-skill occupations are filled with individuals with high human capital in absolute and relative terms.

Looking at years of education and its breakdown by occupation, Table 9 provides an interesting picture. There are significant differences in average years of schooling within an occupation between countries and periods. On average, the maximum difference in average years of schooling reaches 9 years. There is a feature that is noteworthy. While at the lower end of occupations average years of schooling within occupations are very different among countries, average years of schooling at the upper end of the occupations are much more similar.

This table also shows how the distribution of human capital and its allocation has changed over time. Human capital measured as average years of schooling increased in all countries during the periods under analysis. However, in relative terms, average years of schooling increased proportionally more in low-skilled occupations. This is consistent with the idea that convergence is stronger at the lower end of the distribution of human capital.

The allocation according to comparative advantages is also clear from this table. For instance, let us look at two countries in 1960, one with high and one with low human capital. The United States, with an average of 10.4 years of schooling is at the upper end of the country distribution, while Brazil, with an average of 2.1 years of schooling is one of the country with lowest human capital. Let us also consider two types of occupation, one with low human capital intensity: Agriculture; and one with a higher one: Managers. The difference at the lower end of occupations is striking. In the case of Agriculture, workers in the United Stated averaged 8.4 years of schooling while in Brazil this figure falls to only one year. In the case of Managers, average years of schooling in the United States are 11.6 years versus 4.3 years in Brazil.

These figures highlight the importance of relative advantages. Workers with an average of 4 years of schooling would be considered as relatively low human capital in relation to a workforce averaging 10 years of schooling, but would be defined as high human capital when compared with a workforce with an average of 2 years of schooling. This figure highlights the importance of comparative advantages. Comparative advantaged explain why these workers are assigned to occupations of low human capital in the first case and to high human capital occupation in the second case. All these differences in workforce share and average schooling across occupations suggest that these countries have very different production structures.

Stylized Fact 3: There is significant heterogeneity in human capital dispersion across occupations. Dispersion of schooling levels is lower in high skilled ones. As countries increase their average years of schooling, dispersion decreases in all occupations.

Table 10 shows the coefficient of variation for years of schooling within occupations and per country. Again, there is large heterogeneity in schooling dispersion among occupations and countries. The average dispersion among countries is 0.6, a figure that more than doubles in India in 1983 and that drops to 0.3 in the case of the Unites States in the year 2000.

We also observe an inverse relation between average years of schooling and average dispersion. That is, countries that have lower human capital on average tend to exhibit occupations comprising larger heterogeneity in schooling. In contrast, the workforce within occupations is more homogenous in high human capital countries. For example, Brazil (1960), India (1983) and Mexico (1960) are the three countries with the highest dispersion, showing an average coefficient of variation around 1.2: These countries are also the three ones with lowest average years of schooling (2.8 years. On the other hand, it is not surprising that the three countries with the lowest dispersion are also de countries with highest average years of schooling. Thus, the United States (2000), France (2002) and Chile (2002) show an average coefficient of variation of 0.24 and average schooling of more than 12 years.

Another interesting feature is that dispersion tends to decrease as we move into occupations that are more human-capital intensive. This occurs regardless of the level of human capital. This decline in the dispersion is larger, the larger the average dispersion of the economy or, equivalently, the lower the average level of human capital. In fact, as countries become more abundant in human capital, the decline in the dispersion is smaller, becoming only marginal or non-existent in the case of high-human-capital countries. Thus, returning to the case of India (1983) and United States (2000), in the Indian case, the variation coefficient falls from 1.5 in the three less human capital-intensive occupations to 0.6 in the three highest human capital intensity occupations. For the United States, in both cases, the figure is around 0.2.

Stylized Fact 4: There is large heterogeneity in the composition of the workforce by the education degree within occupations.

In all the cases that we analyze (with the exception of Chile), all occupations hire all types of human capital available in the economy. Even in economies with low human capital, there are people with tertiary education working in elementary occupations and there are people with no schooling working as technicians or managers.

In analyzing the allocation of workers by type of education, we observe changes in the distribution of human capital across occupations and periods of time, but these changes are not qualitatively significant. For example, in 1960, 80% of workers without education were assigned to the three occupations with less human capital and about 3%, to the three most human-capital-intensive ones. In 2000, 73% of this type of workers was allocated to the lowest categories and 1% to the highest. While the drop in the allocation of less human capital workers in low human capital occupations might seem strange at first sight, this result is mainly explained by the large contraction of the agricultural sector, which tends to absorb this kind of workers.

A completely different picture arises when conditioning on occupations. We observe a concentration of low-human-capital workers in low-human-capital occupations, but a penetration of high-human-capital workers along all occupations. Tables 10 and 11 show that in 1960, 90% of people working in low human capital occupations had at most primary schooling, and only 1% attained some tertiary education. In the year 2000, 58% of these workers had some primary education and 8% had some tertiary education.

This result reflects the shift in the distribution of human capital towards a more educated workforce. However, these shifts have not been homogenous across occupations. The change in schooling has been more significant in high human capital ones. In 1960, 41% of the people working in the high human capital occupations had at most some primary education and 25% had some tertiary while in year 200, the proportion of the workforce having only some primary schooling fell sharply to 9% and the proportion of workers with some tertiary rose to a significant 60%.

One concern in the cross country and time series comparisons is that differences in the age and sex composition of workers might explain the differences in the allocation of workers. To that end, we decompose the workforce in different age and sex groups. For the sake of presentation, occupations are now separated in three main categories: low, medium and high human capital intensive.[2]. We define young and old as a worker younger and older than 45 years, respectively.

Stylized Fact 5: While there are differences in the allocation of human capital across age and sex groups, these dimensions do not drive the huge differences observe in the patterns of allocation. Tables 15 and 16 show the share of young and old workers by educational attainment and type of occupation. The first interesting feature is that young workers dominate the workforce. For the complete sample, young workers compose 70% of the workforce on average. However, with time, the workforce is becoming slightly older. Brazil and India show the largest fraction of young workers (around 80%) and the United States is the country with the lowest fraction (ca. 60%). Now, for the same level of schooling, old workers are allocated relatively more to high human-capital intensive occupations while young workers tend to be hired in less human capital occupations. However, the table clearly shows that educational attainment is the main driver of the allocations.

Next, we decompose the workforce by sex. A known fact is that men dominate the workforce, but with time women are increasing their representation. Tables 19 and 20 show the fraction of men and women by educational attainment and by occupations. In 1960 (or nearest date), almost 75% of the workforce was composed of men. In the year 2000 (or nearest available date), this figure drops to 60% reflecting the entering of women to the workforce. An interesting result is that when controlling by education attainment, women tend to be (slightly) allocated to more human-capital-intensive occupations in relation to men. For instance, almost 90% of women with more than secondary schooling are allocated to medium and high human-capital-intensive occupations versus 77% in the case of men. This pattern repeats with workers with less than secondary education. While, 45% of low human capital women work in medium and high human capital-intensive occupations, 38% of men do it. However, as in the composition by age, sex does not explain the differences in allocations within and between occupations across countries.

4 The Model

In this section we develop a simple general equilibrium Roy model in which a set of workers with different human capital levels are assigned to a set of different occupations.

[2]Low: Elementary, Operators, and Agriculture. Medium: Traders, Services, and Clerks. High: Managers, Technicians, and Professionals

The model draws on recent work by Acemoglu and Autor (2011), Costinot and Fogel (2014), Burstein et al (2016) and Hsieh et al. (2016). **Edit:** Those papers focus on the equilibrium wage inequality arising in equilibrium as workers with different characteristics are allocated across occupations with different skills requirements. Our focus is instead on the country's aggregate effective supply of human capital services resulting from the endogenous assignment of workers to occupations.

As in the standard growth model, in each period t a composite, final good Y_t is produced according to a production function $Y_t = Z_t F(K_t, H_t)$, where $F(\cdot,\cdot)$ is a constant returns to scale production function, Z_t is an exogenous Hicks-neutral productivity term (TFP), K_t is the flow of services from the stock of physical capital in the country, and H_t is the aggregate flow of human-capital augmented labor services.

We extend the standard model as follows. First, H_t is the aggregation of labor services provided in multiple occupations. We index those occupations by $j = 1,..., J$ and denote by $H_t(j)$ the total supply of effective labor services provided in occupation j in period t. The resulting bundle of human capital services is given by $H_t = G_t[H_t(1), ...H_t(J)]$, where $G(\cdot)$ is a constant returns to scale function. Second, we consider the allocation of workers with different human capital '*groups*', indexed by $e = 1, .., E$ across the different occupations $j = 1, ..., J$. The aggregate supply levels $H_t(j)$ arise from optimal occupation choices, i.e. the general equilibrium assignments, of workers in groups e to occupations j, as we explain below.

Much of our analysis can proceed with generic functions $F_t(\cdot)$ and $G_t(\cdot)$. For concreteness, however, we will proceed using the commonly used functional forms, under which we perform our quantitative exercises. Specifically, we adopt the a Cobb-Douglas aggregate production function:

$$Y_t = Z_t (K_t)^{\alpha} (H_t)^{1-\alpha}, \tag{2}$$

where $0 < \alpha < 1$ if the physical capital share of output. Similarly, the human capital aggregator is given by a CES, i.e.

$$H_t = \left[\sum_{j=1}^{J} M_t(j) [H_t(j)]^{\rho}\right]^{\frac{1}{\rho}}, \tag{3}$$

where ρ is a parameter that indicates the degree of complementarity across the different occupations and can entertain values anywhere between $-\infty$, Leontieff, i.e. extreme complements, and $+1$, i.e.perfect substitutes.[3] Here, $M_t(j) \geq 0$ are factors that determine the contributions of human capital services in occupations j on the overall flow of human capital services H_t in the economy. We adopt the normalization $\sum_{j=1}^{J} M_t(j) = 1$

[3]Values of ρ above 1 are ruled out to keep the aggregate H_t to be concave function of $H_t(j)$.

so that the TFP of the country Z_t captures all the Hicks neutral productivity shifts and $M_t(j)$ are the CES distributional parameters in the production function of H_t.

The population of workers inside the country in period t is described by a discrete distribution

$$S_t = [S_t(1), ..., S_t(e), ...S_t(E)].$$

Here, $S_t(e) \geq 0$ for all groups e, and we normalize the population measure to one, i.e. $\sum_{e=1}^{E} S_t(e) = 1$. Thus, $S_t(\cdot)$ is simply a discrete probability distribution, describing the cross-section of workers types that populate the country at period t. In light of our data, we will assume that the number of human capital groups E is finite. In our baseline exercises, we think of each e as indexing levels –or intervals– of education attainment. We then extend our groupings of human capital to include experience and gender.

As in the data, some workers in all the different groups e could potentially provide labor services in any of the $j = 1, ..., J$ occupations. The human capital type e of a worker, however, determines the proclivity of those workers to choose the different occupations. In our model, the human capital e of a workers determines not only his absolute advantage in the different occupations, but also his comparative advantage relative to other workers.

Specifically, the assignment of workers to occupations is potentially driven by four factors: *(a)* the *unitary skill price* in each occupation, $w_t(j)$, which applies to all workers, regardless of their type e, entering in that occupation; *(b)* an productivity component $T_t(e, j) > 0$ that determines the *average potential productivity* of workers with human capital e in occupation j; and *(c)* a *random* components, $\eta(j)$, of the different workers for each possible occupation j; and *(d) wedges* $D_t(e, j)$ such as barriers and compensatory variations that can be specific to the pairings j and e. We take all four factors *(a)-(d)* as exogenous and for our quantitative exercises infer them from the data. Our first, basic case abstracts from factor *(d)* and focus on factors (a)-(c). Then, we extend to model to consider distorted equilibria and two different specifications for non-pecuniary factors.

