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Sarah Schroeder (sschroeder@econ.au.dk)
Aarhus University

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Accounting for Skill Premia across Countries and Time

Sarah Schroeder[1,1*]

[1*]Department of Economics, Aarhus University, Fuglesangs Allé 4, Aarhus, 8210, Denmark.

Corresponding author(s). E-mail(s): sschroeder@econ.au.dk;

Abstract

This paper uses the structure of a two-sector two-factor model to attribute changes in the skill premium across countries to three potential sources: (i) changes in the relative abundance of skilled workers, (ii) technological change and (iii) market size effects due to external economies of scale. I employ the development and growth accounting methodology as analytic tool to assess the relative importance of each one of these channels in explaining changes in the skill premium across countries and time. My findings add to the growing evidence that there is hardly any association between changes in the relative supply of skills and the observed evolution of the skill-premium. Furthermore, I show that the measure of the importance of market size effects governs the strength of the relationship between technological change and the skill-premium. Moreover, for strong enough economies of scale, an increase in the relative supply of skills increases the the skill premium. Importantly, this finding points out that the scale of the economy is an important factor in shaping developments of the skill premium, independent of the specific features of technological change.

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JEL Classification: E24 , I24 , J21 , J14 , J31

1 Introduction

Applying the basic economic principle of supply and demand in order to understand changes in the relative wage of skilled workers (skill-premium), predicts that an increase in the relative supply of skills ought to decrease the premium the labour market pays for skills. A closer look at recent developments of the skill premium in several countries, however, suggests that for some countries exactly the opposite is true.

Figure 1 illustrates the relationship between the log change in the skill premium and the log change in the share of individuals with completed tertiary education (skill ratio) for a sample of 36 countries between 1983 and 2007 from the [1] occupational wage database.[1] Clearly, despite the large increase in the share of educated people in most countries, the skill premium has failed to decrease during the same period.

[*Figure 1 about here*]

This puzzling observation has stimulated a growing body of research, aimed at investigating the key factors shaping the evolution of the skill-premium across countries and time. Three main explanations have been proposed. Firstly, a change in educational attainment [2–5], secondly, trade integration – either trade in final goods or in intermediate inputs [6–8] and thirdly, a change in the bias in technological change. This latter channel, is generally referred to as "skill-biased technical change" (SBTC) [9–13].

While each of these channels seem inherently different, this paper focuses on an under-explored phenomenon they all bring about, namely an increase in the scale of economic activity. In particular, I use the structure of a two-sector two-factor model to attribute changes in the skill premium across countries to

[1] The skill premium is defined as the ratio of the mean wage in a set of manufacturing occupations that are classified as high-skilled by the International Standard Classification of Occupations (ISCO-88), to the mean wage in a set of low-skilled occupations. The growth in the skill premium is calculated by calculating the relative change of two subperiods. I take 8-year averages, which defines the first (1983-1991) and the last subperiod (1999-2007), respectively.

three potential sources: (i) changes in the relative abundance of skilled workers, (ii) technological change and (iii) market size effects due to external economies of scale. My analysis suggests that the implications of market size effects are key in understanding developments in the skill premium over time and across countries, independent of the specific features of technological change.

The theoretical framework, is an extension of the canonical [14] model of monopolistic competition, where the production of final goods uses low and high-skilled labour, and a continuum of different varieties of intermediate inputs. Due to increasing returns to scale in the underlying production function similar to [15], the model exhibits additional market size effects, which are the source of the latter of the three effects. I further use the model to study the role market size effects play in shaping the skill premium. I do so by analysing two special cases. First, where market size effects are absent and second, re-introducing scale economies into the analysis. Importantly, this characterization of market size effects implies, that the long-run relationship between the relative supply of skills and the skill premium is positive, and greater skill abundance can lead to a greater skill premium. Intuitively, if the market size effect is large enough, it dominates the usual substitution effect between skilled and unskilled workers at a given technology.

I employ the development and growth accounting methodology as an analytical tool to assess the relative importance of each one of these channels in explaining cross-country skill-premium changes.[2] In the context of the skill-premium analysis, I am asking the analogous question of how much of the variation in changes in the skill premium over time, can be explained by

[2]In the context of income differences across countries, development accounting assesses the relative contribution of differences in factor quantities, and differences in the efficiency with which those factors are used, to cross-country differences in per-worker incomes. Equivalently, growth accounting, as first implemented by [16], examines the different aspects of growth to determine which factor most likely created the increase in per-worker income. The development accounting literature usually refers to the unexplained variation of growth as technological progress, efficiency, or the measure of our ignorance (see [17]).

variations in the growth of countries' relative skill-supply and how much of cross-country skill-premium variation remains unexplained. Consequently, the unexplained fraction of the skill-premium must be attributed to technological change. My findings add to the growing evidence that there is hardly any association between changes in the relative supply of skills and the observed evolution of the skill-premium.

The most important results in this paper concern the relationship between market size effects and the observed patterns in the data. I show that the measure of the importance of market size effects governs the strength of the relationship between technological change and the skill-premium, where larger values of the importance of market size effects improve the goodness of fit substantially. Moreover, for strong enough economies of scale, an increase in the share of high-skilled workers increases the the skill premium. This observation may provide a potential explanation for the pattern of skill premia across countries and time, where skill premia were increasing despite the simultaneous rise in the relative supply of skills. In particular, this finding points out that the scale of the economy may be an important factor in shaping developments of the skill premium. What makes this analysis particularly intriguing, is that, although, the suggested mechanism is rather simple it is more general than the existing ones. First, it encompasses scale expansions beyond trade-induced increases in market size and second, it does not rely on specific assumptions on technology to account for skill-premium patterns in the data.

Related Literature. This paper contributes to the large literature studying different determinants of wage inequality across countries and time.[3] While many contributions have been made, analysing a particular channel and/or country, this article highlights how the relationship in the time series and

[3]The main factors identified by the literature are skill-biased technological change (see e.g. [9], [11] and [12]) and international trade (see e.g. [18], [19] and [7]).

across countries between the supply of skills and skill premia is shaped by different factors. [11] and [20], for example, theoretically study how increased international trade induces SBTC, which raises inequality both in developed and the less developed countries. The main departure relative to this literature is that I do not explicitly incorporate trade or SBTC into the model. Instead, my model encompasses scale expansions beyond trade-induced increases in market size and second, it does not rely on specific assumptions on technology to account for skill-premium patterns in the data. In doing so, I contribute to this literature by providing empirical evidence for skill premium developments for developed and developing countries, both over time and in the cross-section.

[21] is particularly related to this article in that they perform a similar development accounting exercise to study cross country income and technology differences. They use information on the relative skill supply and data on the skill premium to back out the values for the high and low-skilled augmenting productivities.[4] Hence, they report cross-country skill premium differences and analyse the resulting implications for technological change in the presence of barriers to technological adoption. Relative to them I make two main contributions. First, while [21] study cross-sectional differences, my paper focuses on changes over time. Second, I analyse the role of market size effects, which is absent from their accounting exercise.

