Trends in Wage Inequality in Sri Lanka

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Abstract

Stylized facts suggest that wage inequality in Sri Lanka has increased over the 1996-2006 period, followed by a significant decrease from 2006 to 2014. Using Labor Force Survey data and a supply and demand framework, I find that an increase in the relative supply of high skilled workers alone does not explain the differential trends in wage inequality. There is a significant shift in factor demand for high skilled workers in both periods, which is countered by a higher increase in relative supply from 2006-2014, contributing to the overall decrease in wage inequality. I also find evidence for occupational upgrade among low skill workers in the later period, which could explain the higher relative wage gains of that group in the 2006-2014 period.

Keywords: Wage Inequality, Income Inequality, Human Capital, Sri Lanka

JEL classification: J20, J31 O15

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1 Introduction

During the last few decades, wage inequality in many countries has increased (Card et al., 2013; Green et al., 2019; Van Reenen, 2011; Western and Rosenfeld, 2011) while some countries experienced a reversal of the increasing trend in the last couple of decades (Acosta et al., 2019). Sri Lanka also shows a similar reversal of the increasing wage inequality trend in the mid-2000s. In this study, I use the supply and demand framework described by Murphy et al. (1992) to investigate which factors contributed to changes in wage inequality in Sri Lanka.

Wage inequality increased for both men and women in Sri Lanka from 1996 to 2006, followed by a rapid decline from 2006 to 2014 (Figure 3).[1] Residual wage inequality as wells as education premium followed a similar trend, increasing before 2006 and then rapidly declining. Large wage gains for low-educated workers appear to drive the trend reversal. Acosta et al. (2019) and Rojas (2006) have made similar observations in South American countries; however, this trend differs from the experience of the developed countries.

The Sri Lankan labor market changed significantly prior to the 2006 shift in wage inequality. First, the tsunami in late 2004 led to significant rebuilding efforts in Sri Lanka, reinvigorating the construction industry. Further, significant foreign investment in infrastructure after the end of the civil war in 2009 made construction the fastest growing industry in Sri Lanka. Second, Sri Lanka received tariff-free access to the European market under the Generalized System of Preferences (GSP), which then attracted large investments in the manufacturing sector, especially in the textile and garment industries. Both the construction and textile industries demand low skill workers, which creates favorable economic conditions for those workers. At the same time, the educational attainment of workers has increased over the last few decades (Figures 5 and 6). The goal of this paper is to assess these supply and demand factors and decompose the wage inequality in Sri Lanka.

I analyze wage changes using the supply and demand framework developed by Murphy et al. (1992). This framework is widely used in the context of both developed countries (Goldin and Katz, 2009) and developing countries (Acosta et al., 2019; Jong-Wha and Wie, 2017; Man-

[1] Wage inequality is measured as the difference between logs of 90^{th} and 10^{th} percentile of the wage distribution.

acorda et al., 2010; Rojas, 2006). In this partial equilibrium model, the demographic groups are considered to be imperfect substitutes in production. The changes in wages are explained in terms of shifts in both the relative supply and demand of these demographic groups. I applied this framework to 19 annual Labor Force Surveys of Sri Lanka form 1996 to 2014 with more than 800,000 individual observations. I create two different sub-samples from the survey data to calculate wages and the quantity of labor. I restrict the wage sample to workers who are wage earners, age 15 to 65, who are full-time workers. I divide each sub-sample into smaller demographic units based on age, education, gender, and experience, and then take a weighted aggregation across demographic groups when necessary.

I find that the significant increase in the relative supply of highly skilled workers compared to low-skilled workers alone does not explain wage inequality trends from 1996 to 2014. From 1996 to 2006, shifts in demand for skilled workers outweighed the supply of those highly skilled workers, causing a positive shift in relative wages for skilled workers in the early period. On the other hand, from 1996 to 2006, the increased supply of highly skilled from explains the decrease in relative wages for skilled workers, despite an increase in demand for those workers. Although the overall demand favored highly skilled workers in the later period, there was a significant increase in the within-industry demand for low-skill workers, suggesting an occupational upgrade among low-skill workers during the later period.