We shall follow Burstein et. al (2016), Hsieh et. al (2016) and others, by assuming that, each worker draws a random $1 \times J$ vector,

$$\eta = [\eta(1), .., \eta(J)] \in \mathbb{R}_+^J$$

from a continuous joint distribution described by a p.d.f. $Q(\eta)$, where each $\eta(j)$ is drawn identically and independently, both, (a) across all individuals, and (b) across all occupations for the same individual. In particular, assume that the distribution is given by a multidimensional Frechet distribution:

$$Q(\eta) = \prod_{j=1}^{J} \exp\left\{-\left[\eta(j)\right]^{-\theta}\right\},$$

where $\theta > 1$ is a dispersion parameter that drives the degree of comparative advantage in the economy. The Frechet distribution is a form of extreme value distribution that has ben vastly used in recent models of international trade because of analytical convenience. [4]Under these assumptions, each of the workers with human capital e would supply an expected amount of labor units to occupation j equal to $T_t(e, j)\,\Gamma(1 - \theta^{-1})$ where $\Gamma(\cdot)$ is the Gamma function.[5]

We also allow for the possibility of distortions and non-pecuniary barriers in the allocation of workers. In particular, we assume that there are wedges $D_t(e, j) \geq 1$, and that workers of group e working in occupation j can only offer a an effective $1/D(e, j)$ of their time endowment and skills for in that occupation.

The equilibrium assignment is based on the income maximization of workers. Given his type e and the realization of η, each worker can offer $\eta(j)\,T_t(e, j)/D_t(e, j)$ effective units of labor for each occupation j. General equilibrum will determine the equilibrium price for skills supplied for each occupation j, and the resulting supplies $H_t(j)$, the human capital H_t and the aggregate output Y_t of the country. Key parameters in the general equilibrium of the model, and in the results for our counterfactual exercises are the complementarity parameter ρ in the production function (**??**), and the dispersion paramter θ that governs the importance of comparative advantage of workers of different groups.

5 Equilibrium Assignment

We consider competitive equilibria. The price system is simply a vector of unitary prices for each skill j, $w_t(j)$, denominated in units of the final good. Taking those prices as given, workers of all groups e will be assigned to occupations j, giving raise to a matrix $p_t(e, j)$ that indicates the fraction of workers in group e that work in occupation j. Here, $p_t(e, j) \geq 0$ and $\sum_{j=1}^{J} p_t(e, j) = 1$ for all e. Taking the vector of unitary *occupation* or *skill* prices $w_t(j)$, in the aggregate the demand for those skills $H_t(j)$ must be consistent with firms' profits maximization. For an equilibrium, the resulting allocations must clear all labor markets.

[4]In particular, our formulation follows Burstein et al. (2016), in which the drivers of absolute and comparative are entirely in the shifters $T_t(j, e)$. An equivalent formulation would subsume those shifters by assuming different joint distributions $Q_e(\eta)$ for each group e.

[5]That is, $\Gamma\left(1 - \theta^{-1}\right) = \int_0^\infty x^{-(1/\theta)} e^{-x} dx$.

Individual optimization conditions are straightforward. First, consider the demand for skills by firms. Because of constant returns to scale, the firm size distribution is not pinned down, but firms' hiring of services from the different forms of human capital services $H_t(j)$ and of physical capital R_t can be characterized by a stand-in firm that maximizes profits taking $w_t(j)$ and R_t as given, i.e.:

$$\max_{\{H_t(j),\ K_t\}} \left\{ Z_t (K_t)^{\alpha} \left(\left[\sum_{j=1}^{J} M_t(j) \left[H_t(j) \right]^{\rho} \right]^{\frac{1}{\rho}} \right)^{1-\alpha} - w_t(j) H_t(j) - R_t K_t \right\}.$$

What is relevant for our purposes is that wages $w_t(j)$ must equate the marginal product of $H_t(j)$:

$$w_t(j) = \bar{w}_t \times M_t(j) \left[H_t(j) \right]^{\rho-1}, \tag{4}$$

where $\bar{w}_t \equiv (1-\alpha) Z_t (K_t/H_t)^{\alpha} \times (H_t)^{1-\rho}$ is an economywide component that is common across in the price of all skills j.

Second, each worker chooses the occupation that maximizes his net income,

$$\max_{i \in \{1,\ldots,J\}} \left\{ \eta(i) T_t(e,i) \frac{w_t(i)}{D_t(e,i)} \right\}.$$

This is, regardless of whether a worker opts for an occupation because his human capital e leads to a *relatively* high value for the average $T_t(e,j)$ or because he had a *relatively* high realization $\eta_t(j)$, the worker is, ex-post, compensated equally. With many ex-ante identical workers in each group e, the share of workers of that group opts to each of the occupations j is equal to the probability that any of them chooses them. Under the Frechet distribution, such probability is given by

$$p_t(e,j) = \frac{\left[w_t(j) \frac{T_t(e,j)}{D_t(e,j)} \right]^{\theta}}{\sum_{i=1}^{J} \left[w_t(i) \frac{T_t(e,i)}{D_t(e,i)} \right]^{\theta}}. \tag{5}$$

In what follows, we examine the equilibrium skill prices $w_t(j)$ and the allocations $p_t(e,j)$ and $H_t(j)$ that arise, given the cross-section of workers S_t, their productivity across occupations T_t and Q, the productivity shifts M_t and the wedges D_t.

5.1 Undistorted Equilibrium

In an undistorted equilibrium, $D(e,j) = 1$, for all e and j. All workers get the same wage $w_t(j)$ for each unit of effective labor provided in occupation j. We first discuss the assignment of workers given the wages, and then the determination of equilibrium wages, and finally, the fixed point condition required by an equilibrium.

In the absence of distortions, the assignment condition (**??**), becomes,

$$p_t(e,j) = \frac{[w_t(j)\, T_t(e,j)]^\theta}{\sum_{i=1}^J [w_t(i)\, T_t(e,i)]^\theta}. \tag{6}$$

Given the fractions $\{S_t(e)\}_{e=1}^E$, the total mass of workers in from education e in occupation j will be given by $q_t(e,j) = S_t(e)\, p_t(e,j)$ and the total fraction of individuals in occupation j in the country will be $q_t(j) = \sum_{e=1}^E S_t(e)\, p_t(e,j)$. More importantly, in terms of effective labor units, the total labor from workers with human capital e supplied to occupation j, $H_t(j,e)$, is given by

$$H_t(j,e) = [S_t(e)\, p_t(e,j)] \left[\Gamma\left(1-\theta^{-1}\right) T_t(e,j)\, p_t(e,j)^{-1/\theta}\right], \tag{7}$$

where the first term in brackets is the total mass of workers with human capital e working in occupations j and the second term is the average effective labor units provided by such a group. Notice that this average goes down with the probability of entry, as the marginal worker entering, on average, have lower skills realizations $\eta(j)$. Then, summing over all human capital types e:

$$H_t(j) = \Gamma\left(1-\theta^{-1}\right) \sum_{e=1}^E S_t(e)\, [p_t(e,j)]^{(\theta-1)/\theta}\, T_t(e,j). \tag{8}$$

From here, we can write the total human capital H_t as

$$H_t = \Gamma\left(1-\theta^{-1}\right) \left[\sum_{j=1}^J M_t(j) \left[\sum_{e=1}^E S_t(e)\, [p_t(e,j)]^{(\theta-1)/\theta}\, T_t(e,j)\right]^\rho\right]^{\frac{1}{\rho}}.$$

After plugging expression (**??**) for $p_t(e,j)$, the aggregate human capital H_t becomes

$$H_t = \Gamma\left(1-\theta^{-1}\right) \left[\sum_{j=1}^J M_t(j) \left[\sum_{e=1}^E \frac{S_t(e)\, w_t(j)^{\theta-1}\, T_t(e,j)^\theta}{\left[\sum_{i=1}^J [w_t(i)\, T_t(e,i)]^\theta\right]^{(\theta-1)/\theta}}\right]^\rho\right]^{\frac{1}{\rho}},$$

which is driven by the cross-section $S_t(e)$, the average productivities $T_t(i,e)$, and the occupation productivities $M_t(j)$, but also by the given wages $w_t(j)$.

Recall that wages are given by the condition (??). Plugging this expression into (??) and taking out the common factor $\bar{w}_t$, we obtain

$$p_t(e,j) = \frac{\left[M_t(j)\,[H_t(j)]^{\rho-1}\,T_t(e,j)\right]^{\theta}}{\sum_{i=1}^{J}\left[M_t(i)\,[H_t(i)]^{\rho-1}\,T_t(e,i)\right]^{\theta}}.$$

Next, plug this expression into the formula for (??) for the human capital services in occupation j to obtain the fixed-point conditions

$$H_t(j) = \left\{\Gamma\left(1-\theta^{-1}\right)\sum_{e=1}^{E}\frac{S_t(e)\,M_t(j)^{(\theta-1)}\,T_t(e,j)^{\theta}}{\left[\sum_{i=1}^{J}\left(M_t(i)\,[H_t(i)]^{\rho-1}\,T_t(e,i)\right)^{\theta}\right]^{(\theta-1)/\theta}}\right\}^{\frac{1}{1-(\rho-1)(\theta-1)}}.$$

With a solution to this fixed point problem in $\{H_t(j)\}_{j=1}^{J}$, we could readily compute the value of H_t, the equilibrium wages $w_t(j)$, and, of course the assignment of workers $p_t(e,j)$. This is straightforward to implement numerically as we report below.[6]

To be completed: SLP fixed point arguments. There has to be a simple way to establish existence (Brower) and uniqueness (Lucas).

Numerical illustrations?

5.2 Distorted Equilibria

We now consider the case in which different workers may receive different compensations for the same units of skills. To this end, we allow for wedges $D_t(e,j) \geq 1$ that reduce

[6] The fixed point conditions for $H_t(j)$ have closed-form solutions when $\rho = 1$, i.e. H_t is linear in all $H_t(j)$ The unique solution for $H_t(j)$ is given by

$$H_t(j) = \Gamma\left(1-\theta^{-1}\right)\sum_{e=1}^{E} S_t(e)\,\frac{M_t(j)^{(\theta-1)}\,T_t(j,e)^{\theta}}{\left[\sum_{i=1}^{J}\left(M_t(i)\,T_t(i,e)\right)^{\theta}\right]^{(\theta-1)/\theta}},$$

and

$$H_t = \Gamma\left(1-\theta^{-1}\right)\sum_{e=1}^{E} S_t(e)\sum_{j=1}^{J}\frac{\left[M_t(j)\,T_t(j,e)\right]^{\theta}}{\left[\sum_{i=1}^{J}\left(M_t(i)\,T_t(i,e)\right)^{\theta}\right]^{(\theta-1)/\theta}}$$

with wages $w_t(j) = \bar{w}_t \times M_t(j)$ and assignment of workers as

$$p_t(j,e) = \frac{\left[M_t(j)\,T_t(j,e)\right]^{\theta}}{\sum_{i=1}^{J}\left[M_t(i)\,T_t(i,e)\right]^{\theta}}.$$

the effective supply of services of workers of type e into occupations j. With those wedges, the effective wages for workers in group e operating in occupation j are scale down by $1/D_t(e,j)$, i.e.

$$w_t(e,j) = w_t(j)/D_t(e,j),$$

where $w_t(j)$ is the marginal product to aggregate human capital services $H_t(j)$.

The wedges $D_t(e,j)$ can arise from different forms of distortions, e.g. discrimination, as analyzed by Hsieh et al. (2016). They can be group specific, i.e. depending only on e, or occupation specific, i.e. depending only on j. Simple but extreme version of these wedges would be (a) a caste system in which for each group e, there are designed occupations $\hat{J}(e)$ such $D_t(e,j) = 1$ if $j \in \hat{J}(e)$ and $D_t(e,j) = \infty$ otherwise; or (b) an uniform barrier to only one occupation if $D_t(e,j^*) = \bar{D} > 1$ for j^*. At any rate, any arbitrarily patterns across e and j can be considered in this setting.

We take the wedges as exogenously given and consider two different formulations, pure wedges and taxes.