Lastly, my paper relates to previous contributions studying the skill bias of scale, as proposed by [22] and [15] . These papers highlight that the increase in market size can lead to higher skill premia and income inequality. Similar to the framework employed for my analysis, their mechanism is based on a two-sector, two-factor model. They show that an increase in the market size through trade increases the relative wage of skilled workers, as output increases

[4]Furthermore, the implied methodology relies on the fact that wages are informative about relative marginal productivities, which may not be the case given the large discrepancies in labour market institutions across countries.

relatively more in the skill-intensive sectors due to stronger economies of scale.[5] I complement the findings of this literature by exploring the role of market size effects in shaping the skill premium over time and across countries by employing the development and growth accounting methodology.

The structure of the paper is as follows. In section 2 I preset the model, which serves as the basis of the skill-premium accounting exercise. Section 3 provides a description of the data and presents the results of the accounting exercise. In section 4 I discuss the implications of my findings, and section 5 concludes the paper.

2 The Model

2.1 Setup

This section outlines a basic two-factor two-sector model that captures the approximate determinants of the skill premium. The framework is a based on a standard Dixit-Stiglitz formulation for a closed economy.

2.1.1 Preferences

Consumers have preferences represented by a utility function which is defined over a constant elasticity of substitution (CES) aggregate of a low-skill intensive and a high-skill intensive good

$$U_t = \left[\sigma_L C_{Lt}^{\frac{\theta-1}{\theta}} + \sigma_H C_{Ht}^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}} \tag{1}$$

where $\theta > 1$ is the elasticity of substitution between the two final goods. C_{Lt} and C_{Ht} stand for the consumption of the low-and high-skill intensive good

[5] Other explanations for recent developments in the skill premium are among others, skill-biased structural change (see e.g. **(author?)** [23, 24, 25]) and the sector-bias of SBTC (e.g. **(author?)** [26])

in year t. Furthermore, σ_i is a parameter capturing the relative importance in consumption of the i -intensive good $(i \in L, H)$, where $\sigma_L + \sigma_H = 1$.

2.1.2 Technologies and Market Structure

Production of final goods uses low (L_{it}) and high-skilled labour (H_{it}), and a continuum of different varieties of intermediate inputs indexed by $m \in [0, M_{it}]$, with M_{it} being the aggregate measure of input varieties. The production technology of industry i can be summarized by the total cost function B_{it} of producing Q_{ti} final good and the cost function $b_{it}(m)$ of producing $q_{it}(m)$ units of variety m of the intermediate inputs used in industry i in period t,

$$B_{it} = \left[\frac{1}{Z_{it}}\left(\frac{w_{Lt}}{1-\alpha_i}\right)^{1-\alpha_i}\left(\frac{w_{Ht}}{\alpha_i}\right)^{\alpha_i}\right]^{1-\beta} \times \left[\int_0^{M_{it}} p_{it}\left(m\right)^{1-\varepsilon} dm\right]^{\frac{\beta}{(1-\varepsilon)}} Q_{it} \tag{2}$$

$$b_{it}\left(m\right) = \frac{1 + q_{it}\left(m\right)}{Z_{it}} \times \left(\frac{w_{Lt}}{1-\alpha_i}\right)^{1-\alpha_i}\left(\frac{w_{Ht}}{\alpha_i}\right)^{\alpha_i} \tag{3}$$

where $0 \leq \beta \leq 1$ captures the relative importance of intermediate inputs in the production of sector i , $0 \leq \alpha_i \leq 1$ is the share of skilled workers employed in industry i, $\varepsilon > 1$ denotes the elasticity of substitution between input varieties and Z_{it} is an exogenous industry-productivity measure. In the following we will assume that $\alpha_H > \alpha_L$, i.e. that industry $i = H$ is skill-intensive relative to industry $i = L$. With perfectly mobile labour the competitive wage workers receive is denoted by w_{it}. Equation (2) states that the technology to produce the final good of industry i is a Cobb-Douglas function on low and high-skilled workers, and intermediate inputs. Equation (3) implies that the production technology of intermediate inputs is also a Cobb-Douglas function on the two different types of workers and that there are fixed and variable costs.

The labour market is assumed to be perfectly competitive. The market for the final goods Q_{it} operates under perfect competition, whereas the market for intermediate inputs exhibits monopolistic competition.

2.2 Equilibrium

2.2.1 Prices

The production function of final goods in equation (2) exhibits constant returns. Under perfect competition the price is given by the marginal cost of a good, given by

$$P_{it} = \frac{\partial B_{it}}{\partial Q_{it}} \tag{4}$$

Moreover, the representative household's utility maximisation from equation (1) implies the following relationship between the relative price and the relative inverse demand of a good:

$$\frac{P_{Ht}}{P_{Lt}} = \frac{\sigma_H}{\sigma_L} \left[\frac{C_{Lt}}{C_{Ht}} \right]^{\frac{1}{\theta}} \tag{5}$$

Choosing the final output as the numeraire, the price index P in the economy for a given period t can be expressed by

$$P = \left[\sigma_L^{\theta} P_{Lt}^{1-\theta} + (1-\sigma_L)^{\theta} P_{Ht}^{1-\theta} \right]^{\frac{1}{1-\theta}} = 1 \tag{6}$$

Intermediate goods producers are assumed to operate under monopolistic competition with free entry. This implies that the profit maximising price is being set according to the following 'markup rule'

$$p_{it}(m) = \left(\frac{\varepsilon}{\varepsilon - 1}\right) \frac{\partial b_{it}(m)}{\partial q_{it}(m)} \tag{7}$$

2.2.2 Market clearing

Market clearing conditions for the goods and labour market by the following set of equations:

$$P_{it} Q_{it} = E_{it} \tag{8}$$

which states that the aggregate supply of each good matches its demand, where $E_{it} = P_{it} C_{it}$ is the aggregate expenditure on the i-intensive good . The expression for aggregate demand of low- (L_t) and high-skilled (H_t) are given by

$$L_t = \sum L_{it} \quad with \;\; L_{it} = L_{it}^{Q} + L_{it}^{q} \tag{9}$$

$$H_t = \sum H_{it} \quad with \;\; H_{tit} = H_{it}^{Q} + H_{it}^{q} \tag{10}$$

where L_{it} and H_{it} are the number of low and high-skilled workers demanded by industry i. Furthermore, low- and high-skilled workers producing the final good in industry i can be denoted as L_{it}^{Q} and workers engaged in the production of intermediate inputs as L_{it}^{q}. Likewise, H_{it}^{Q} and H_{it}^{q}, represent the number of high-skilled workers engaged in producing final goods and intermediate goods respectively. Equations (9) and (10) imply that aggregate supply of high and low-skilled labour must equal their demands.