I contribute to the literature by analyzing which factors contribute to wage inequality trends in Sri Lanka. Because wage inequality can affect social and political environments worldwide, a significant body of research has emerged in recent years in both developed countries (Card and Lemieux, 2001; Card et al., 2013; Carneiro and Lee, 2011; Green et al., 2019) and developing countries (Acosta et al., 2019; Kumar and Mishra, 2008; Rojas, 2006; Velde et al., 2004). Developed countries tend to exhibit increases in wage inequality. This pattern is readily observed in developed countries like the United States (Murphy et al., 1992), Canada (Green et al., 2019), United Kingdom (Van Reenen, 2011), West Germany (Card et al., 2013). On the other hand, developing countries show mixed wage inequality trends. For example, urban China and India experience increased wage inequality during similar time periods (Han et al., 2012; Jong-Wha and Wie, 2017). In contrast, Acosta et al. (2019) provides evidence of a reversing wage inequality

trend in sixteen Latin American countries, including Argentina, Brazil, and Chile. Rojas (2006) shows that the skill premium in Mexico has decreased after 1995. In this study, I document that Sri Lanka follows a trend similar to Latin America.

Increased demand for high-skilled labor is credited for increasing wage inequality. Murphy et al. (1992) provide evidence for increased demand for more educated, more skilled, and female workers as drivers of change in relative wages, while college premiums are closely correlated with supply rates of college graduates. Johnson (1997); Juhn (1999) also discusses the role of demand shifts in favor of high-skilled labor driving wage inequality in the United States. Acosta et al. (2019) explores wage inequality in Latin America and shows that shifts in demand explain changes in wage inequality more than changes in supply. In this paper, I demonstrate that Sri Lanka shows the same dynamic of higher demand for high-skilled labor in the early period from 1996 to 2006, where wage inequality is increasing. Studies show that decreases in wage inequality are often due to increases in low-skilled occupations. However, both Acosta et al. (2019) and Rojas (2006) argue that decreasing wage inequality trends in Latin American countries are correlated with an increased supply of high-skilled workers. In this study, I find that decreasing wage inequality in Sri Lanka during the period from 2006 to 2014 can also be explained by both supply and demand for low skilled occupations.

I also contribute to wage inequality literature by being the first to study the reversal of wage inequality trends in Sri Lanka over the 1996-2014 period. Seneviratne (2019) studies the wage inequality in Sri Lanka using a quantile regression method using 1992, 2003, and 2014 Labor Force Surveys and concludes that rising relative demand for low-skilled workers lowers the wage inequality from 1992 to 2014. However, this paper establishes the distinctive reversal of wage inequality trends in Sri Lanka in the mid-2000s and studies the demand and supply effects in those two periods separately. Therefore, this paper attempts to take the first step to understand the reversal of the wage inequality trend in Sri Lanka. Additionally, few researchers have studied gender wage inequality in Sri Lanka (Ajwad and Kurukulasuriya, 2002; Gunewardena et al., 2009; Seneviratne, 2020).

Following the introduction, I discuss wage inequality in Sri Lanka Section 2, followed by data and sample selection in Section 3. I then describe the supply and demand framework in Section

4. I provide results in Section 5 and conclude the paper in Section 6. Finally, I provide tables and figures in Section 7.

2 Stylized Facts

2.1 Observed Patterns in Data

Wage inequality in Sri Lanka take a dramatic shift around 2006 and start to decline. I use Labor Force Surveys from Sri Lanka from 1996 to 2014. I restrict my sample to wage earners who are aged between 15-65 and full-time workers. I use hourly wages that are directly available for hourly wage earners and computed for monthly wage earners. I use the 2012 Consumer Price index to adjust wages for inflation.