5.2.1 $D_t(e,j)$ as Pure Wedges

Besides scaling by $1/D_t(e,j)$ the earnings of workers e in occupations j, the wedges can also distort in the same proportion the effective supply of labor services received by the firm. The equilibrium supply of skills from group e is

$$H_t(e,j) = \Gamma\left(1-\theta^{-1}\right) \frac{S_t(e)\left[p_t(e,j)\right]^{(\theta-1)/\theta} T_t(e,j)}{D_t(e,j)}. \tag{9}$$

The equilibrium conditions (**??**) and (**??**) remain valid. Therefore, the wedges $D_t(e,j)$ not only distort the effective supplies directly, but also indirectly by distorting $p_t(e,j)$.

It is evident that the analysis for the undistorted equilibrium carries through as long as the terms $T_t(e,j)$ are replaced for $T_t(e,j)/D_t(e,j)$. Then, as with the undistorted case, we can take out the common factor $\bar{w}_t$ from (**??**) and obtain

$$p_t(e,j) = \frac{\left[M_t(j)\left[H_t(j)\right]^{\rho-1}\frac{T_t(e,j)}{D_t(e,j)}\right]^{\theta}}{\sum_{i=1}^{J}\left[M_t(i)\left[H_t(i)\right]^{\rho-1}\frac{T_t(e,j)}{D_t(e,j)}\right]^{\theta}}. \tag{10}$$

Next, plug this expression into the formula for (**??**) for the human capital services in occupation j to obtain a very similar set of fixed-point conditions as above:

$$H_t(j) = \left\{ \Gamma\left(1-\theta^{-1}\right) \sum_{e=1}^{E} \frac{S_t(e)\, M_t(j)^{(\theta-1)} \left[\frac{T_t(e,j)}{D_t(e,j)}\right]^{\theta}}{\left[\sum_{i=1}^{J} \left(M_t(i)\,[H_t(i)]^{\rho-1} \frac{T_t(e,j)}{D_t(e,j)}\right)^{\theta}\right]^{(\theta-1)/\theta}} \right\}^{\frac{1}{1-(\rho-1)(\theta-1)}}.$$

Needless to say, when $D_t(e,j)$ are pure wedges, a distorted equilibrium with T_t is observable equivalent to an undistorted equilibrium with T_t/D_t. However, in the quantitative exercises of the next sections, allowing for distortions $D_t(e,j)$ can be quite useful for the countries and years for which reliable wage data allows us to obtain an independent measure of the wedges.

5.2.2 $D_t(e,j)$ as Implicit Taxes to Workers

As a variation, we can think of $D_t(e,j)$ as implicit taxes. In that case, even if there is not a reduction in the effective supply of services that each worker of type e delivers to the firms, the effective income for the workers is $w_t(e,j) = w_t(j)/D_t(e,j)$.

Under this form of wedges, the solution fo $p_t(e,j)$ would be given by (**??**), but the expression for $H_t(e,j)$ is not (**??**) but the undistorted one, (**??**). Plugging the distorted $p_t(e,j)$ into the undistorted (**??**) and summing over all e, the supply of human capital services into occupation j, we get that the equilibrium allocation of $H_t(j)$ must solve the fixed point conditions

$$H_t(j) = \left\{ \Gamma\left(1-\theta^{-1}\right) \sum_{e=1}^{E} S_t(e) \frac{\left[\frac{M_t(j)}{D_t(e,j)}\right]^{(\theta-1)} [T_t(e,j)]^{\theta}}{\left[\sum_{i=1}^{J} \left[M_t(i)\,[H_t(i)]^{\rho-1} \frac{T_t(e,j)}{D_t(e,j)}\right]^{\theta}\right]^{(\theta-1)/\theta}} \right\}^{\frac{1}{1-(\rho-1)(\theta-1)}}.$$

With the solution to $H_t(j)$, we compute the equilibrium value of H_t using (**??**), wages $w_t(j)$ using (**??**) and the equilibrium $p_t(e,j)$ using (**??**.)

5.3 A Convenient Decomposition

It is convenient to separate the role of pure comparative advantage from those from comparative advantage and pure occupations productivities. Consider a decomposition in the form $T_t(e,j)$ as $T_t(e,j) = A_t(e)\, C_t(e,j)$ where $A_t(e)$ is *uniform absoluted productivity term of group* e across all *across all occupations* j and $C_t(e,j)$ is the comparative advantage term.[7] For brevity, we will discuss the pure wedges case only here.

Under such a decomposition, the assignment of workers becomes

$$p_t(e,j) = \frac{\left[w_t(j)\,\frac{C_t(e,j)}{D_t(e,j)}\right]^{\theta}}{\sum_{i=1}^{J}\left[w_t(i)\,\frac{C_t(e,i)}{D_t(e,i)}\right]^{\theta}}.$$

Two immediate implications follow. First, given wages, pure absolute advantage terms $A_t(e)$ do not affect the allocation of workers across occupations. Second, the the general equilibrium determination of the wages $w_t(j)$ is how the aggregate equilibrium affects the assignment of different workers e across occupations j.

Similarly, the formula for the country's overall human capital services becomes:

$$H_t = \Gamma\left(1-\theta^{-1}\right)\left[\sum_{j=1}^{J} M_t(j)\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\,\frac{w_t(j)^{\theta-1}\left[\frac{C_t(e,j)}{D_t(e,j)}\right]^{\theta}}{\left[\sum_{i=1}^{J}\left[w_t(i)\,\frac{C_t(e,i)}{D_t(e,i)}\right]^{\theta}\right]^{(\theta-1)/\theta}}\right]^{\rho}\right]^{\frac{1}{\rho}},$$

which is strictly increasing in $A_t(\cdot)$ and homogeneous of degree one in $A_t(\cdot)$ and $S_t(\cdot)$. Solving for the general equilibrium determination of wages, and human capital across occupations, the fixed point that solves the equilibrium allocations becomes

$$H_t(j) = \left\{\Gamma\left(1-\theta^{-1}\right)\sum_{e=1}^{E} S_t(e)\, A_t(e)\,\frac{M_t(j)^{(\theta-1)}\left[C_t(e,j)/D_t(e,j)\right]^{\theta}}{\left[\sum_{i=1}^{J}\left[M_t(i)\left[H_t(i)\right]^{\rho-1}\left[\frac{C_t(e,i)}{D_t(e,i)}\right]\right]^{\theta}\right]^{(\theta-1)/\theta}}\right\}^{\frac{1}{1-(\rho-1)(\theta-1)}}.$$

5.4 A Simple Benchmark: Absolute Advantage Only

Before characterizing the equilibrium assignment of workers to occupations of the model, it is convenient to consider a the underlying, simpler case of absolute advantage only. Such a case boils down to the aggregate efficiency human capital units underlying in most the standard growth- and development-accounting analyses in the literature.

[7] Any productivity shifts specific to an occupation but commong to all groups e would be captured by the terms $M_t(j)$, and, because of rescaling, in the TFP term Z_t.

Assume **absolute but no comparative advantage**, across human capital types, i.e., for some $A_t(e) \geq 0$, we can write $T_t(e,j) = A_t(e)$ for all e and j. That is, the effective units of labor that a worker can provide is shifted *uniformly across all occupations* by the absolute advange term $A_t(e)$.

For now, consider a random and uniform assignment in which, regardless their human capital type e workers are randomly allocated to each occupation $j = 1, ..., J$ with probability $p(j)$, where $\sum p(j) = 1$. Then, the total human capital services $H_t(j)$ provided by group e to occupation j is simply $p(j) S_t(e) \Gamma(1-\theta^{-1}) B_t(j) A_t(e)$. Summing over all groups e, we obtain

$$H_t(j) = \Gamma\left(1-\theta^{-1}\right) p(j) \sum_{e=1}^{E} S_t(e) A_t(e).$$

Plugging this formula it in the aggregator (**??**), the combination of all $H_t(j)$ leads to an aggregate human capital for the country in the form

$$H_t = \Gamma\left(1-\theta^{-1}\right)\left(\sum_{j=1}^{J} M_t(j)\,[p(j)]^{\rho}\right)^{\frac{1}{\rho}}\left(\sum_{e=1}^{E} S_t(e) A_t(e)\right),$$

The term inside brackets becomes completely indistinguishable from any other underlying the TFP term Z_t in the aggregate production function (**??**). Accounting for human capital boils down to the traditional measurement of the population's distribution of human capital levels, $S_t(e)$, and the absolute enhancements on productivity, $A_t(e)$, of the different types of human capital, as traditionally done using Mincer estimates.

Notice that this separation is indepedent of the particular choice of $p(j)$.[8] More interestingly, this form of indeterminacy is much more general. As as long as human capital only shifts absolute advantage, i.e. $T_t(e,j) = A_t(e)$, the term $\sum_{e=1}^{E} S_t(e) A_t(e)$ enters multiplicatively in the production function. The equilibrium assignment of human capital types e to occupations j is undetermined, and many different configurations of $p_t(e,j)$ could deliver the same $H_t(j)$ and H_t levels. The details for this argument are in the appendix. In any case, if human capital levels e only drive absolute advantage across all occupations, observing data on the allocation of those human capital groups

[8] With some simple algebra it can be shown that, under the two conditions stated above, the optimal uniform allocation $p^*(\cdot)$ across occupations is simply

$$p^*(i) = \frac{\left[T_t^J(i)\right]^{\frac{\rho}{1-\rho}}}{\sum_{j=1}^{J}\left[T_t^J(j)\right]^{\frac{\rho}{1-\rho}}},$$

for all $i = 1, ..., J$.

across occupations, $p_t(e,j)$ would be uninformative about the human capital H_t of a country and the aggregate return of expanding the human capital endowments of countries, $S_t(\cdot)$ across the different levels e. This irrelevance result is overturned once we look into economies where comparative advantage drives the allocation of workers.

6 Inference from Observed Data

In this section we show how we can use the general equilibrium conditions of the model to infer the underlying distribution of skills of the different human capital groups. We first show how the conditions of undistorted equilibria can be used to deliver a simple characterization of the comparative advantage components $C_t(e,j)$ from the observed allocation $p_t(e,j)$. Next, we show how to extend the inference to include both the components of $T_t(e,j)$ and the barriers $D_t(e,j)$ when, besides the assignment data $p_t(e,j)$, we also observe earnings data $y_t(j,e)$. We should how to use these inferred values and general equilibrium assigment conditions to infer the aggregate human capital of countries.

6.1 Undistorted Equilibrium: Inferring $T_t(e,j)$ and $M_t(j)$ from observed $p_t(e,j)$

From the equation (**??**), we get that, for any two occupations j,j' and human capital groups, e, e', there is a "ratio of ratios"

$$\left[\frac{p_t(e,j)/p_t(e,j')}{p_t(e',j)/p_t(e',j')}\right] = \left[\frac{T_t(e,j)/T_t(j',e)}{T_t(e,j)/T_t(j',e')}\right]^{\theta}. \tag{11}$$

This simple condition leads to three very useful implications about $A_t(e)$, $C_t(e,j)$ and $M_t(j)$. First, the comparative advantage terms $C_t(e,j)$ must be proportional to $p_t(e,j)^{\frac{1}{\theta}}$. Therefore, only the distribution parameter θ is needed to infer comparative advantage terms from observed assignment data $p_t(e,j)$. Second, the occupation shifters $M_t(j)$ are direct drivers of $w_t(j)$ and therefore, can be inferred from the allocation of total human capital across occupations. Third, since absolute productivity components $A_t(e)$ have no bearing on the allocation of workers across occupations, then data on $p_t(e,j)$ has no information regarding $A_t(e)$, and those terms must be inferred directly from income data, i.e. $A_t(e) = y_t(e)$. Formally we state the following:

Proposition 1 *Adopt the decomposition $T_t(e,j) = A_t(e)\,C_t(e,j)$ explained above and let $p_t(e,j)$ be the observed assignment of workers of human capital types $e = 1, ..., E$ into jobs $j = 1, ..., J$, and $A_t(e)$ an estimate of the absolute productivities of workers* *in group e. Then, if the underlying equilibrium of the economy is undistorted:* ***(a)*** *the comparative advantage term is given by*

$$C_t(e,j) = \bar{C}_t p_t(e,j)^{\frac{1}{\theta}},$$

for some positive $\bar{C}_t$ *uniform across* e *and* j*;* ***(b)*** *the pure relative occupation productivity terms* $M_t(j)$ *are given by*

$$M_t(j) = \frac{\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,j)\right]^{1-\rho}}{\sum_{i=1}^{J}\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,i)\right]^{1-\rho}}.$$

Proof. See Appendix. ■

From these simple results, we can obtain a very straightforward characterization of the aggregate human capital of a country.