Next, we can find an expression of output Q_{it} as a function of the measure of input varieties M_{it}:[6]

$$Q_{it} = M_{it}^{\mu} \left(\frac{\varepsilon}{\varepsilon - 1} \right)^{-\beta} \frac{\varepsilon}{\beta} \tag{11}$$

where $\mu = 1 + \beta / (\varepsilon - 1)$. It is clear to see that the production function in (11) exhibits increasing returns to scale if the parameter $\mu > 1$; i.e. an increase in the available number of varieties M_{it}, through an increase in the market size, increases output over proportionally. Thus, μ can be interpreted as a measure of the importance of market size effects. Intuitively, this implies that a larger market benefits from external economies of scale as they tend to have a larger number of varieties of goods and inputs available.[7] The following section determines the equilibrium skill-premium with ($\mu > 1$) and without ($\mu = 1$) market size effects. In doing so, we will be able to identify to what extent market size effects play a role in shaping skill-premium differences across countries and time.

2.2.3 Skill Premium

Defining the wage rate for skilled labour as w_{Ht} and w_{Lt} as the wage rate for unskilled labour in a frictionless labour market, the relative wage of high skilled workers can be expressed by using the relative price from equation (4) and relative demand of a good from equation (10). Hence, the above system

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[6] See Appendix for the derivation of equation (11).

[7] Note, that economies of scale effects only depend on ε and do not directly come from the presence of fixed costs at the firm level. Epafani & Gancia (2006, 2008) show that 'external economies of scale' (from the firm perspective) are a good proxy for the latter. Especially [22], review evidence showing that high-skilled workers, in any country, are employed in sectors where plant-level fixed costs are high, and produce highly differentiated goods that are gross substitutes for less-skill-intensive products. Given these findings, their theory implies that scale is skill-biased, thereby providing a micro foundation for the perpetual increase in the relative demand for skilled workers.

(1)-(10) implies the following expression for the skill-premium:

$$\frac{w_{Ht}}{w_{Lt}} = \left(\frac{\eta_H}{\eta_L}\frac{Z_{Ht}}{Z_{Lt}}\right)^{\frac{1}{(\alpha_H-\alpha_L)}} \left(\frac{M_{Ht}}{M_{Lt}}\right)^{\frac{(\theta-1)\mu-\theta}{\theta(\alpha_H-\alpha_L)}} \tag{12}$$

where $\eta_i = \sigma_i (1-\alpha_i)^{1-\alpha_i} \alpha_i^{\alpha_i} \beta^{\frac{1}{\theta}} / \left[\varepsilon^{\frac{1+(\theta-1)\beta}{\theta}} (\varepsilon-1)^{\beta\frac{\theta-1}{\theta}}\right]$. Next, solving for the equilibrium expressions of M_H and M_L in equation (11) yields the following equation for the skill-premium:[8]

$$\frac{w_{Ht}}{w_{Lt}} = \left(\frac{\psi_H}{\psi_L}\frac{Z_{Ht}}{Z_{Lt}}\right)^{\frac{1}{(\alpha_H-\alpha_L)}} \left(\frac{(1-\alpha_L)\frac{H_t}{L_t}\frac{w_{Ht}}{w_{Lt}} - \alpha_L}{\alpha_H - (1-\alpha_H)\frac{H_t}{L_t}\frac{w_{Ht}}{w_{Lt}}}\right)^{\frac{(\theta-1)\mu-\theta}{\theta(\alpha_H-\alpha_L)}} \tag{13}$$

where $\psi_i = \sigma_i^{\theta/(\theta-1)\mu}(1-\alpha_i)^{(1-\alpha_i)}\alpha_i^{\alpha_i}$. Equations (12) and (13) highlight three potential channels through which the skill-premium can be affected: changes in relative industry productivities Z_{Ht}/Z_{Lt}, the share of skilled workers H_t/L_t, and an increase in the market sizes, captured by M_{Ht} and M_{Lt}. Equation (13) implies that *ceteris paribus* the skill-premium is decreasing in the relative supply of skills H_t/L_t, as long as $((\theta-1)\mu-\theta)/\theta < 0$. In other words, in order for the skill premium and relative skill supply to be inversely correlated, it has to be true that $\mu < \theta/(\theta-1)$. Moreover, for a given supply of skills the skill-premium also depends on relative industry productivities Z_{Ht}/Z_{Lt} and hence, an increase in the relative industry specific efficiency with which labour is used, tends to increase the relative wage of high skilled workers. For simplicity, I subsequently assume that the high-skill intensive industry uses only high-skilled workers and the low-skill intensive industry only low-skilled workers respectively (i.e. $\alpha_H = 1$ and $\alpha_L = 0$).

[8] See Appendix for the derivation of equation (13).

2.3 Special Cases

2.3.1 Special Case: No market size effects ($\mu = 1$)

In order to understand the importance of the measure of market size effects μ in shaping skill-premium developments, I first consider the special case where $\mu = 1$, i.e. market size effects are entirely absent. Under the above mentioned condition, i.e. $\alpha_H = 1$ and $\alpha_L = 0$, we can find an explicit expression of the skill-premium in terms of relative industry productivities Z_{Ht}/Z_{Lt} and relative factor endowments H_t/L_t. In this polar case the expression for the log relative wage of high skilled workers simplifies to

$$\ln\left(\frac{w_{Ht}}{w_{Lt}}\right) = \frac{(\theta-1)}{\theta}\ln\left(\frac{\sigma_H}{\sigma_L}\right) + \frac{(\theta-1)}{\theta}\ln\left(\frac{Z_{Ht}}{Z_{Lt}}\right) - \frac{1}{\theta}\ln\left(\frac{H_t}{L_t}\right), \qquad (14)$$

Concerning this equation, two observations stand out: First, the inverse of the elasticity of substitution in consumption θ can now be interpreted as the elasticity of the skill-premium with respect to the relative supply of skills.[9] Second, the simplified formulation in equation (14) suggests that the relative importance in consumption of high-skill intensive goods in the economy may be another important factor in determining the skill-premium; i.e. a rise in the importance in consumption of the high-skill intensive good σ_H causes the skill-premium to increase. Intuitively, this means that the demand for skilled workers increases the higher its relative demand within the economy, resulting in higher relative wages for skilled workers. As in equation (13) the positive relationship between the relative wage of high skilled workers and relative industry productivities remains.

[9] The special feature of this kind of specific-factor model is that, the elasticity of substitution in consumption also coincides with the elasticity of substitution between high and low skilled workers.