Figure 1 shows mean the log hourly real wages for both men and women. Wages are adjusted for inflation, and in Panel B, wages are normalized to zero at 1996. Men and women show an overall wage increase of about 57% and 46% in real wages during the period from 1996 to 2014. The overall trends itself does not help to understand the wage inequality. Therefore, I plot wages for the 90^{th}, 50^{th}, and 10^{th} percentile for each gender group. Figure 2 shows the wage trends for those percentile groups, and wages are normalized at 2006 for better clarity. There is a distinct pattern before and after 2006, for both men and women. 90^{th} percentile shows a relatively higher wage growth prior to 2006 compared to that of lower percentile groups. However, after 2006 both 50^{th} and 10^{th} show a higher wage growth, whereas the highest growth is for the lowest percentile. Moreover, wages growth for lower percentiles is nearly stable before taking a steep turn after 2006 while the 90^{th} percentile shows the opposite patter. This dynamic indicates the changes in wage ratios between higher earners and lower earners.

Next, I look at wage differential between logs of 90^{th} and 10^{th} percentile groups, which is a common measure of wage inequality in the literature (Card et al., 2013; Green et al., 2019; Murphy et al., 1992). Panel A of Figure 3 shows the 90-10 wage differential trend. The two distinctive periods are clearly, visible and during the early period, wage inequality among men increases slowly and rapidly decreases in the later period. Wages for women show similar trends,

but the magnitude of changes is greater. Panel A of Figure 3 shows the residual wage inequality, measured as the log differences of 90^{th} and 10^{th} percentiles of residuals from the standard Mincer regression.[2] The reversing pattern is prominent in the residual graphs which also show an increase wage inequality in the first period followed by a rapid decline in the later period.

Observed patterns for Sri Lankan wages, as shown in Figure 3 is different from developed countries during a similar period. Green et al. (2019) shows that US and Canada wage inequality as measures in log 90-10 differential is continuously increasing or stable (See Figure 10 in Appendix 2.1). However, observed patterns are similar to that of Latin America (Acosta et al., 2019).

2.2 Educational Wage Differentials

Next, I look at wage differentials between different educational groups. I divided the LFS data into three education groups based on years of schooling: workers who completed 13 years or more of schooling, which includes high school graduates and college graduates, workers with 9 to 12 years of schooling, and workers with 8 or fewer years of schooling, which was mandatory for most of the period under study. I refer to each group as skill groups, with 13 or more years of schooling as the high skill group, 9 to 12 years of schooling as the medium skill group, and 8 or fewer years of schooling as the low skill group.[3] Figure 4 shows the share of each education category in the labor force from 1996 to 2014. For both men and women, education attainment is increasing. The share of low educated drops from 48% to 32% for men and 48% to 30% for women. High educated workers nearly doubled their share during the same period, from 8% and 9% in 1996 for men and women.

Figures 5 and 6 present the wage trends based on education groups, which shows differential patterns before and after 2006. Panel C and D of Figures 5 and 6 shows wages for each education

[2] I used log real hourly wage as the dependent variable, education as the indicator variable, and cubic of potential experience as control variables. Potential experience is defined as (age - school completion age).

[3] College graduates alone only consist of about 5% of the workers as of 2014. Such a small sample could result in significant noise when calculating aggregate wages. Adding high school and college graduates together does not reduce within-group comparability. Only a fraction of skill groups increased, up to 15% for men and 20% for women. Among Sri Lankan private sector workers, high school graduates with experience and college graduates are comparable, especially given that most of the college graduates are from non-stem fields. 9-12 years of schooling roughly translated to attending and/or completing middle school in USA.

group relative to 1996 and 2006. Low-educated workers experience significant wage growth after 2006. During the same period, higher-educated workers experience relatively small real wage growth, and mid-educated workers experience modest growth. However, the magnitude of increase similar to trends observed in percentile wages. Panel B of Figures 5 and 6 show the skill premium based on wage differentials between education groups for men and women. Both high and low skill premium exhibit a sharp decrease, followed by an increase before 2006. However, in the post-2006 period, there is a significant decline in the skill premium between high to low skills. Similar trends are observed for high to medium skill premium. When analyzed for women, similar trends across skill groups are observed, although differences in growth of real wages between skills groups are larger (Figure 6). Further, during the early period, skill premium among women did not experience the same rapid decline as men, instead remained stable or increased slightly. It is important to note that during the earliest years of the data set, skill premium declines while the overall 90^{th} to 10^{th} percentile ratio increases.