Proposition 2 *Let* $p_t(e,j)$ *be the observed assignment of workers of human capital types* $e = 1,...,E$ *into jobs* $j = 1,...,J$*, and* $A_t(e)$ *an estimate of the absolute productivities of workers in group* e*. If the underlying equilibrium of the economy is undistorted, then the aggregate human capital of the country is given by*

$$H_t = \Gamma\left(1-\theta^{-1}\right)\frac{\left[\sum_{e=1}^{E} S_t(e) A_t(e)\right]^{\frac{1}{\rho}}}{\left\{\sum_{i=1}^{J}\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,i)\right]^{1-\rho}\right\}^{\frac{1}{\rho}}}.$$

Proof. See Appendix. ■

An important result is that the resulting aggregate human capital is independent of the comparative advantage parameter θ. The key parameter is ρ, which governs the degree of substitution between occupations. The data on $p_t(e,j)$ determines the value of H_t unless $\rho = 1$ and occupations are perfect substitutes. If so, $H_t = \sum_{e=1}^{E} S_t(e) A_t(e)$, as in traditional measurements. Finally, as expected, notice that the equilibrium assignment of workers into occupations results in a country's that is increasing and homogeneous of degree 1 both in the quantity $S_t(e)$ of their workers as well as in their quality, $A_t(e)$.

6.2 Distorted Equilibrium: Inferring $\{T_t(e,j), M_t(j), D_t(e,j)\}$ from observed $\{p_t(e,j), y_t(e,j)\}$

In the previous section we showed how to use data on the assignment of workers to occupations, $p_t(e,j)$, and the average income $y_t(e)$ of each type of workers, and the conditions of an indistorted equilibrium to infer the comparative and absolute advantage components of the skills of workers, and the productivity parameters of each occupation in the aggregate human capital. In this section, we extend those inference exercises to economies in which frictions and/or compensating differentials can distort the assignment of workers to occupations. Such distortions generate income differences in conditional mean incomes each type e of wokers across occupations j.

First, we show how to perform a similar inference as before, conditional on any form of wedges $D_t(e,j)$. Here, we show several simple results: (a), if the distortions are uniform across occupations j, i.e. $D_t(e,j) = \hat{D}_t(e)$ for all j, even if they vary across human capital groups e, then they do not distort the allocation of workers. Those distortions only alter the absolute advantage of workers and since they do not distort asignments, the inference of the previous section remain valid; (b), if the conditional average income differences in the data are driven by pure wedges (in the sense defined above), then the formula for aggregate human capital remains unchanged; (c) when the distortions are in the form of implicit taxes (in the sense defined above) then they affect the inferred values of aggregate human capital, but simple formulas still attain. It is worth recalling that in all those cases, changes in the wedges $D_t(e,j)$, would resulting in changes in the effective comparative advantage of workers and result in changes in aggregate human capital of countries. Second, we show our simple method for using $y_t(e,j)$ data to infer wedges $D_t(e,j)$.

Inference of $C_t(e,j), M_t(j)$ and H_t given $D_t(e,j)$: Consider having already gotten (inferred) data on $D_t(e,j)$ and on the average income $y_t(e)$ for workers of type e. First, consider that the wedges vary across workers, but not across occupations, i.e. $D_t(e,j) = \hat{D}_t(e) > 1$. In this case, the terms $\hat{D}_t(e)$ only distort the absolute advantage of workers. The true $A_t(e)$ underlying in the economy is the counterfactual income $y_t(e)\hat{D}_t(e)$ that group e would accrue in an undistorted economy. Other than that, the inferred comparative advantage terms $C_t(e,j)$ would not change.

Next consider the pure wedges case, where the average earnings $y_t(e,j)$ differences terms $D_t(e,j)$ reduce the effective supply of skills. In this case, the equilibrium assigment is given by the expression (**??**) leading to a ratio-of-ratios, for any pairs e, e' and j,j' of the form

$$\left[\frac{p_t(e,j)/p_t(e,j')}{p_t(e',j)/p_t(e',j')}\right] = \left[\frac{\frac{C_t(e,j)}{D_t(e,j)}/\frac{C_t(e,j')}{D_t(e,j')}}{\frac{C_t(e',j)}{D_t(e',j)}/\frac{C_t(e',j')}{D_t(e',j')}}\right]^{\theta}.$$

Therefore, the observed assignment of workers to occupations can be driven by either the underlying comparative advantages of workers of by the wedges they face in each occupations. From the previous expression, the only possible solution for $C_t(e,j)$ must necessarily be of the form

$$C_t(e,j) = \bar{C}_t D_t(e,j)\left[p_t(e,j)\right]^{\frac{1}{\theta}} \tag{12}$$

for any constant $\bar{C}_t$, which we normalize so as to the weight of the distortions are

subsummed into the absolute advantage $A_t(e)$, as discussed below. When plugging expression (**??**) into (**??**) the $D_t(e,j)$ terms cancel each other. Similarly, when plugging (**??**) into (**??**) those terms cancel out. Therefore, the same expressions as in the undistorted equilibrium for $H_t(e,j)$, $M_t(j)$**,** and H_t attain when $D_t(e,j)$ are pure wedges that reduce the effective supply of skills from workers.

Finally, consider the case where $D_t(e,j)$ are pure taxes that reduce the earnings of the worker but not the services received by firms. First, notice that the only solution for solution for $C_t(e,j)$ is still (**??**) since occupation choice, from the point of view of the worker, is the same as the pure wedges case. Now, plugging $T_t(e,j) = A_t(e)\bar{C}_t D_t(e,j)[p_t(e,j)]^{\frac{1}{\theta}}$ into the undistorted expression $H_t(j,e) = [S_t(e)p_t(e,j)]\Gamma(1-\theta^{-1})T_t(e,j)p$ normalizing $\bar{C}_t = 1$, simplifying and then summing over e, we obtain

$$H_t(j) = \Gamma\left(1-\theta^{-1}\right)\sum_{e=1}^{E} S_t(e)A_t(e)p_t(e,j)D_t(e,j). \tag{13}$$

That is, the effective aggregate supply of skills j include the taxes $D_t(e,j)$ on workers. Since aggregate skill prices, $w_t(j) = \bar{w}_t \times M_t(j)[H_t(j)]^{\rho-1}$, are equalized, then

$$M_t(j)\left[\sum_{e=1}^{E} S_t(e)A_t(e)p_t(e,j)D_t(e,j)\right]^{\rho-1} = M_t(i)\left[\sum_{e=1}^{E} S_t(e)A_t(e)p_t(e,i)D_t(e,i)\right]^{\rho-1}.$$

Then, impossing $\sum_{i=1}^{J} M_t(i) = 1$ and solving,

$$M_t(j) = \frac{\left[\sum_{e=1}^{E} S_t(e)A_t(e)p_t(e,j)D_t(e,j)\right]^{1-\rho}}{\sum_{i=1}^{J}\left[\sum_{e=1}^{E} S_t(e)A_t(e)p_t(e,i)D_t(e,i)\right]^{1-\rho}}, \tag{14}$$

i.e. the tax distortions would enter in our inference for the distributional occupational weights $M_t(j)$.

We summarize the previous discussion with the following proposition, which is the extension of the previous two for economies with distortions:

PROPOSITION.

Inference of $D_t(e,j)$, $A_t(e)$ **from** $y_t(e,j)$**:** We now consider how to use income data, $y_t(e,j)$, to infer the abolute advantage parameters $A_t(e)$ and the wedges or utility costs, $D_t(e,j)$.

Undistorted Equilibrium: As a point of departure, notice that a consequence of the Frechet distribution for the idiosyncratic skills, the average income of a worker e on occupation j, denoted $y_t(e,j)$ depends only on e and does not vary across occupations j

- Inferring $D_t(e,j)$ from participation and average incomes $p_t(e,j)$, $I_t(e,j)$ we must have $A_t(e) = \sum_j p_t(e,j) I_t(e,j)$.
- The average incomes $A_t(e) = \sum_j p_t(e,j) I_t(e,j)$ and maximum $A_t^{\max}(e) = \max\{\}$

Imagine that we have $A_t(e)$ and $D_t(e,j)$ inferred from data on $\{p_t(e,j), I_t(e,j)\}$. Now, we can infer $C_t(e,j)$ from $p_t(e,j)$ and $D_t(e,j)$ from (**??**)

$$p_t(e,j) = \frac{\left[w_t(j)\frac{T_t(e,j)}{D_t(e,j)}\right]^{\theta}}{\sum_{i=1}^{J}\left[w_t(i)\frac{T_t(e,i)}{D_t(e,i)}\right]^{\theta}}. \tag{15}$$

$$\begin{aligned}\left[\frac{p_t(e,j)/p_t(e,j')}{p_t(e',j)/p_t(e',j')}\right] &= \frac{\left[w_t(j)\frac{T_t(e,j)}{D_t(e,j)}\right]^{\theta}/\left[w_t(j')\frac{T_t(e,j')}{D_t(e,j')}\right]^{\theta}}{\left[w_t(j)\frac{T_t(e',j)}{D_t(e',j)}\right]^{\theta}/\left[w_t(j')\frac{T_t(e',j')}{D_t(e',j')}\right]^{\theta}} \\ &= \frac{\left[\frac{C_t(e,j)}{D_t(e,j)}\right]^{\theta}/\left[\frac{C_t(e,j')}{D_t(e,j')}\right]^{\theta}}{\left[\frac{C_t(e',j)}{D_t(e',j)}\right]^{\theta}/\left[\frac{C_t(e',j')}{D_t(e',j')}\right]^{\theta}}.\end{aligned}$$

Then, the only solutions for $C_t(e,j)$ must necessarily be of the form

$$C_t(e,j) = \bar{C}_t D_t(e,j)\left[p_t(e,j)\right]^{\frac{1}{\theta}}$$

Now, to establish part (b), plug $T_t(e,j) = A_t(e)\, C_t(e,j) = A_t(e)\,\bar{C}_t D_t(e,j)\left[p_t(e,j)\right]^{\frac{1}{\theta}}$ into $p_t(e,j) = \frac{\left[w_t(j)\frac{T_t(e,j)}{D_t(e,j)}\right]^{\theta}}{\sum_{i=1}^{J}\left[w_t(i)\frac{T_t(e,i)}{D_t(e,i)}\right]^{\theta}}$ to obtain the same equation as before:

$$1 = \frac{\left[w_t(j)\right]^{\theta}}{\sum_{i=1}^{J}\left[w_t(i)\right]^{\theta} p_t(e,i)}. \tag{16}$$

The only solution for these equations, as long as $p_t(e,i) \neq p_t(e',i)$ for some e, e' and i, is that

$$w_t(j) = w_t(i), \tag{17}$$

for all i and j. First, consider the pure wedges case: To solve for the vector of unitary wages $[w_t(1), ..., w_t(J)]$, again plug $T_t(e,j) = A_t(e)\bar{C}_t D_t(e,j)[p_t(e,j)]^{\frac{1}{\theta}}$ into the expression $H_t(e,j) = \Gamma(1-\theta^{-1}) S_t(e)[p_t(e,j)]^{(\theta-1)/\theta} T_t(e,j)/D_t(e,j)$, normalize $\bar{C}_t = 1$, simplify and then sum over e to obtain

$$H_t(j) = \Gamma\left(1-\theta^{-1}\right)\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,j). \tag{18}$$