2.3.2 General Case: The role of market size effects ($\mu > 1$)

Next, we turn to the more general case, where market size effects, through $\mu > 1$, are present. As in the special case without market size effects, we here assume that $\alpha_H = 1$ and $\alpha_L = 0$. The skill-premium is now given by

$$\ln\left(\frac{w_{Ht}}{w_{Lt}}\right) = \frac{(\theta-1)\mu}{\theta}\ln\left(\frac{\sigma_H}{\sigma_L}\right) + \frac{(\theta-1)\mu}{\theta}\ln\left(\frac{Z_{Ht}}{Z_{Lt}}\right) + \frac{(\theta-1)\mu-\theta}{\theta}\ln\left(\frac{H_t}{L_t}\right), \tag{15}$$

This equation makes clear that introducing market size effects ($\mu > 1$) reduces the responsiveness of the skill-premium to changes in the supply of high-skilled workers. As pointed out in the special case without market size effects, an increase in the relative supply of skills lowers relative wages with elasticity $1/\theta$. Hence in the more general case with $\mu > 1$ the elasticity is given by

$$\frac{\partial \ln(w_H/w_L)}{\partial \ln(H/L)} = \frac{(\theta-1)\mu-\theta}{\theta} \tag{16}$$

Therefore, for a given level of RTFP the implied relative demand curve for high vs low skilled workers is downward sloping if the elasticity implied by (16) is negative.

3 Accounting for Skill-Premium Changes

In this section I use the theoretical model in order to determine and quantifying to what extent the individual channels, i.e. changes in the relative scarcity of high-skilled workers and relative industry productivities, contribute to changes in the skill-premium across countries. Furthermore, I will explore the way market size effects play a role in shaping the observed results. This accounting exercise is very similar to the one in the development and growth accounting literature. Development accounting assesses the relative contribution of differences in factor quantities, and differences in the efficiency with which those factors are used, to cross-country differences in per-worker incomes.

Equivalently, growth accounting allows one to examine the different aspects of growth to determine which factor most likely created the increase in per-worker income. Using the growth accounting methodology in the context of the skill-premium analysis is a powerful tool that enables us to identify the proximate sources of changes in the skill-premium. In other words, I am asking the question of how much of the variation in changes in the skill premium over time, can be explained by variations in the growth of countries' relative skill-supply and how much of cross-country skill-premium variation remains unexplained. Consequently, the unexplained fraction of the skill-premium must be attributed to changes in relative industry productivities. Given the simplified framework, as in equation (14) and (15), this residual variation, also called the 'measure of ignorance' (see [17]), may not only capture differences in efficiencies with which labour is used, but also other omitted factors, such as changes in the demand for skills.

The following section is structured as follows: first, I will present the data sources and Paramatrisation strategy of this accounting exercise and second, I will implement the accounting exercise (i) without market size effects ($\mu = 1$) and (ii) in the presence of market size effects ($\mu > 1$).

3.1 Data Sources

In order to perform the accounting exercise we need data on the skill premium (w_H/w_L) and the relative supply of skills (H/L), as well as calibrated values for the elasticity of substitution in demand (θ) and the importance of market size effects (μ), which is central to my accounting exercise.

3.1.1 Skill Premium

The empirical counterpart of the skill premium (w_H/w_L) can be constructed by using wage data for different occupations, where the skill-premium can be defined as the ratio of the mean wage in a set of high-skill to low-skill occupations. The occupational wage data come from the updated *Occupational Wages Around the World* (OWW) database by [1], which contains occupational wages for 161 occupations in 171 countries from 1983 until 2008. The data for their study were derived from the ILO October Inquiry, which collects information on pay (wages, earnings, and hours of work) across detailed occupations at the four-digit International Standard Classification of Occupations (ISCO88) level. The scope of the ILO October Inquiry has been increasing since its inception in 1924, both in country coverage and in number of occupations included. So far, the ILO October Inquiry is the most far-ranging survey of wages by occupations around the world. However, due to the lack of comparability in reported wage formats across countries and over time, the ILO dataset is not directly usable. [1] constructed the OWW database by standardising data derived from the ILO October Inquire database, such that wages could be made comparable across occupations, countries and over time.[10]

However, the data is very unbalanced in that countries rarely report wages for all occupations in all years, which limits the size of my sample to 36 countries. Moreover, it should be noted that, although OWW represents a significant improvement in standardising the data, [1] rely to a high degree on data correction, calibration and imputation to standardise the occupational wage data from the ILO datset. For example, some countries report more than one wage for a single occupation, others give wages for one gender only, or

[10] [1] use several different ways to impute the occupational wage data, but the occupational wages from the different approaches are highly correlated. The present study employs their occupation wages in U.S. dollars with country-specific and uniform calibration, type 3, lexicographic weighting (x3wlus in their data set). See [1] for a detailed description of how the OWW data file is being constructed.

only for the dominant economic region. Another issue is the fact that countries report wages in different formats, i.e. either hourly, monthly or some only report minimum wages.

3.1.2 Relative Skill Supply

A variable that has played a prominent role in the development-accounting literature and which I am going to employ for the same purpose, is the measure of relative skill supply from the [27] dataset of educational attainment in the world. The [27] database provides educational attainment data for 146 countries in 5-year intervals from 1950 to 2010. Their key sources of raw data to build measures of skilled and unskilled labor supply come from census/survey information, as compiled by UNESCO, Eurostat, and other sources. The census/survey figures report the distribution of educational attainment in the population over age 15 by sex and by 5-year age group, for most cases, in seven categories: (1) no formal education, (2) incomplete primary, (3) complete primary, (4) lower secondary, (5) upper secondary, (6) incomplete and (7) complete tertiary.

3.2 Data Description and Parameters

3.2.1 Data

[*Table 1 about here*]

I use the provided hourly wages from the updated OWW dataset to calculate the skill premium as the ratio of the mean wage in a set of manufacturing occupations that are classified as high-skilled by the International Standard Classification of Occupations (ISCO-88), to the mean wage in a set of low-skilled occupations. Further, I divide the sample into two periods; i.e $t = 1, 2$: first, the average skill premium in the first 8 years (w_{H1}/w_{L1}) (i.e. 1983-1991) and second, the respective value in the last 8 years (w_{H2}/w_{L2})(1999-2007). In using 8 year averages I am able to control and smooth out (at least to some extent) potential measurement errors, outliers in a particular year and common macro changes. The choice of countries is mainly dictated by the availability of data. More specifically, the countries selected for the sample are those, where the average manufacturing skill premium and the relative supply of skilled workers exist for the first and last 8 years of the sample. This leaves us with 36 countries in total.[11]

[*Table 2 about here*]

Furthermore, I choose the relative supply of high-skilled workers, to match the share of tertiary schooling attained in the population (i.e. university graduates with degrees and post-graduates) from the [27] dataset. Table 1 displays the summary statistics for w_H/w_L and Table 2 for $H/(H + L)$ respectively. Moreover, Figure 1 depicts the relationship between relative changes in skill premia and the relative supply of skills.

3.2.2 Paramatrisation

In the baseline version, the skill intensity in the high-skill intensive sector is given by $\alpha_H = 1$, and in the low-skill intensive sector by $\alpha_L = 0$ respectively.

For the elasticity of substitution between input varieties (ε), I use the median value estimated by [28], which is set at 6.07. [15] use a similar model specification based on a two sector - two factor framework as the one I employ and provide estimates for the elasticity of substitution in demand (θ) between 1-2. Thus, here I choose the average value of $\theta = 1.5$.