In the following chapters, I use the supply and demand framework suggested by Murphy et al. (1992) to study changes in wages in terms of supply and demand for skills.

3 Data

For the purposes of this study, I use the quarterly Labor Force Survey (LFS) data from the Department of Census and Statistics of Sri Lanka (Department of Census and Statistics, 1996-2014). Survey data are available for the period from 1996 to 2014. The surveys cover all households in Sri Lanka and have a sample size of 25,000 households. LFS covers all the provincials of the country. However, due to the civil war, which ended in 2009, two out of nine provinces (Northern and Eastern provinces) were excluded in all surveys except for 2004-2005 and 2010-2014. Therefore, I exclude these two provinces and restrict the analysis to seven provinces of Sri Lanka. According to the 2014 LFS, the excluded provinces comprise 12% of the total population. 2005 survey has a smaller sample size due to the Tsunami in December 2004 which destroyed many coastal areas of the island nation. However, I keep the 2005 survey data in the results shown in this paper as the findings are similar to those, including the 2005 survey.

3.1 Selection of Sub-Samples

Following Murphy et al. (1992), I construct two different sub-samples for the analysis. I use the first sample is to calculate wage changes. Since the availability of data on wages (or income) is limited. I restrict the wage sample to the workers who are wage earners. Moreover, an important requirement of the wage sample is that it must provide consistency in demographic composition across time, thereby increasing comparability across time. Next, I restrict the sample to workers aged between 15 to 65 and include only full-time workers. I consider workers who had 35 or more hours per week as full-time workers following the definition given by the Department of Census and Statistics of Sri Lanka.

LFS collects information on wages for workers as monthly salary, daily wage, additional income such as overtime pays. LFS also collects the total number of hours worked in the last week for all workers. Using LFS data, I construct a common hourly wage measure for all. First, I calculate the total earning for a week by dividing total monthly earning by 4.2. For monthly salary earners, total monthly earning is salary plus additional earnings. For Daily wage earners, I take the total earning for month calculated and given in the survey. Then, I divide weekly earnings by the total number of hours worked in the last week to obtain the hourly wage measure. Finally, I used the Consumer Price Index (the base year is 2010) to obtain real wages. Finally, I truncate the real log wages at 1% at both the lower and upper tail.

I construct a second sub-sample to analyze the quantity of labor. Measuring aggregate supply and demand for a particular group of workers, which can be based on age, education, gender, experience, etc., is imperative to understanding how wages in each group responded to changes in supply and demand. Therefore, I include all the workers to the quantity of labor sub-sample who are between ages 15 and 65. I measure the supply in terms of hours of labor supplied by each worker, as reported in the survey. Total hours worked are reported in the survey as a weekly measurement. I further discuss the use of these separate samples in the following sections.

I use years of schooling as a measure of education level. Sri Lanka provides free education up to the college level, and education is mandatory until the age of 14 (Nawastheen, 2019). School attendance is high in Sri Lanka compared to the other developing countries, and literacy

rate stands at about 96.3% as of 2015. In 2015, 90.5% of children completed Grade 5 and 64% children completed Grade 10 (Central Bank of Sri Lanka, 2015).[4]

I use three main education groups. The first group is 8 or less years of schooling. 8 years of schooling was the mandatory limit of education until the age of 14. Moreover, grade 8 completion sets the bar for minimum education qualification, most of the lowest skill jobs which require education as a qualification. The second group is workers who completed grades 9 - 12. Sri Lanka has two national level exams at grade 11 and grade 13 level. I put workers who completed grade 9 up to the grade 13, but failed grade 13 exam, into this group. Grade 13 exam is the university entrance exam and passing grade 13 implies you are qualified to enter a university. Therefore, I put workers who passed grade 13 and above, and who completed tertiary education into the third education group.

I calculate the experience of a worker by taking the difference between the age of the worker and his school completion age. I take a particular worker's highest education qualification to calculate the school completion age since all students follow the government-mandated grade system in Sri Lanka. If a worker is college-educated, it counts as 4 years of education. I assume all the workers start accruing the experience after the completion of education, which closely follows Murphy et al. (1992).