Since $w_t(j) = \bar{w}_t \times M_t(j)[H_t(j)]^{\rho-1}$, then, from (**??**)

$$M_t(j)\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,j)\right]^{\rho-1} = M_t(i)\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,i)\right]^{\rho-1},$$

or

$$M_t(i) = M_t(j)\frac{\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,i)\right]^{1-\rho}}{\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,j)\right]^{1-\rho}},$$

But, since $M_t(j)$ are distributional shifts in the CES for H_t, it has to be the case that $\sum_{i=1}^{J} M_t(i) = 1$. Writing all $M_t(i)$ in terms of a single $M_t(j)$

$$\sum_{i=1}^{J} M_t(j)\frac{\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,i)\right]^{1-\rho}}{\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,j)\right]^{1-\rho}} = 1,$$

and taking j terms out of the summation and solving, we get

$$M_t(j) = \frac{\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,j)\right]^{1-\rho}}{\sum_{i=1}^{J}\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,i)\right]^{1-\rho}}, \tag{19}$$

i.e. exactly as in the case of no wedges. Second, consider the case of pure taxes. As before, $T_t(e,j) = A_t(e)\bar{C}_t D_t(e,j)[p_t(e,j)]^{\frac{1}{\theta}}$ into the undistorted expression $H_t(j,e) = [S_t(e) p_t(e,j)]\Gamma(1-\theta^{-1}) T_t(e,j) p_t(e,j)^{-1/\theta}$, normalize $\bar{C}_t = 1$, simplify and then sum over e to obtain

$$H_t(j) = \Gamma\left(1-\theta^{-1}\right)\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,j) D_t(e,j). \tag{20}$$

Since $w_t(j) = \bar{w}_t \times M_t(j)\left[H_t(j)\right]^{\rho-1}$, then, from (**??**)

$$M_t(j)\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,j)\, D_t(e,j)\right]^{\rho-1} = M_t(i)\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,i)\, D_t(e,i)\right]^{\rho-1}.$$

Then, rearranging terms, impossing $\sum_{i=1}^{J} M_t(i) = 1$ and solving, we get Writing all $M_t(i)$ in terms of a single $M_t(j)$

$$\sum_{i=1}^{J} M_t(j)\, \frac{\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,i)\right]^{1-\rho}}{\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,j)\right]^{1-\rho}} = 1,$$

and taking j terms out of the summation and solving, we get

$$M_t(j) = \frac{\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,j)\, D_t(e,j)\right]^{1-\rho}}{\sum_{i=1}^{J}\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,i)\, D_t(e,i)\right]^{1-\rho}}, \tag{21}$$

i.e. the tax distortions would enter in our inference for the distributional occupational weights $M_t(j)$.■

A Proofs

Proof of Proposition ACM (U) First, notice that for any pairs j, j' and e, e', equation (**??**)

$$\left[\frac{p_t(e,j)/p_t(e,j')}{p_t(e',j)/p_t(e',j')}\right] = \left[\frac{[A_t(e)\,C_t(e,j)]/[A_t(e)\,C_t(e,j')]}{[A_t(e')\,C_t(e',j)]/[A_t(e')\,C_t(e',j')]}\right]^{\theta}.$$

The pure absolute terms $A_t(e)$ and $A_t(e')$ cancel out within the ratios in the numerator and denominator, respectively. Hence,

$$\left[\frac{p_t(e,j)/p_t(e,j')}{p_t(e',j)/p_t(e',j')}\right] = \left[\frac{C_t(e,j)/C_t(e,j')}{C_t(e',j)/C_t(e',j')}\right]^{\theta}. \tag{22}$$

Then, for any $\bar{C}_t > 0$, a constant across e and j, we have $C_t(e,j) = \bar{C}_t * p_t(e,j)^{\frac{1}{\theta}}$ solves the solution and, without loss of generality, we can normalize $\bar{C}_t = 1$, so all absolute advantage terms are scaled in $A_t(e)$. To see that the only solutions are given by this form, assume that there is another solution of the form $C_t(e,j) = \nu_t(e,j) * p_t(e,j)^{\frac{1}{\theta}}$ for some $\nu_t(e,j) > 0$ that varies across e and/or j. Then, using (**??**), it has to be the case that, for all e and j

$$1 = \left[\frac{\nu_t(e,j)/\nu_t(e,j')}{\nu_t(e',j)/\nu_t(e',j')}\right]^{\theta},$$

which can only hold if $\nu_t(e,j) = \nu_t^E(e)\,\nu_t^J(j)$ for some $\nu_t^E(e) > 0$ and $\nu_t^J(j) > 0$. Hence, without loss of generality, we can normalize $A_t(e)$ and $M_t(j)$ as respectively embedding those terms. This establishes part (a).

To establish part (b), plug $T_t(e,j) = A_t(e)\,p_t(e,j)^{\frac{1}{\theta}}$ into $p_t(e,j) = \frac{[w_t(j)T_t(e,j)]^{\theta}}{\sum_{i=1}^{J}[w_t(i)T_t(i,e)]^{\theta}}$ to obtain that for all e and j:

$$p_t(e,j) = \frac{[w_t(j)\,A_t(e)]^{\theta}\,p_t(e,j)}{\sum_{i=1}^{J}\left[w_t(i)\,A_t(e)\,p_t(e,i)^{\frac{1}{\theta}}\right]^{\theta}}.$$

Notice that the terms $A_t(e)$ cancel out, as absolute advantages do not drive the allocation of workers across occupations. More interestingly, $p_t(e,j)$ cancels across both sides of this equation and then, the conditions boil down to

$$1 = \frac{[w_t(j)]^{\theta}}{\sum_{i=1}^{J}[w_t(i)]^{\theta}\,p_t(e,i)}. \tag{23}$$

The only solution for these equations, as long as $p_t(e,i) \neq p_t(e',i)$ for some e, e' and i, is that

$$w_t(j) = w_t(i), \tag{24}$$

for all i and j. To solve for the vector of unitary wages $[w_t(1), ..., w_t(J)]$, plug $T_t(e,j) = A_t(e)\, p_t(e,j)^{\frac{1}{\theta}}$ into the expression $H_t(j,e) = S_t(e)\, p_t(e,j) \left\{ \Gamma(1-\theta^{-1})\, T_t(e,j)\, p_t(e,j)^{-1/\theta} \right\}$, and then sum over e to obtain

$$H_t(j) = \Gamma\left(1-\theta^{-1}\right) \sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,j). \tag{25}$$

Since $w_t(j) = \bar{w}_t \times M_t(j)\, [H_t(j)]^{\rho-1}$, then, from (**??**)

$$M_t(j) \left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,j) \right]^{\rho-1} = M_t(i) \left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,i) \right]^{\rho-1},$$

or

$$M_t(i) = M_t(j) \frac{\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,i)\right]^{1-\rho}}{\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,j)\right]^{1-\rho}},$$

But, since $M_t(j)$ are distributional shifts in the CES for H_t, it has to be the case that $\sum_{i=1}^{J} M_t(i) = 1$. Writing all $M_t(i)$ in terms of a single $M_t(j)$

$$\sum_{i=1}^{J} M_t(j) \frac{\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,i)\right]^{1-\rho}}{\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,j)\right]^{1-\rho}} = 1,$$

and taking j terms out of the summation and solving, we get

$$M_t(j) = \frac{\left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,j)\right]^{1-\rho}}{\sum_{i=1}^{J} \left[\sum_{e=1}^{E} S_t(e)\, A_t(e)\, p_t(e,i)\right]^{1-\rho}}, \tag{26}$$

as claimed.■

Proof of Proposition H (U) With the expression for H_t

$$H_t = \left[\sum_{j=1}^{J} M_t(j)\, [H_t(j)]^{\rho} \right]^{\frac{1}{\rho}},$$

and plugging the expression for (??) and (??)

$$H_t = \left\{ \sum_{j=1}^{J} \frac{\left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,j)\right]^{1-\rho}}{\sum_{i=1}^{J} \left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,i)\right]^{1-\rho}} \left[\Gamma\left(1-\theta^{-1}\right) \sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,j)\right]^{\rho} \right\}^{\frac{1}{\rho}},$$

which, after re-arranging, grouping and simplifying

$$H_t = \Gamma\left(1-\theta^{-1}\right) \left\{ \frac{\sum_{j=1}^{J} \sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,j)}{\sum_{i=1}^{J} \left[\sum_{e=1}^{E} S_t(e) A_t(e) p_t(e,i)\right]^{1-\rho}} \right\}^{\frac{1}{\rho}},$$

as claimed.■

B Calibration and Policy Counterfactuals

To be added

C Conclusions

To be added

D References

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Table 1: Share of population 25 and over, by Education Attainment, 1960

	No Schooling	Incomplete Primary	Completed Primary	Incomplete Secondary	Completed Secondary	Incomplete Tertiary	Completed Tertiary
Region							
Advanced Economies	6.81	18.78	38.12	13.85	16.00	2.40	4.02
East Asia and the Pacific	44.47	21.38	19.89	7.86	4.25	0.69	1.46
Eastern Europe	9.58	22.68	34.00	14.47	13.43	2.25	3.59
Latin America and the Caribbean	32.13	35.22	20.67	5.87	3.87	0.76	1.47
Middle East and North Africa	68.96	10.96	8.46	3.36	5.28	1.09	1.90
South Asia	71.72	14.10	3.88	3.26	6.52	0.21	0.32
Sub-Saharan Africa	71.90	17.17	6.85	1.97	1.42	0.32	0.37
World Average	41.91	20.92	19.83	7.30	6.97	1.14	1.93

Table 2: Share of population 25 and over, by Education Attainment, 2000

	No Schooling	Incomplete Primary	Completed Primary	Incomplete Secondary	Completed Secondary	Incomplete Tertiary	Completed Tertiary
Region							
Advanced Economies	2.46	2.44	13.45	17.76	36.96	10.35	16.60
East Asia and the Pacific	12.51	14.17	16.76	20.97	24.43	3.90	7.27
Eastern Europe	0.58	0.76	4.77	14.18	59.10	7.26	13.33
Latin America and the Caribbean	9.85	17.48	22.44	18.01	19.82	4.38	8.00
Middle East and North Africa	26.46	10.93	11.78	15.12	22.78	3.72	9.20
South Asia	49.93	7.19	10.68	11.08	13.92	2.10	5.10
Sub-Saharan Africa	41.35	15.66	15.86	13.81	10.25	1.16	1.89
Total	18.80	10.58	14.44	16.19	26.54	4.77	8.68

Table 3: Share of population 25 and over, by Education Attainment, 1960

	No Schooling	Incomplete Primary	Completed Primary	Incomplete Secondary	Completed Secondary	Incomplete Tertiary	Completed Tertiary
Region							
Advanced Economies	6.81	18.78	38.12	13.85	16.00	2.40	4.02
East Asia and the Pacific	44.47	21.38	19.89	7.86	4.25	0.69	1.46
Eastern Europe	9.58	22.68	34.00	14.47	13.43	2.25	3.59
Latin America and the Caribbean	32.13	35.22	20.67	5.87	3.87	0.76	1.47
Middle East and North Africa	68.96	10.96	8.46	3.36	5.28	1.09	1.90
South Asia	71.72	14.10	3.88	3.26	6.52	0.21	0.32
Sub-Saharan Africa	71.90	17.17	6.85	1.97	1.42	0.32	0.37
World Average	41.91	20.92	19.83	7.30	6.97	1.14	1.93