[11] See Appendix for the list of countries in the sample.

Lastly, the measure of importance of market size effects (μ) is taken from [29], who estimate the impact of new varieties on GDP using highly disaggregated trade data. They find that a one percent increase in the number of varieties raises GDP by 0.14 percent. This estimate implies that here $\mu = 1.14$. Table 3 summarises data sources and the Paramatrisation strategy.

[*Table 3 about here*]

3.3 Accounting Methodology

In order to perform an equivalent growth accounting exercise of the skill premium, I will first rewrite equation (15) in terms of relative changes between the first and second subperiod,

$$\widehat{\left(\frac{w_H}{w_L}\right)} = \frac{(\theta-1)\mu}{\theta}\widehat{\left(\frac{Z_H}{Z_L}\right)} + \frac{(\theta-1)\mu-\theta}{\theta}\widehat{\left(\frac{H}{L}\right)}, \tag{17}$$

where a 'hat' above the different terms indicates relative changes; i.e. $(w_H\widehat{/}w_L) = \Delta(w_H/w_L)/(w_H/w_L))$, $(H\widehat{/}L) = \Delta(H/L)/(H/L))$ and $(Z_H\widehat{/}Z_L) = \Delta(Z_H/Z_L)/(Z_H/Z_L))$. Equation (16) further implies that the unobservable term $(Z_H\widehat{/}Z_L)$ can be inferred from the data on the observable variables; namely (i) the relative change in the skill-premium $(w_H\widehat{/}w_L)$ and (ii) the relative change in the supply of high-skilled workers $(H\widehat{/}L)$.

Rearranging equation (17) for $(Z_H\widehat{/}Z_L)$ yields the following expression for the relative change in RTFP:

$$\widehat{\left(\frac{Z_H}{Z_L}\right)} = \frac{\theta}{(\theta-1)\mu}\widehat{\left(\frac{w_H}{w_L}\right)} - \frac{(\theta-1)\mu-\theta}{(\theta-1)\mu}\widehat{\left(\frac{H}{L}\right)}. \tag{18}$$

Hence, changes in RTFP are entirely pinned down by equation (18), implying that $(Z_H\widehat{/}Z_L)$ is chosen to fit the theoretical relationship between the observed relative changes in the skill-premium and changes in the relative skill supply. Next, I define the known term in equation (15) as $(w_H \hat{/} w_L)^S = -((\theta-1)\mu - \theta)/\theta)(H \hat{/} L)$, and $(Z_H \hat{/} Z_L)^S = ((\theta-1)\mu/\theta)(Z_H \hat{/} Z_L))$, which I will refer to as the 'skill-supply model'. We can then rewrite equation (17) as

$$\widehat{\left(\frac{w_H}{w_L}\right)} = \widehat{\left(\frac{w_H}{w_L}\right)}^S + \widehat{\left(\frac{Z_H}{Z_L}\right)}^S \tag{19}$$

Based on this equation I can pursue the following skill-premium accounting question: How successful is the 'skill-supply model' in explaining the observed growth of skill-premium across countries? To perform this assessment I will look at a simple variance decomposition of equation (19), given by

$$Var\widehat{\left(\frac{w_H}{w_L}\right)} = Var\widehat{\left(\frac{w_H}{w_L}\right)}^S + Var\widehat{\left(\frac{Z_H}{Z_L}\right)}^S + 2Cov\left(\widehat{\left(\frac{w_H}{w_L}\right)}^S, \widehat{\left(\frac{Z_H}{Z_L}\right)}^S\right) \tag{20}$$

A look at this equation makes clear that if more of the cross-country variation in changes of the skill-premium have to be attributed to changes in RTFP, less of the variation in $(w_H \hat{/} w_L)$ can be explained by variations in changes of countries' relative skill-supply. this in turn, implies that much of the skill-premium changes are due to other omitted factors, such as changes in efficiencies with which labour is used or changes in the demand for skilled workers. Hence, the share of cross-country variation in $(w_H \hat{/} w_L)$ which must be attributed to the variation in the backed out relative changes in RTFP, is a suitable *'measure of ignorance'*, given by

$$ignorance \equiv \frac{Var\widehat{\left(\frac{Z_H}{Z_L}\right)}^S}{Var\widehat{\left(\frac{w_H}{w_L}\right)}}, \tag{21}$$

A perfect match between theory and data would be depicted by a measure of ignorance equal to zero. This is the case, where the variance of the relative change in RTFP is also zero.[12]

3.4 Accounting with $\mu = 1$

Table 4 presents the results of this skill-premium accounting assessment for the special case of no market size effects ($\mu = 1$), confirming what the summary statistics in Tables 1 and 2 jointly point out: despite the fact that the relative supply of skills has increased markedly in the last decades, the skill-premium has failed to decline during the same period. This finding has important implications: changes of the relative supply of skill do not seem to adequately capture changes in the skill-premium across countries.

[*Table 4 about here*]

3.5 Accounting Methodology

As the figures in Table 4 suggest, the missing link here is technological change, i.e. changes of the skill-premium across countries have to be attributed to changes in RTFP. While the observed variance of the relative change in the skill premium is small, the heterogeneity in $(Z_H \hat{/} Z_L)$, according to this accounting exercise, is very large. This explains the relatively large value for the measure of ignorance, which is equal to 38.08 for the special case of no market size effects. We can therefore conclude that a simple framework that only incorporates the supply side of skills, does not adequately capture changes in the skill-premium across countries.

[12] Alternatively, we could assess this skill premium-accounting exercise by looking at the *measure of success* as in [17], which compares the variation in changes in the supply of skills to the cross-country variation in the relative change of the skill-premium.

Having a closer look at the bottom two rows of Table 4, reveals that although the implied variation in RTFP is larger in low-income countries, the measure of ignorance is greater for high-income countries. This, in turn, implies that the observed heterogeneity in skill premia among high-income countries is smaller than the analogous variation among low-income countries. The smaller value of *ignorance* for low-income countries implies that the skill-supply model does a better job in explaining cross-country changes of the skill premium for this subsample than for high-income countries.

Moreover, the positive mean change in RTFP, suggests that technological change in the high-skill intensive industry is on average larger than in the low skill-intensive industry. This observation is in line with [30], who find strong evidence that productivity growth was increasingly concentrated in the more skill-intensive manufacturing industries.[13]

3.6 Accounting with $\mu > 1$

Table 5 presents the analogous accounting exercise for the case with market size effects ($\mu > 1$). Given the parameter values according to the paramatrisation strategy as described in section 3.2, the value of the measure of market size effects takes 1.14. The summary statistics for the implied relative changes in RTFP are depicted in Table 5. Similar to the special case with $\mu = 1$, the cross-country heterogeneity in changes in RTFP are large: the values range between -1.03 and 5.24 and the necessary mean increase in RTFP takes a value of 1.68. Furthermore, Table 5 suggests that in the presence of market size effects, the necessary variation in changes in RTFP is now slightly lower. This finding is in line with the discussion related to equation (14), i.e. for higher values of μ,

[13] [31] provide a theoretical framework for this so called 'sector bias' of technological change. The intuition behind sector bias relies on changes in the relative profitability of sectors. Any sector-specific technological change makes that sector profitable at fixed product prices and initial factor prices. Given fixed labour supply, relative wages adjust until the profit opportunities are arbitraged away.