4 Methodology

The methodology of my study is to decompose the changes in wage inequality in terms of demand and supply of different skills. Changes in wages and wage structure could occur due to changes in labor force demographics and the interaction of various macroeconomic conditions. These changes will impact the equilibrium supply and demand conditions of the labor market, leading to observed changes in wages. I use the supply and demand framework suggested by Murphy et al. (1992) to analyze the wage trends in relation to changes in supply and demand.

[4]The government actively encourages education by providing free textbooks, clothes, and food, lowering the cost of attending.

Murphy et al. (1992) formalized a supply and demand framework to analyze observed relative wage changes between demographic groups in the USA from 1963-1987. Within the framework, relative wages of demographic groups are generated by the interaction between relative supply of those groups and factor demand schedules. This is a partial equilibrium model, and the demographic groups are considered to be imperfect substitutes in the production. The changes in wages are explained in terms of shifts in both relative supply and relative demand.

4.1 Framework for Supply of Labor

The framework suggested by Murphy et al. (1992) derived the following discrete equation by taking factor demands as a function of factor prices (W) and variables (Z) that contribute to the shifts in demand. X represents the labor inputs. Z represents the non-labor demand shifters, such as changes in technology, product demand, etc.

$$(W_t - W_\tau)' \Big[(X_t - X_\tau) - \big(D(W_t, Z_t) - D(W_\tau, Z_\tau) \big) \Big] \leq 0 \tag{1}$$

Derivation of Equation 1 is described in Appendix 2.2. Inequality implies when the production function is concave, cross-price on factor demands, D_ω, take the negative semi-definite form. Murphy et al. (1992) argue that if the stable factor demand hypothesis is true (i.e., there are no demand shifts affecting labor demand), then the changes in wages should arise from changes in the supply of labor. These changes could occur due to demographic characteristics of labor supply, such as education. Within the above framework, stable factor demand suggest Z_t is fixed, and therefore, Equation 1 can be written as,

$$(W_t - W_\tau)' (X_t - X_\tau) \leq 0 \tag{2}$$

Equation 2 provides an empirical strategy to evaluate wage changes arising from supply shifts absent from any demand shifts. If the negativity holds for any period of time, it suggests that changes in wages are potentially fully explained by changes in supply. However, if the sign of Equation 2 is positive, it suggests that changes in supply alone does not explain the changes in

wages.

First, I will explore the changes in supply of labor in Sri Lanka from 1996 to 2014. Second, I employ Equation 2 to test how well the changes in supply explain the observed differential changes in wages.

4.2 Framework for Demand Index

Next, I analyze changes in demand in terms of skill levels in the Sri Lankan labor market from 1996 to 2014. Following Murphy et al. (1992), I approximate the demand shifts for skills based on industry and occupation of workers and movement of employment across industry and/or occupation sectors. My goal is to explore between- and within-industry shifts in relative demand and quantify these shifts using Equation 1.

I measure the demand shifts in terms of weighted sums of sector employments for each factor. Weights are represented by the percentage change in the value of inputs in each sector.

$$\Delta D = \Sigma_j X_j \frac{W' dX_j}{W' X_j} \tag{3}$$

Derivation of Equation 3 is explained in Appendix 2.3. Equation 3 approximates shifts in demands. This demand shift index corresponds to the standard "fixed-coefficient manpower-requirement index". The index measures the percentage change in demand for a particular demographic group as the weighted average of percentage employment growth by sector. Weights are a sectoral distribution of a demographic group in a base period. If a particular demographic group is dominant in a particular industry and that industry is growing over time, the index implies the demand for such a demographic group should also be increasing over the same period.