Table 4: Share of population 25 and over, by Education Attainment, 2000

	No Schooling	Incomplete Primary	Completed Primary	Incomplete Secondary	Completed Secondary	Incomplete Tertiary	Completed Tertiary
Region							
Advanced Economies	2.35	1.70	10.96	15.82	38.38	12.40	18.39
East Asia and the Pacific	10.30	10.04	17.65	19.64	27.56	6.03	8.79
Eastern Europe	0.57	0.73	4.32	13.74	61.29	7.76	11.56
Latin America and the Caribbean	7.44	14.88	21.28	20.19	23.48	4.87	7.83
Middle East and North Africa	19.40	10.39	13.72	15.68	26.50	4.60	9.70
South Asia	40.89	8.12	12.90	11.08	18.08	3.26	5.68
Sub-Saharan Africa	34.75	14.62	19.09	16.23	12.26	1.35	1.67
Total	15.29	9.21	14.96	16.63	29.22	5.75	8.94

Table 5: Share of Female Population 25-35 years old by Educational Attainment

	No Schooling	Incomplete Primary	Completed Primary	Incomplete Secondary	Completed Secondary	Incomplete Tertiary	Completed Tertiary
Region							
1960							
Advanced Economies	7.92	18.92	38.42	15.21	14.87	2.23	2.41
East Asia and the Pacific	55.71	19.00	16.19	5.36	2.59	0.40	0.73
Eastern Europe	12.40	24.94	32.81	14.12	11.30	1.92	2.53
Latin America and the Caribbean	35.52	33.42	20.38	5.48	3.67	0.65	0.88
Middle East and North Africa	78.58	7.82	6.13	2.16	3.79	0.66	0.86
South Asia	80.26	10.16	2.59	1.78	5.07	0.06	0.07
Sub-Saharan Africa	79.21	13.59	4.20	1.49	1.01	0.25	0.25
Total	47.77	19.24	18.24	6.76	5.90	0.93	1.15
2000							
Advanced Economies	2.47	1.84	10.60	14.80	37.30	13.07	19.91
East Asia and the Pacific	12.73	9.03	17.27	18.58	28.09	5.24	9.05
Eastern Europe	0.55	0.70	4.01	13.17	59.24	8.88	13.43
Latin America and the Caribbean	7.99	14.18	20.74	20.31	23.64	5.12	8.00
Middle East and North Africa	23.87	9.47	12.42	13.16	26.29	4.87	9.90
South Asia	51.70	7.16	10.80	8.71	14.96	2.32	4.34
Sub-Saharan Africa	40.23	14.18	17.56	15.06	10.55	1.06	1.33
Total	18.02	8.72	14.11	15.58	28.29	5.87	9.39

Table 6: Share of Male Population 25-35 years old by Educational Attainment

	No Schooling	Incomplete Primary	Completed Primary	Incomplete Secondary	Completed Secondary	Incomplete Tertiary	Completed Tertiary
Region							
1960							
Advanced Economies	5.68	18.74	37.72	12.57	17.09	2.15	6.02
East Asia and the Pacific	33.65	23.13	24.03	10.14	5.91	0.89	2.25
Eastern Europe	6.69	20.35	35.25	14.53	15.87	2.48	4.82
Latin America and the Caribbean	28.71	37.09	20.88	6.28	4.08	0.78	2.16
Middle East and North Africa	60.59	13.45	10.60	4.37	6.79	1.29	2.92
South Asia	63.68	17.76	5.14	4.89	7.63	0.32	0.57
Sub-Saharan Africa	64.44	20.26	10.11	2.50	1.83	0.37	0.51
Total	36.23	22.32	21.57	7.79	8.07	1.20	2.81
2000							
Advanced Economies	2.23	1.56	11.33	16.86	39.37	11.75	16.88
East Asia and the Pacific	7.81	11.44	17.68	20.64	27.07	6.87	8.49
Eastern Europe	0.59	0.76	4.62	14.37	63.26	6.64	9.72
Latin America and the Caribbean	6.84	15.65	21.80	19.80	23.58	4.60	7.69
Middle East and North Africa	14.75	11.09	14.93	17.68	27.10	4.47	9.97
South Asia	30.54	7.88	16.09	13.55	20.87	4.24	6.87
Sub-Saharan Africa	29.25	15.29	20.49	17.30	14.01	1.68	1.96
	12.53	9.73	15.77	17.56	30.21	5.66	8.53

Table 7: Share of population 25 and over, by Education Attainment, 2000

	Change in Primary	Change in Secondary	Change in Tertiary	Total Change
Region				
Advanced Economies	74.7	71.1	14.4	160.2
East Asia and the Pacific	127.4	48.6	7.3	183.4
Eastern Europe	100.6	74.9	8.0	183.5
Latin America and the Caribbean	114.1	40.6	6.4	161.1
Middle East and North Africa	144.6	43.9	7.8	196.3
South Asia	95.4	28.4	5.3	129.1
Sub-Saharan Africa	104.3	15.5	1.3	121.2
World Average	108.2	45.5	7.0	160.7

Table 8: The Data: Share of workers occupation

	Elementary	*Operators*	*Agriculture*	*Traders*	*Services*	*Clerks*	*Managers*	*Technicians*	*Professionals*	***Total***
Brazil										
1960	8.26	3.39	56.87	15.25	5.09	3.44	3.39	0.98	3.33	100.00
2000	7.18	8.75	22.86	14.88	21.86	7.55	4.08	7.56	5.29	100.00
Chile										
1960	35.22	7.78	11.56	21.81	6.23	5.83	6.01	2.35	3.21	100.00
2002	22.28	8.73	5.26	12.97	12.81	8.59	5.80	14.01	9.53	100.00
France										
1962	1.79	27.05	11.94	7.60	17.16	11.00	3.98	11.23	8.24	100.00
2006	12.73	4.24	3.07	11.66	15.90	13.12	6.20	20.14	12.93	100.00
India										
1983	25.20	3.58	40.42	11.93	4.05	2.98	6.82	1.49	3.54	100.00
1999	11.84	5.37	28.37	13.58	6.79	5.94	15.89	3.16	9.07	100.00
Mexico										
1960	12.53	5.09	46.79	14.21	10.08	5.58	0.85	1.32	3.54	100.00
2000	14.00	8.88	25.41	17.48	15.37	7.43	1.75	2.57	7.12	100.00
USA										
1960	11.67	18.68	4.04	12.47	17.24	17.19	6.95	3.46	8.30	100.00
2000	5.44	11.10	1.86	11.00	18.34	19.26	9.93	9.61	13.46	100.00

Source: Authors'calculations based on IPUMS.

Table 9: The Data: Average years of schooling by occupation

	Elementary	*Operators*	*Agriculture*	*Traders*	*Services*	*Clerks*	*Managers*	*Technicians*	*Professionals*	***Average***
Brazil										
1960	2.47	2.95	0.99	2.44	1.81	6.12	4.35	5.00	9.61	2.06
2000	5.16	6.26	3.10	5.49	6.31	10.23	10.42	10.46	13.52	6.52
Chile										
1960	3.01	5.50	3.18	5.09	5.72	9.95	7.07	9.54	13.45	4.98
2002	7.80	9.78	6.77	9.15	10.56	12.06	13.77	13.73	16.14	10.79
France										
1962	5.61	6.68	5.42	6.85	6.79	7.83	10.07	9.58	11.47	7.53
2006	9.30	9.92	10.30	10.49	11.49	11.86	15.43	13.61	16.24	12.32
India										
1983	1.36	4.79	2.19	3.60	5.14	11.21	6.31	8.91	11.80	3.35
1999	7.39	8.58	8.23	8.34	9.03	12.72	10.37	11.42	13.70	9.42
Mexico										
1960	2.01	3.80	1.39	3.46	3.89	6.61	6.86	5.55	9.68	2.82
2000	5.92	7.69	4.19	6.81	8.19	11.36	14.24	11.18	14.99	7.47
USA										
1960	7.91	8.98	8.41	9.49	10.04	11.71	11.55	12.68	14.96	10.35
2000	11.29	11.80	11.96	12.12	12.35	12.84	14.13	14.39	16.08	13.17

Source: Authors'calculations based on IPUMS.

Table 10: The Data: Coefficient of variation (years of schooling) by occupation

	Elem-entary	*Oper-ators*	*Agric-ulture*	*Traders*	*Serv-ices*	*Clerks*	*Manag-ers*	*Tech-nicians*	*Profes-sionals*	***Average***
Brazil										
1960	0.92	0.61	1.48	0.77	0.99	0.50	0.80	0.63	0.47	1.17
2000	0.69	0.52	0.92	0.60	0.57	0.29	0.41	0.31	0.28	0.60
Brazil										
1960	0.83	0.51	0.93	0.52	0.50	0.25	0.53	0.34	0.31	0.65
2002	0.46	0.31	0.56	0.37	0.30	0.21	0.16	0.13	0.13	0.30
Brazil										
1962	0.33	0.40	0.28	0.41	0.40	0.37	0.31	0.31	0.19	0.35
2006	0.35	0.31	0.33	0.28	0.29	0.28	0.22	0.25	0.19	0.27
India										
1983	1.95	0.87	1.56	1.09	0.82	0.32	0.78	0.50	0.38	1.40
1999	0.33	0.32	0.36	0.34	0.34	0.25	0.35	0.29	0.22	0.32
Mexico										
1960	1.12	0.67	1.30	0.75	0.77	0.48	0.60	0.61	0.51	1.03
2000	0.58	0.40	0.77	0.56	0.47	0.28	0.25	0.29	0.19	0.53
USA										
1960	0.42	0.32	0.41	0.30	0.29	0.17	0.28	0.23	0.17	0.29
2000	0.19	0.16	0.20	0.15	0.17	0.14	0.17	0.16	0.15	0.16

Source: Authors'calculations based on IPUMS.

Table 11: The Data: Share of workers by educational attainment and occupation

	Elem- entary	*Oper- ators*	*Agric- ulture*	*Traders*	*Serv- ices*	*Clerks*	*Manag- ers*	*Tech- nicians*	*Profes- sionals*	***Total***
Brazil 1960										
No school	37.43	20.66	69.47	32.76	47.49	2.77	17.36	7.83	1.99	51.54
Primary	61.08	78.71	30.39	66.78	52.33	78.98	72.08	81.20	41.48	45.18
Secondary	1.36	0.60	0.10	0.42	0.16	16.39	7.04	8.25	31.34	2.19
Tertiary	0.13	0.04	0.04	0.03	0.02	1.86	3.52	2.73	25.19	1.09
Brazil 2000										
No school	17.07	6.70	34.56	11.87	9.75	1.06	3.12	1.34	1.35	13.99
Primary	64.96	69.02	60.53	70.14	62.30	22.87	27.41	22.11	9.80	53.63
Secondary	16.57	23.03	4.44	16.94	25.53	61.06	37.92	56.45	18.28	23.71
Tertiary	1.40	1.25	0.47	1.05	2.42	15.01	31.55	20.10	70.56	8.67
Chile 1960										
No school	31.49	7.99	30.18	9.30	7.95	0.14	7.05	0.51	0.25	18.18
Primary	66.18	77.55	63.44	79.60	75.91	24.15	55.97	34.63	10.62	64.69
Secondary	2.30	14.05	5.66	11.05	15.70	70.95	32.89	55.07	41.36	14.67
Tertiary	0.03	0.41	0.72	0.05	0.45	4.76	4.09	9.80	47.78	2.45
Chile 1960										
No school	7.27	2.38	10.67	3.80	2.31	0.59	0.00	0.00	0.00	3.23
Primary	50.58	29.28	60.33	36.51	20.07	6.05	0.00	0.00	0.00	24.83
Secondary	38.10	58.14	24.78	50.48	58.96	58.65	45.39	33.17	0.00	41.29
Tertiary	4.06	10.20	4.22	9.21	18.66	34.71	54.61	66.83	100.00	30.65
France 1962										
Primary	89.65	71.55	92.63	68.26	67.64	49.34	23.90	26.67	7.53	58.81
Secondary	9.77	28.12	6.84	30.81	30.75	49.26	48.20	58.83	58.68	35.00
Tertiary	0.58	0.33	0.53	0.93	1.62	1.41	27.90	14.50	33.79	6.19
France 1962										
Primary	31.27	21.97	22.28	16.08	11.42	9.45	2.71	4.49	2.05	11.87
Secondary	63.27	72.19	66.52	75.93	68.19	66.54	27.42	46.47	17.96	54.97
Tertiary	5.46	5.84	11.20	7.98	20.39	24.01	69.87	49.04	80.00	33.16
India 1983										
No school	74.68	32.81	64.22	44.74	29.42	3.35	25.84	10.15	5.71	54.69
Primary	21.95	44.67	28.19	41.03	45.65	11.91	37.82	28.95	10.70	29.01
Secondary	3.17	19.83	6.76	12.55	21.64	50.16	25.60	41.41	36.67	11.77
Tertiary	0.20	2.69	0.83	1.68	3.28	34.58	10.75	19.49	46.91	4.53
india 1999										
Primary	78.63	60.60	66.16	63.72	54.62	10.47	38.99	23.14	6.69	51.85
Secondary	19.32	33.95	28.20	31.40	36.56	46.70	39.06	49.33	34.37	32.51
Tertiary	2.05	5.46	5.64	4.88	8.83	42.82	21.95	27.53	58.94	15.64

Source: (1): Authors' calculations based on IPUMS.