$(\hat{w_H/w_L})$ becomes less responsive to changes in the relative scarcity of skills. Consequently, by increasing μ from 1.0 to 1.14, less variation in technological change is required to capture the observed cross-country skill-premium changes in the data, represented by a lower level of $ignorance = 27.02$.

[*Table 5 about here*]

The results so far confirm what Figure 1 already suggested: There is hardly any association between changes in the skill premium and changes in the relative supply of skills. This finding is in particular true for high-income countries, as suggested by the relatively larger values for the measure of *ignorance*. Moreover, introducing market size effects, i.e. $\mu > 1$, reduces the need for changes in RTFP to explain the data. In the next section I will further explore the relationship between this parameter and the overall model performance in capturing the cross-country variation in skill premium changes.

4 Discussion

4.1 Market size effects and the measure of *ignorance*

The skill premium accounting exercise in the previous section was performed for two specific values of μ, i.e. $\mu = 1.0$ and $\mu = 1.14$. In this section I assess the model-fit for different values μ. The relationship between the measure of *ignorance* and the measure of the importance market size effects is summarised in Figure 2 and Table 6. The Figure confirms the above finding: the higher the value for μ the lower the level of *ignorance*, where the vertical dotted line depicts $\mu = 1.14$, which is the value for μ given the parameters as outlined in the parametrisation strategy. As the measure of ignorance is highest in the polar case ($\mu = 1.0$), the model with no market size effects can be regarded as the lower bound (see Table 6).

[*Figure 2 about here*]

The results have important implications. For a given elasticity of substitution between high - and low-skilled workers (θ), a higher value of μ implies that less of a change in RTFP is required to explain the observed changes in the skill premium. Looking at equation (17), it becomes clear why this is the case: Changes in μ imply that the skill premium becomes less sensitive to changes in the relative supply of skills.

The results above were driven by the fact that - given the implied value of μ - the relationship between $(w_H \hat{/} w_L)$ and $(H \hat{/} L)$ in the data is weaker than the relationship implied by the model. In order to reconcile the changes observed in the data with the 'skill-supply model', countries with a large increase in the share of high-skilled workers must also have a large increase in RTFP. Therefore, with higher values of μ the skill premium becomes less responsive to changes in the relative supply of skills and thus, closer to the empirical one. This in turn explains the negative relationship between the measure of *ignorance* and the parameter μ.

[*Table 6 about here*]

Furthermore, for large enough values of μ, an increase in the share of high-skilled workers increases the the skill premium. Taking into consideration the expression for the elasticity of the skill premium with respect to the relative supply of skills in (16), clarifies that for $\mu \geq \theta/(\theta - 1)$ the negative relationship between relative skill supply and the skill premium no longer holds. This observation provides a potential explanation for the pattern of skill premia across countries and time, where skill premia were increasing despite the simultaneous rise in the relative supply of skills.

4.2 Interpretation and Implications

The analysis above highlights that market size effects govern the strength of the relationship between technological change and the skill-premium. My findings suggest that the larger the market size effect the less we need technological change in order to explain patterns in the data, i.e. a higher value for μ implies lower levels of *ignorance*. However, even for reasonable estimates of market size effects (1.14), relatively large changes in RTFP are necessary in order to explain the observed skill premium patterns in the data.

The lower bound for μ is equal to one, which represents the case where the economy operates under constant returns to scale. In the model this is captured by setting $\beta = 0$, which implies that we exclude intermediate inputs in the production process and hence, shut down the source for market size effects. As discussed above, $\mu = 1.0$ the highest level of *ignorance*.

Table 6 presented different levels of the measure of *ignorance* for varying degrees of market size effects. The question, however, arises what the upper bound on μ ought to be. Suppose $\beta = 1$, which represents a model of full monopolistic competition á la [32, 33]. Estimates of the elasticity of substitution between varieties suggest an average value of about $\varepsilon = 6$ (i.e. $\mu = 1.2$) and the lower range lies at about $\varepsilon = 2$, implying $\mu = 2$. The measure of *ignorance*, in turn, then takes a value of 4.12, which is a lot lower than the the above analysed cases. Nonetheless, it can be argued whether this is close or far from the measure of ignorance being close to zero. [14] Hence, even for the upper bound of plausible values for μ, technological change would have to explain the major share of variation in skill premia across countries and time. Consequently, for plausible parametrisations, market size effects can help to explain the observed patterns in the data.

[14] See for example [34], [35] and [29] for studies which provide estimates for the elasticity of substitution between varieties.

Lastly, my analysis allows for a comparison between high vs low-income countries regarding the relative importance of the different drivers of wage inequality. As outlined above, the measure of ignorance differed substantially between the two sub-samples. Specifically, in the polar case without economies of scale, the accounting exercises delivered a measure of ignorance equal to 61.88 for high-income countries and 40.81 for low-income countries respectively (see Table 4). Including market size effects into the analysis highlights two important results. First, market size effects are important in accounting for skill-premium changes, as the measure of ignorance falls for both sub-samples. Second, for a given value of economies of scale, the measure of ignorance reduces by relatively more for the high-income sample. A look at Table 5 and 4 reveals that for the high-income sample *ignorance* decreases from 61.88 to 43.75, while for low-income countries the corresponding drop is from 40.81 to 28.87. The proportionately stronger decline for high-income countries indicates that market size effects play a comparatively larger role for more developed economies. These tend to be countries with larger market sizes in the first place. Consequently, it raises the question whether there are differences in the strength of economies of scales across different countries.

5 Conclusion

In this paper I shed light on the proximate determinants of changes in the skill-premium over time and across countries. My findings add to the growing evidence that there is hardly any association between changes in the relative supply of skills and the observed evolution of the skill-premium. Rather, it is technological change and market size effects that are the main drivers of recent skill premium developments. Furthermore, I show that the measure of the importance of market size effects governs the strength of the relationship between technological change and the skill-premium. Importantly, for strong enough economies of scale, an increase in the relative supply of skills increases the the skill premium. This finding points out that the scale of the economy may be an important factor in shaping developments of the skill premium, independent of the specific features of technological change.

A central parameter in the analysis of this paper is the measure of the importance of market size effects, which more generally captures the presence of economies of scale in the economy. The analysis has shown that even for the upper bound of plausible market size effects, technological change plays the main role in explaining the observed skill premium patterns. Potentially, market size effects play a greater role if economies of scale and innovation are linked. Studies analysing the implications of endogenous technological change have suggested that the R&D process of innovating new varieties is subject to economies of scale. This indicates a close link between market size effects and the nature of technological change, together pointing towards theories of directed technological change as proposed by [11] and [20]. To the extent that economies of scale are an important factor in shaping technological change, the channel identified in my analysis would amplify the connection between technological developments and skill premium changes.