4.3 Construction of Measure for Wages

I use the wage sample to construct wage measures.[5] For each year, I divide the wage sample into worker-cells based on gender, education, and experience.[6] There are two gender groups, three education groups, and 40 potential experience groups.[7]

For each worker-cell, I calculate the average wage. When the wage for broader groups is calculated, I use weighted average instead of worker-cells. Weights are average share of employment of each worker-cell over 1996-2014 (α_j). For example, Wages of high-skilled male was obtained by weighting across 40 experience groups. Then, the change in wage for a broader group k can be represented as follows.

$$\Delta W_k = \Sigma_j \alpha_j \Delta W_j \quad \text{where } j \text{ is worker-cells within } k \text{ group} \tag{4}$$

α_j is the average share of employment of each worker-cell over the 1996-2014 period. Thus, for all calculations, I keep the weights across time as fixed weights. My goal was to keep the composition of groups fixed over time so that the changes in wages do not reflect changes arising from different compositions of labor share across worker-cells.

5 Results and Discussion

5.1 Changes in Relative Wages

First, I analyze changes in wages from 1996 to 2014 within the Murphy et al. (1992) framework. Table 1 presents the changes in real wages for different labor groups. I divide the period under study into four sub-periods and present the changes in each period. Each number represents the change of log real wage for the labor group specified under the first column and for the period specified in the respective column head. Total change over the full period from 1996 to 2014 is

[5] Wage sample selection is described in Section 3.1.

[6] Full-time wage earners, age 15-65.

[7] Eight or less year of schooling, 9-12 years of school, and 13 or more years of schooling correspond to low, medium, and high skill groups, respectively. Potential experience is calculated as min {(age – school complete year), (age -14)}. The minimum working age in Sri Lanka is 14. Workers with 40 or above experience are grouped together as 40.

under the last column. Table 1 shows that wages increase throughout all sub-periods except for 2006-2014, and the increases in 2001-2006 and 2010-2014 periods are relatively larger. Decomposition based on gender also shows wage increases for both genders except during the period 2006-2010. Changes in wages are not significantly different for men and women throughout the period.

Panel B and C of Table 1 show that low skill workers clearly experienced greater wage gains over medium and high skill workers and maintain those gains in the 2006-2010 period. Figures 5 and 6 show similar changes in wages, where relative wage gains for low skill workers are significantly higher. Except for the early 2000s, low skill workers record the highest wage gains for men. Overall, wage gains for men are decreasing with the skill level for men. However, among women, both high and low skill workers experienced higher growth in overall wages. However, similar to men, growth in wages is monotonically increasing with skills after 2006. Panel D of Table 1 looks at the wage decomposition based on experience. Accordingly, experience does not appear to explain differences in wage growth, even when wages are considered in terms of different experience groups within education groups. These results suggest experience does not significantly affect differences in wage inequality, but education did.

Next, I explore whether the supply of skills could explain observed changes in wages.

5.2 Changes in Relative Supply

To build supply measures of labor, I use the supply/demand sub-sample.[8] First, similar to wage calculations, I divide the sample into worker-cells based on gender, education, and experience. There are two gender groups, three education groups, and 40 potential experience groups. The supply of labor from each cell is measured as the number of hours worked by all individuals in that particular cell in a week. However, in order to aggregate across groups, I must have a comparable measure across cells. Therefore, I convert the total number of hours in each cell into efficiency terms. Following Murphy et al. (1992), I use relative wages as the weight for the conversion. Accordingly, I calculate the wage index for each year.

[8] All workers age 15-65. Sample selection is described in Section 3.1.

$$WI_t = \Sigma_i \Sigma_k \Sigma_j W_{ikjt} * EmpShare_{ikj} \tag{5}$$

Where, $i = Gender$, $k = Education$, $j = Experience$, and $t = Year$. WI is the wage index. W is the average wage for each worker-cell, $EmpShare$ is the average labor share of each group over 1996-2014. Then, I calculate the relative wage for each worker-cell (ω).

$$\omega_{ikjt} = \frac{W_{ikjt}}{WI_t} \tag{6}$$

Then, the total number of hours in each worker-cell (H) is multiplied by the relative wage to obtain the relative supply of labor (S_{ikjt}) in each worker-cell.

$$S_{ikjt} = H_{ikjt} * \omega_{ikj} \tag{7}$$

Accordingly, I give more value to an hour of work by a worker with a higher relative wage. Since supply measure is now in efficiency units, aggregation across worker-cells and time is feasible. Therefore, changes in the labor supply of a broader group (i.e. high skill male (k)) are obtained by aggregating across experience groups correspond to the broader group groups(j).