Table 12: The Data: Share of workers by educational attainment and occupation

	Elementary	*Operators*	*Agriculture*	*Traders*	*Services*	*Clerks*	*Managers*	*Technicians*	*Professionals*	***Total***
Mexico 1960										
No school	48.13	19.58	58.99	24.00	24.24	6.81	9.66	10.83	7.22	41.35
Primary	50.92	77.16	40.55	72.96	68.47	63.55	55.81	71.49	32.02	52.66
Secondary	0.80	2.80	0.39	2.60	6.15	26.32	24.53	13.87	33.61	4.46
Tertiary	0.16	0.46	0.06	0.45	1.15	3.32	10.00	3.81	27.15	1.53
Mexico 2000										
No school	13.26	3.49	24.56	9.43	5.71	0.52	0.56	0.98	0.33	11.03
Primary	56.97	45.58	61.96	51.92	38.92	10.98	6.20	12.30	2.90	44.27
Secondary	28.10	48.01	12.79	33.76	46.51	64.15	23.79	62.95	14.30	32.31
Tertiary	1.67	2.92	0.69	4.88	8.86	24.35	69.45	23.77	82.47	12.39
USA 1960										
No school	5.13	1.95	3.53	1.33	1.16	0.12	0.80	0.20	0.05	1.56
Primary	52.20	43.95	56.08	38.81	29.99	8.53	19.67	10.23	2.69	29.99
Secondary	38.85	49.51	32.59	52.34	56.71	70.58	47.75	43.43	19.00	49.93
Tertiary	3.82	4.60	7.80	7.52	12.14	20.76	31.78	46.14	78.27	18.52
USA 2000										
Primary	12.85	7.91	11.43	5.84	4.57	1.38	1.21	0.54	0.27	3.74
Secondary	66.29	65.42	54.23	58.53	52.86	44.70	26.29	19.42	6.38	41.95
Tertiary	20.86	26.67	34.35	35.63	42.57	53.93	72.50	80.05	93.35	54.30

Source: (1): Authors' calculations based on IPUMS.

Table 13: The Data: Share of workers by educational attainment and occupation

	Elem-entary	*Oper-ators*	*Agric-ulture*	*Traders*	*Serv-ices*	*Clerks*	*Manag-ers*	*Tech-nicians*	*Profes-sionals*	***Total***
Brazil 1960										
No school	6.00	1.36	76.65	9.69	4.69	0.18	1.14	0.15	0.13	100.00
Primary	11.16	5.91	38.25	22.54	5.90	6.02	5.40	1.77	3.05	100.00
Secondary	5.13	0.93	2.55	2.92	0.38	25.82	10.90	3.71	47.67	100.00
Tertiary	1.02	0.12	2.25	0.48	0.08	5.88	10.93	2.46	76.78	100.00
Brazil 2000										
No school	8.76	4.19	56.48	12.62	15.23	0.57	0.91	0.72	0.51	100.00
Primary	8.70	11.26	25.81	19.46	25.39	3.22	2.08	3.12	0.97	100.00
Secondary	5.02	8.49	4.28	10.63	23.54	19.45	6.52	17.99	4.08	100.00
Tertiary	1.16	1.26	1.25	1.80	6.10	13.08	14.84	17.52	43.01	100.00
Chile 1960										
No school	61.02	3.42	19.18	11.16	2.73	0.04	2.33	0.07	0.04	100.00
Primary	36.03	9.33	11.33	26.84	7.31	2.17	5.20	1.26	0.53	100.00
Secondary	5.51	7.45	4.46	16.42	6.67	28.17	13.48	8.80	9.05	100.00
Tertiary	0.48	1.29	3.39	0.48	1.13	11.31	10.02	9.37	62.52	100.00
Chile 1960										
No school	50.16	6.43	17.40	15.28	9.15	1.58	0.00	0.00	0.00	100.00
Primary	45.39	10.30	12.79	19.07	10.35	2.09	0.00	0.00	0.00	100.00
Secondary	20.56	12.30	3.16	15.86	18.29	12.21	6.37	11.26	0.00	100.00
Tertiary	2.95	2.91	0.73	3.90	7.80	9.73	10.33	30.55	31.10	100.00
France 1962										
Primary	2.73	32.91	18.80	8.82	19.74	9.23	1.62	5.09	1.06	100.00
Secondary	0.50	21.74	2.33	6.69	15.08	15.48	5.48	18.88	13.82	100.00
Tertiary	0.17	1.42	1.02	1.14	4.48	2.50	17.94	26.32	45.00	100.00
France 1962										
Primary	33.53	7.85	5.77	15.81	15.31	10.45	1.42	7.62	2.23	100.00
Secondary	14.65	5.57	3.72	16.11	19.73	15.88	3.09	17.03	4.22	100.00
Tertiary	2.09	0.75	1.04	2.81	9.78	9.50	13.06	29.78	31.19	100.00
India 1983										
No school	34.40	2.15	47.46	9.76	2.18	0.18	3.22	0.28	0.37	100.00
Primary	19.07	5.52	39.28	16.87	6.38	1.22	8.88	1.48	1.31	100.00
Secondary	6.80	6.03	23.23	12.72	7.45	12.68	14.83	5.23	11.03	100.00
Tertiary	1.09	2.13	7.45	4.42	2.94	22.72	16.18	6.39	36.69	100.00
india 1999										
Primary	17.96	6.28	36.20	16.69	7.15	1.20	11.95	1.41	1.17	100.00
Secondary	7.04	5.61	24.61	13.12	7.63	8.53	19.09	4.80	9.59	100.00
Tertiary	1.55	1.87	10.23	4.24	3.83	16.26	22.30	5.57	34.16	100.00

Source: (1): Authors' calculations based on IPUMS.

Table 14: The Data: Share of workers by educational attainment and occupation

	Elementary	*Operators*	*Agriculture*	*Traders*	*Services*	*Clerks*	*Managers*	*Technicians*	*Professionals*	***Total***
Mexico 1960										
No school	14.59	2.41	66.76	8.25	5.91	0.92	0.20	0.34	0.62	100.00
Primary	12.12	7.47	36.04	19.69	13.11	6.73	0.90	1.79	2.15	100.00
Secondary	2.23	3.19	4.12	8.26	13.89	32.90	4.68	4.09	26.63	100.00
Tertiary	1.28	1.52	1.81	4.13	7.56	12.12	5.56	3.28	62.74	100.00
Mexico 2000										
No school	16.83	2.81	56.58	14.95	7.96	0.35	0.09	0.23	0.21	100.00
Primary	18.01	9.15	35.56	20.50	13.51	1.84	0.24	0.71	0.47	100.00
Secondary	12.17	13.20	10.06	18.27	22.12	14.74	1.29	5.01	3.15	100.00
Tertiary	1.89	2.10	1.42	6.89	10.99	14.60	9.79	4.94	47.38	100.00
USA 1960										
No school	38.46	23.33	9.16	10.61	12.84	1.35	3.56	0.45	0.25	100.00
Primary	20.32	27.37	7.56	16.14	17.25	4.89	4.56	1.18	0.74	100.00
Secondary	9.08	18.52	2.64	13.07	19.58	24.30	6.65	3.01	3.16	100.00
Tertiary	2.40	4.64	1.70	5.07	11.31	19.27	11.93	8.62	35.06	100.00
USA 2000										
Primary	18.69	23.45	5.68	17.17	22.39	7.08	3.21	1.38	0.96	100.00
Secondary	8.60	17.32	2.40	15.34	23.10	20.52	6.22	4.45	2.05	100.00
Tertiary	2.09	5.45	1.18	7.22	14.37	19.13	13.26	14.16	23.14	100.00

Source: (1): Authors' calculations based on IPUMS.

Table 15: The Data: Share of workers by age, educational attainment, and occupation

	Low HK	*Medium HK*	*High HK*	***Total***
Brazil 1960				
Less than Secondary-young	69.77	25.34	4.89	100.00
Less than Secondary-old	73.98	17.87	8.15	100.00
More than Secondary-young	6.67	23.85	69.48	100.00
More than Secondary-old	7.89	10.11	82.01	100.00
Brazil 2000				
Less than Secondary-young	48.29	46.66	5.05	100.00
Less than Secondary-old	57.60	36.23	6.17	100.00
More than Secondary-young	14.37	47.51	38.13	100.00
More than Secondary-old	11.70	28.00	60.30	100.00
Chile 1960				
Less than Secondary-young	62.34	32.58	5.08	100.00
Less than Secondary-old	63.42	27.76	8.83	100.00
More than Secondary-young	15.04	49.77	35.18	100.00
More than Secondary-old	17.71	32.54	49.75	100.00
Chile 2002				
Less than Secondary-young	70.84	29.16	0.00	100.00
Less than Secondary-old	66.57	33.43	0.00	100.00
More than Secondary-young	24.83	37.97	37.20	100.00
More than Secondary-old	18.99	28.31	52.70	100.00
France 1962				
Less than Secondary-young	57.90	35.72	6.38	100.00
Less than Secondary-old	47.95	41.68	10.37	100.00
More than Secondary-young	24.51	33.82	41.67	100.00
More than Secondary-old	10.69	29.80	59.51	100.00
France 2006				
Less than Secondary-young	49.54	40.95	9.50	100.00
Less than Secondary-old	45.43	42.02	12.55	100.00
More than Secondary-young	17.18	42.41	40.41	100.00
More than Secondary-old	14.52	36.22	49.26	100.00
India 1983				
Less than Secondary-young	77.24	16.93	5.83	100.00
Less than Secondary-old	76.28	14.51	9.20	100.00
More than Secondary-young	30.40	32.98	36.62	100.00
More than Secondary-old	19.20	25.85	54.95	100.00
India 1999				
Less than Secondary-young	60.94	25.78	13.29	100.00
Less than Secondary-old	57.98	21.44	20.58	100.00
More than Secondary-young	31.12	28.78	40.10	100.00
More than Secondary-old	23.35	23.15	53.50	100.00

Source: (1): Authors' calculations based on IPUMS.

Table 16: The Data: Share of workers by age, educational attainment, and occupation (cont.)