Lastly, the comparison between high vs low-income countries highlights that market size effects play a comparatively larger role for more developed economies. These tend to be countries with larger market sizes in the first place. This finding, raises the question, whether there are differences in the importance of market size effects across countries and whether they matter in accounting for skill premium changes over time and across countries. In doing so, I touch upon an issue that is particularly under-explored in the developing country context. Hence, further analysing the relationship between market size effects and skill premia, is particularly important for understanding the recent increase in inequality in medium and low-income countries. Exploring this additional heterogeneity in the measure of importance of scale economies in the context of skill premia developments, is left for future research.

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7 Declarations

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- Availability of data and materials:
  The "Occupational Wages around the World (OWW) Database" used in this study are available to the public under: https://www.nber.org/research/data/occupational-wages-around-world-oww-database

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9 Appendix

9.1 Theory

9.1.1 Derivation of output equation (10)

From equation (4) and (7) it follows that $P_{it}Q_{it} = B_{it}$; together with equation (2) we get

$$P_{it}Q_{it} = \left[\frac{1}{Z_{it}}\left(\frac{w_{Lt}}{1-\alpha_i}\right)^{1-\alpha_i}\left(\frac{w_{Ht}}{\alpha_i}\right)^{\alpha_i}\right]^{1-\beta} \times \left[\int_0^{M_{it}} p_{it}\left(m\right)^{1-\varepsilon} dm\right]^{\frac{\beta}{(1-\varepsilon)}} Q_{it}$$

Next, we solve (9) with (6), which yields

$$p_{it}(m) = \left(\frac{\varepsilon}{\varepsilon-1}\right)\frac{1}{Z_{it}}\left(\frac{w_{Lt}}{1-\alpha_i}\right)^{1-\alpha_i}\left(\frac{w_{Ht}}{\alpha_i}\right)^{\alpha_i}$$

Furthermore, plugging this expression into the previous one and using the expression for factor shares $w_{Ht}H_{it}/P_{it}Q_{it} = \alpha_i$ and $w_{Lt}L_{it}/P_{it}Q_{it} = 1-\alpha_i$ we get

$$P_{it}Q_{it} = M_{it}^{\frac{\beta}{1-\varepsilon}} Q_{it}\frac{1}{Z_{it}}\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\beta}\left(P_{it}Q_{it}\right)^{1-\alpha_i} L_{it}^{\alpha_i-1}H_{it}^{-\alpha_i}$$

Lastly, we arrange this equation for Q_{it}, which yields equation (10):

$$Q_{it} = M_{it}^{\mu} \left(\frac{\varepsilon}{\varepsilon - 1} \right)^{-\beta} \frac{\varepsilon}{\beta}$$

9.1.2 Expression for the Skill-Premium

Given equation (11), we next find the demand for low and high-skilled workers (see equation (8) and (9)), which I derive using Shephard's lemma,

$$L_t = \frac{\varepsilon}{\beta} \frac{1}{Z_{Lt}} \left(\frac{1-\alpha_L}{\alpha_L} \frac{w_{Ht}}{w_{Lt}} \right)^{\alpha_L} M_{Lt} + \frac{\varepsilon}{\beta} \frac{1}{Z_{Ht}} \left(\frac{1-\alpha_H}{\alpha_H} \frac{w_{Ht}}{w_{Lt}} \right)^{\alpha_H t} M_{Ht}$$

$$H_t = \frac{\varepsilon}{\beta} \frac{1}{Z_{Lt}} \left(\frac{1-\alpha_L}{\alpha_L} \frac{w_{Ht}}{w_{Lt}} \right)^{\alpha_L - 1} M_{Lt} + \frac{\varepsilon}{\beta} \frac{1}{Z_{Ht}} \left(\frac{1-\alpha_H}{\alpha_H} \frac{w_{Ht}}{w_{Lt}} \right)^{\alpha_H - 1} M_{Ht}$$

We can now use the expression for L_t and H_t to solve for the measures of input varieties M_{Ht} and M_{Lt}

$$\begin{aligned} M_{Lt} &= \frac{\left[\alpha_H L_t - (1-\alpha_H) H_t \left(\frac{w_{Ht}}{w_{Lt}}\right)\right] \beta Z_{Lt} \left(1-\alpha_L\right)^{(1-\alpha_L)} \alpha_L^{\alpha_L}}{\varepsilon \left(\alpha_L - \alpha_H\right) \left(\frac{w_{Ht}}{w_{Lt}}\right)^{\alpha_L}} \\ &= \frac{\left[\alpha_H - (1-\alpha_H) \frac{H_t}{L_t} \left(\frac{w_{Ht}}{w_{Lt}}\right)\right] \beta Z_{Lt} \left(1-\alpha_L\right)^{(1-\alpha_L)} \alpha_L^{\alpha_L}}{\varepsilon \left(\alpha_L - \alpha_H\right) \left(\frac{w_{Ht}}{w_{Lt}}\right)^{\alpha_L}} \end{aligned}$$

$$
\begin{aligned}
M_{Ht} &= \frac{\left[(1-\alpha_L)\, H_t \left(\frac{w_H}{w_L}\right) - \alpha_L L\right] \beta Z_{Ht} \left(1-\alpha_H\right)^{(1-\alpha_H)} \alpha_H^{\alpha_H}}{\varepsilon\left(\alpha_H - \alpha_L\right)\left(\frac{w_{Ht}}{w_{Lt}}\right)^{\alpha_H}} \\
&= \frac{\left[(1-\alpha_L)\, \frac{H_t}{L_t} \left(\frac{w_{Ht}}{w_{Lt}}\right) - \alpha_L\right] \beta Z_{Ht} \left(1-\alpha_H\right)^{(1-\alpha_H)} \alpha_H^{\alpha_H}}{\varepsilon\left(\alpha_H - \alpha_L\right)\left(\frac{w_{Ht}}{w_{Lt}}\right)^{\alpha_H}}
\end{aligned}
$$

Finally, plugging the expression for M_{Ht} and M_{Lt} back into equation (11), yields the expression of the skill premium in equation (12).

9.2 Data

[*Table 7 about here*]

10 Figures Legends

10.1 Legend for Figure 1:

Legend to Figure 1 with the Title "Relative changes in skill-supply and the skill-premium (1983-2007)".

"The figure shows the correlation between the log change in the relative skill supply and log changes in the skill premium. The regression coefficient is 0.01 (robust SE: 0.036), p-value of 0.807 and with R^2 of 0.001. Data are for a balanced panel of 36 countries in 8 year intervals between 1983-1991 and and 1999-2007. See section 3.1 for a detailed description of data sources."

See approximate location for Figure 1 about here[1]

10.2 Legend for Figure 2:

Legend to Fig 2 with the Title "The measure of *ignorance* and the importance of market size effects (μ)".