$$\Delta S_k = \Sigma_j \Delta S_j \tag{8}$$

Table 2 summarize the changes in the supply of labor changes from 1996 to 2014. All numbers are in terms of efficient units and log differences. The overall supply of labor has decreased marginally during the full period under study, which is mainly driven by men. Supply changes based on education groups (i.e., skill levels) are significantly different for the low and high skill groups. Panel B and C of Table 2 show that the supply of low skill men decreased by 69%. However, high skill workers have significantly increased by 45% over the same period. The supply of medium skill workers moderately increased over the entire period. As per Table 2, experience also generates some variation in the supply of labor. There is a significant decrease in the relative supply of less-experienced workers. This suggests that experience distribution shifted

to more experienced workers over time. Panel E of Table 2 mirrors the earlier observation that the supply of low skill workers decreased while the supply of high skill workers increased in all experience categories.

5.3 Relative Wages vs. Relative Supply

How do changes in the relative supply of skill levels explain the relative changes in wages? To answer this question, I calculate relative wage and supply changes for high skill men. I summarize the results in Table 3 and show changes in relative wages and supply of high skill over two different periods. I select two periods, 1996-2006 and 2006-2014, to compare based on observed change in the wage inequality trend. Values represent the log difference of relative wages and supply of high skill workers compared to the other category. The increase in the relative supply of high skilled workers is apparent in both periods. This is similar to other developing countries where educational attainment is increasing over time. However, the rate of increase is lower in the later period compared to the earlier period. If this was purely a supply effect, wage inequality should be higher in the second period because the rate of increase in relative supply is decreasing. However, changes in relative wages do not support this argument, and in fact show the opposite pattern. Table 4 presents the results for women, which shows a trend similar to men. However, wage gains for women during the 1996-2006 period is significantly larger.

Increases in both relative supply and wages of high skill workers suggest that there should be a demand shift favoring high skill workers among men in the earlier period from 1996 to 2006. Table 2 and Table 3 suggest the directional change for supply and wage is mainly driven by the later part of the 1996-2006 period. In contrast, during the later period of 2006-2014, relative supply and relative wages moved in different directions, implying that changes in relative supply could explain the changes in relative wages. During the earlier period from 1996 to 2006, the existence of an increase in relative supply and increase relative wages for high skill workers suggest that demand for high skill workers should play a key role. In contrast, for the trends in the second period, there are two possible explanations. First, changes in relative wages could be a result of relative supply alone, and wages fell following a stable demand curve. Second, the possibility is that there could be a demand shift that supported or negated a supply effect that

favors or discourages high skill workers among men. Results for women are qualitatively similar to those of men.

Equation 2, described in Section 4.1 provides an empirical strategy to test the stable demand hypothesis where the supply drives the wage changes while the demand is stable across time. I calculate the inner product as specified in Equation 2 by dividing the entire period into four periods: 1996-2000, 2001-2005, 2006-2010, and 2011 -2014. I take averages across these years to estimate wages rather than taking wages and supply in individual years. Table 5 presents the results of the inner products. The results suggest that the stable demand hypothesis may be true for the later period based on the relatively large, negative numbers for both men and women. However, for the earlier period, numbers are either positive or close to zero, implying demand shift may explain the changes in wages. Findings are qualitatively similar for men and women.

As the findings so far suggest, there are shifts in demand that could potentially explain changes in wage inequality. Next, I investigate the demand for labor using the same Murphy et al. (1992) supply and demand framework.

5.4 Demand for Skills

5.4.1 Changes in Labor Share across Industries/Occupations

Understanding the composition of the labor force across industries is an important first step in demand analysis. Panel A of Table 6 shows labor share in each group averaged over the stated period the change from the 2002-2006 period to the 2011-2014 period. Data include both genders and all education groups. The largest change occurs in agriculture and employed by household categories. Utility/Transport/Communication and Construction industries have increased labor share over the period. However, changes in labor share are relatively small. Panel B of Table 6 shows changes in labor share across occupations, specifically that mid-level occupations are favored. Labor share of both high and lower-level occupations declines from 2002-2014, and mid-level occupations experience the highest labor share gains. This suggests that there may be occupational upgrades among low skill workers, while high skill workers are

increasingly employed in lower occupational categories.