	Low HK	*Medium HK*	*High HK*	***Total***
Mexico 1960				
Less than Secondary-young	68.14	28.68	3.18	100.00
Less than Secondary-old	67.58	29.08	3.34	100.00
More than Secondary-young	8.13	48.93	42.94	100.00
More than Secondary-old	8.94	39.38	51.69	100.00
Mexico 2000				
Less than Secondary-young	65.59	33.32	1.09	100.00
Less than Secondary-old	65.00	33.39	1.61	100.00
More than Secondary-young	28.41	49.22	22.37	100.00
More than Secondary-old	16.04	45.68	38.28	100.00
USA 1960				
Less than Secondary-young	62.92	33.50	3.58	100.00
Less than Secondary-old	51.33	40.41	8.27	100.00
More than Secondary-young	26.17	52.84	20.99	100.00
More than Secondary-old	19.56	46.59	33.85	100.00
USA 2000				
Less than Secondary-young	49.11	46.31	4.59	100.00
Less than Secondary-old	46.33	47.02	6.65	100.00
More than Secondary-young	17.80	50.77	31.43	100.00
More than Secondary-old	16.27	44.78	38.95	100.00

Source: (1): Authors' calculations based on IPUMS.

Table 17: The Data: Share of workers by age, educational attainment, and occupation

	Low HK	*Medium HK*	*High HK*	***Total***
Brazil 1960				
Less than Secondary-young	54.12	19.66	3.79	77.57
Less than Secondary-old	14.17	3.42	1.56	19.15
More than Secondary-young	0.18	0.65	1.90	2.73
More than Secondary-old	0.04	0.06	0.45	0.55
Brazil 2000				
Less than Secondary-young	24.36	23.53	2.55	50.44
Less than Secondary-old	9.89	6.22	1.06	17.18
More than Secondary-young	4.03	13.31	10.68	28.01
More than Secondary-old	0.51	1.22	2.63	4.37
Chile 1960				
Less than Secondary-young	39.15	20.46	3.19	62.80
Less than Secondary-old	12.73	5.57	1.77	20.07
More than Secondary-young	1.98	6.54	4.62	13.14
More than Secondary-old	0.71	1.30	1.98	3.98
Chile 2002				
Less than Secondary-young	11.85	4.88	0.00	16.73
Less than Secondary-old	7.54	3.79	0.00	11.33
More than Secondary-young	13.72	20.99	20.56	55.27
More than Secondary-old	3.17	4.72	8.79	16.67
France 1962				
Less than Secondary-young	22.21	13.70	2.45	38.37
Less than Secondary-old	9.80	8.52	2.12	20.44
More than Secondary-young	7.73	10.66	13.14	31.53
More than Secondary-old	1.03	2.88	5.75	9.66
France 2006				
Less than Secondary-young	2.47	2.04	0.47	4.99
Less than Secondary-old	3.12	2.89	0.86	6.88
More than Secondary-young	10.64	26.25	25.02	61.91
More than Secondary-old	3.81	9.50	12.92	26.22
India 1983				
Less than Secondary-young	50.43	11.06	3.81	65.29
Less than Secondary-old	14.05	2.67	1.70	18.42
More than Secondary-young	4.33	4.70	5.22	14.26
More than Secondary-old	0.39	0.53	1.12	2.04
India 1999				
Less than Secondary-young	26.21	11.09	5.71	43.01
Less than Secondary-old	5.12	1.89	1.82	8.83
More than Secondary-young	12.03	11.13	15.51	38.66
More than Secondary-old	2.22	2.20	5.08	9.49

Source: (1): Authors' calculations based on IPUMS.

Table 18: The Data: Share of workers by age, educational attainment, and occupation (cont.)

	Low HK	*Medium HK*	*High HK*	***Total***
Mexico 1960				
Less than Secondary-young	48.31	20.33	2.26	70.89
Less than Secondary-old	15.62	6.72	0.77	23.11
More than Secondary-young	0.39	2.36	2.07	4.83
More than Secondary-old	0.10	0.46	0.60	1.16
Mexico 2000				
Less than Secondary-young	25.19	12.80	0.42	38.41
Less than Secondary-old	10.98	5.64	0.27	16.89
More than Secondary-young	11.37	19.70	8.95	40.01
More than Secondary-old	0.75	2.14	1.79	4.68
USA 1960				
Less than Secondary-young	8.03	4.28	0.46	12.76
Less than Secondary-old	9.64	7.59	1.55	18.78
More than Secondary-young	13.18	26.61	10.57	50.36
More than Secondary-old	3.54	8.43	6.12	18.09
USA 2000				
Less than Secondary-young	0.98	0.93	0.09	2.01
Less than Secondary-old	0.80	0.82	0.12	1.74
More than Secondary-young	11.13	31.75	19.66	62.54
More than Secondary-old	5.49	15.10	13.13	33.71

Source: (1): Authors' calculations based on IPUMS.

Table 19: The Data: Share of workers by sex, educational attainment, and occupation

	Low HK	*Medium HK*	*High HK*	***Total***
Brazil 1960				
Less than Secondary-male	75.88	18.90	5.21	100.00
Less than Secondary-female	45.47	47.48	7.05	100.00
More than Secondary-male	9.35	22.46	68.19	100.00
More than Secondary-female	1.05	19.45	79.50	100.00
Brazil 2000				
Less than Secondary-male	54.82	39.79	5.39	100.00
Less than Secondary-female	41.84	52.94	5.22	100.00
More than Secondary-male	18.13	42.79	39.08	100.00
More than Secondary-female	9.57	47.12	43.31	100.00
Chile 1960				
Less than Secondary-male	64.75	30.04	5.21	100.00
Less than Secondary-female	54.66	36.48	8.86	100.00
More than Secondary-male	19.44	42.95	37.61	100.00
More than Secondary-female	5.54	53.32	41.14	100.00
Chile 2002				
Less than Secondary-male	68.09	31.91	0.00	100.00
Less than Secondary-female	72.19	27.81	0.00	100.00
More than Secondary-male	27.59	35.10	37.31	100.00
More than Secondary-female	16.82	36.76	46.41	100.00
France 1962				
Less than Secondary-male	60.77	29.94	9.29	100.00
Less than Secondary-female	43.14	51.82	5.04	100.00
More than Secondary-male	29.39	23.50	47.11	100.00
More than Secondary-female	7.52	48.75	43.73	100.00
France 2006				
Less than Secondary-male	47.04	40.50	12.46	100.00
Less than Secondary-female	47.30	42.78	9.92	100.00
More than Secondary-male	20.19	37.11	42.70	100.00
More than Secondary-female	12.13	44.44	43.43	100.00
India 1983				
Less than Secondary-male	74.09	18.26	7.65	100.00
Less than Secondary-female	84.30	11.80	3.90	100.00
More than Secondary-male	30.22	32.55	37.22	100.00
More than Secondary-female	17.08	27.55	55.37	100.00
India 1999				
Less than Secondary-male	58.69	26.13	15.18	100.00
Less than Secondary-female	69.07	19.64	11.29	100.00
More than Secondary-male	30.74	28.10	41.16	100.00
More than Secondary-female	21.96	24.83	53.21	100.00

Source: (1): Authors' calculations based on IPUMS.

Table 20: The Data: Share of workers by sex, educational attainment, and occupation (cont.)

	Low HK	*Medium HK*	*High HK*	***Total***
Mexico 1960				
Less than Secondary-male	70.95	26.47	2.58	100.00
Less than Secondary-female	49.32	43.41	7.26	100.00
More than Secondary-male	10.77	45.36	43.87	100.00
More than Secondary-female	2.86	50.83	46.30	100.00
Mexico 2000				
Less than Secondary-male	68.34	30.45	1.21	100.00
Less than Secondary-female	56.90	41.74	1.36	100.00
More than Secondary-male	32.67	46.56	20.77	100.00
More than Secondary-female	16.98	53.03	29.99	100.00
USA 1960				
Less than Secondary-male	55.68	37.40	6.91	100.00
Less than Secondary-female	56.72	38.06	5.21	100.00
More than Secondary-male	29.23	41.99	28.78	100.00
More than Secondary-female	18.77	61.99	19.24	100.00
USA 2000				
Less than Secondary-male	50.53	44.18	5.29	100.00
Less than Secondary-female	43.14	50.88	5.98	100.00
More than Secondary-male	23.90	43.83	32.28	100.00
More than Secondary-female	10.29	53.76	35.95	100.00

Source: (1): Authors' calculations based on IPUMS.

Figure 1: Difference between male and female distribution

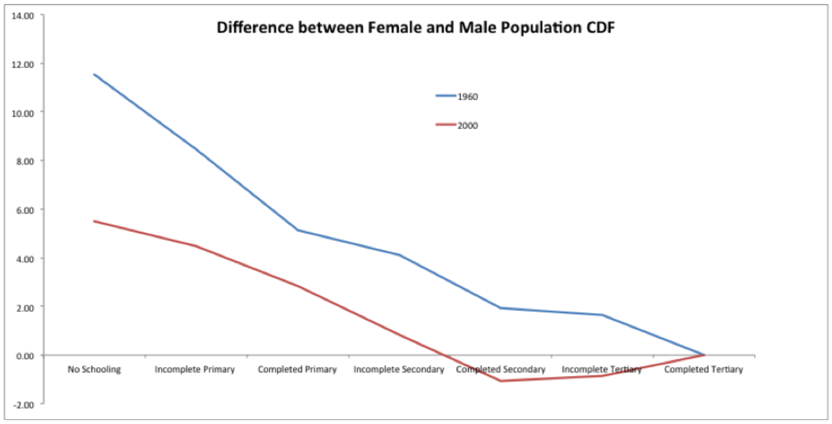

Figure 2: Cross-country histogram by country groups. Share of population with less than complete secondary (1960)

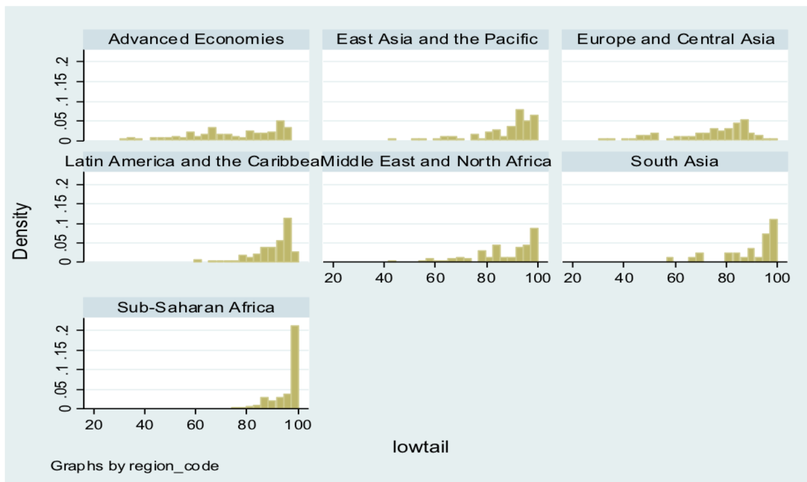

Figure 3: Cross-country histogram by country groups. Share of population with less than complete secondary (2000)

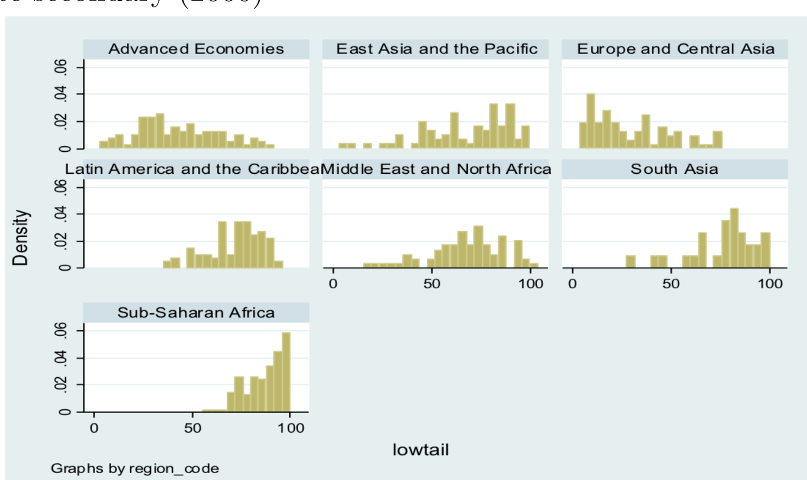

Figure 4: Cross-country education distribution