"The figure shows the relationship between the measure of *ignorance* and the measure of the importance market size effects. The corresponding values are summarised in Table 6. The vertical dotted line depicts $\mu = 1.14$, which is the value for the measure of the importance market size effects given the parameters as outlined in the parametrisation strategy. See section **??** for more details on the parametrisation of μ."

See approximate location for Figure 2 about here[4.1]

11 Figures

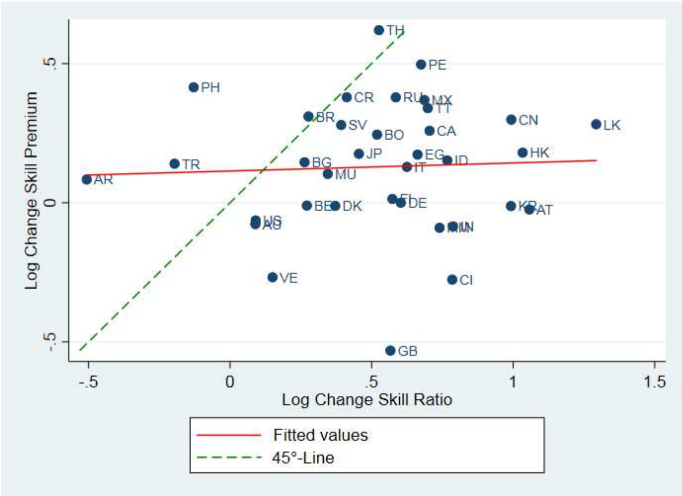

Fig. 1 Relative changes in skill-supply and the skill-premium (1983-2007)

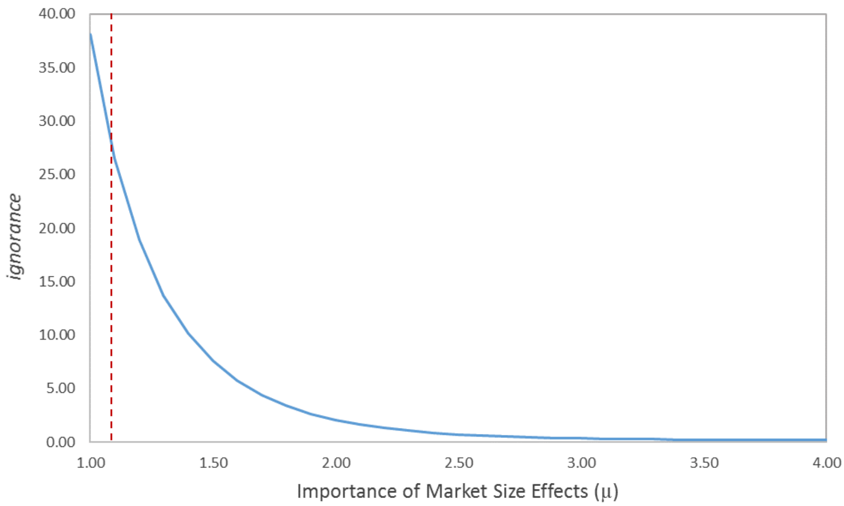

Fig. 2 The measure of *ignorance* and the importance of market size effects (μ)

12 Tables

Table 1 Summary Statistics for w_H/w_L

Subsample	Obs	Min	Mean	Max	Std. Dev.
1983-1991	36	0.77	1.53	2.82	0.47
1999-2007	36	0.78	1.77	3.85	0.66
$\frac{d(w_H/w_L)}{w_H/w_L}$	36	-0.41	0.17	0.86	0.26

See approximate location for Table 1 about here[3.2.1]

Table 2 Summary Statistics for $H/(H+L)$

Subsample	Obs	Min	Mean	Max	Std. Dev.	Corr w_H/w_L
1983-1991	36	0.008	0.06	0.23	4,93	-0.24
1999-2007	36	0.001	0.10	0.25	7.12	-0.21
$\frac{d(H/(H+L)}{H/(H+L)}$	36	-0.87	0.74	2.62	0.68	0.04

See approximate location for Table 2 about here[3.2.1

Table 3 Data and Paramatrisation Strategy

Data & Parameters	Value	Description	Source
w_H/w_L	data	Skill-Premium	[1]
$H/(H+L)$	data	Relative supply of skilled workers	[27]
θ	1.5	Elasticity of substitution in demand	[15]
μ	1.14	Importance of market sizes effects	[29]
α_H	1	Share of high-skilled workers in the high skill-intensive industry	-
α_L	0	Share of high-skilled workers in the low skill-intensive industry	-

See approximate location for Table 3 about here[3.2.2]

Table 4 Summary Statistics for changes in RTFP ($\mu = 1$)

	Obs	Min	Mean	Max	Var	*ignorance*
Full Sample	36	-1.28	1.99	6.27	2.59	38.08
High-Income Countries	12	-0.03	1.64	4.23	1.98	61.88
Low-Income Countries	24	-1.28	2.12	6.27	2.90	40.81

See approximate location for Table 4 about here[3.4]

Table 5 Summary Statistics for changes in RTFP for $\mu = 1.14$

	Obs	Min	Mean	Max	Var	*ignorance*
Full Sample	36	-1.03	1.68	5.24	1.84	27.02
High-Income Countries	12	-0.04	1.36	3.52	1.40	43.75
Low-Income Countries	24	-1.03	1.84	5.24	2.05	28.87

See approximate location for Table 5 about here[3.6]

Table 6 *ignorance* and the importance of market size effects (μ)

	$\mu = 1.0$	$\mu = 1.14$	$\mu = 1.5$	$\mu = 2.0$	$\mu = 2.5$	$\mu = 3.0$	$\mu = 3.5$
ignorance	38.08	27.02	11.38	4.15	1.77	1.00	0.85

See approximate location for Table 6 about here[4.1]

Table 7 Countries in the Sample

Country	Code	High-Income
Argentina	AR	no
Austria	AT	yes
Australia	AU	yes
Belgium	BE	yes
Bulgaria	BG	no
Bolivia	BO	no
Brazil	BR	no
Canada	CA	yes
Cote d'Ivoire	CI	no
China	CN	no
Costa Rica	CR	no
Germany	DE	yes
Denmark	DK	yes
Egypt	EG	no
Finland	FI	yes
United Kingdom	GB	yes
Guyana	GY	no
Hong Kong	HK	yes
Indonesia	ID	no
India	IN	no
Italy	IT	yes
Japan	JP	yes
Republic of Korea	KR	no
Sri Lanka	LK	no
Mayanmar	MM	no
Mauritius	MU	no
Mexico	MX	no
Peru	PE	no
Philippines	PH	no
Russia	RU	no
El Salvador	SV	no
Thailand	TH	no
Turkey	TR	no
Trinidad & Tobago	TT	no
United States	US	yes
Venezuela	VE	no

See approximate location for Table 7 about here[9.2]