Figure 7 and Figure 8 show the share of workers with three educational levels in three occupational categories created based on skill levels for men and women. I divide occupations into three skill categories.[9] The share of high skill labor in each occupational category has increased over 1996 to 2006 period, while both low and mid-skill labor share declines. In contrast, during the 2006-2014 period, the trend reversed, resulting in a drop in high skill labor within each occupational category. This shows some preliminary evidence of change in the relative demand for low skill workers within each occupational category.

Next, I look at the demand shifts across industries and across occupations. The analysis is limited to data from 2002 to 2014 due to the unavailability and the inconsistency of industry codes in surveys prior to 2002.

5.4.2 Constructing Demand Index

In order to formally explore the demand shift, I construct a demand index using Murphy et al. (1992) demand and supply framework. I use change in demand for demographic group k relative to employment share of group k, where the base year is d. I take average over the total 2002-2014 period as the base year. Therefore, I can calculate the average employment share of group k as E_k. Then, using Equation 3,

$$\Delta X_k^d = \frac{\Delta D_k}{E_k} = \Sigma_j \Big(\frac{E_{jk}}{E_k}\Big)\Big(\frac{\Delta E_j}{E_j}\Big) = \frac{\Sigma_j \alpha_{jk} \Delta E_j}{E_k} \tag{9}$$

Here, $\alpha_{jk} = \frac{E_{jk}}{E_j}$ is the average employment share of group k in sector j over 2002-2014 period and E_j is the share of employment in sector j. As described in Section 4.2, the index measures the percentage change in demand for a particular demographic group as the weighted average of percentage employment growth by sector. All the employment shares are measured in efficiency units. I take the base year value for E_k as the average over the 2002-2014 period. Results are

[9] High Skill: Legislators, Senior Officials, Managers, Professional, Technical, Associate Professionals. Mid Skill: Clerks, Service Workers, and Shop and Market Sales Service Workers, Plant and Machinery Operates and Assemblers. Low Skill: Elementary Workers, Skilled Agricultural and Fishery Workers, Craft and related workers, and Armed Services.

robust to different base years.

Using Equation 9, I calculate two demand shift measures. One is the Overall Demand Index ($X_k^{overall}$), where a sector j is industry-occupation cell. For the purpose of calculations, there are 32 industries and 4 occupations.[10] I also calculate the Between-Industry Demand Index ($X_k^{between}$), where sector j is 32 industries. Thereafter, I calculate the Within-Industry Demand Index (X_k^{within}) by subtracting the Between-Industry Demand Index from the Overall Demand Index.

$$X_k^{within} = X_k^{overall} - X_k^{between} \tag{10}$$

In doing so, I approximate the Within-Industry Demand Index as the demand shifts that occur across occupations. Table 7 shows the results from the above demand shift indexes. One drawback of this analysis is the limitation of data. Information on industry codes for employment was either unavailable or inconsistent before 2002. Therefore, I calculate the demand shifts from 2002 to 2014. I present results for three categories are presented: Between-Industry, Within-Industry, and Overall demand shifts. For each category, I show the demand shifts from 2002 to 2006, 2006 to 2014, and 2002 to 2014 periods.

5.4.3 Shifts in Demand

Table 7 shows the result of demand shifts calculated based on Equation 9. Overall shifts in demand favor high skill workers for the entire period from 2002 to 2014 for both men and women. Both low skill men and women experienced a negative shift in overall demand. However, the demand shift for medium skill men is slightly higher than high skill men. Women experience monotonically increasing demand for higher skilled workers.

For men, the shifts in demand in two sub-periods correlates with the observed changes in

[10]Industries are based on 2-digit classification from International Standard Industry Classification (ISIC) (United Nations Statistical Division, 2008). Occupations are based on International Standard Classification of Occupations (ISCO) (International Labour Office, 2012). ISCO has 10 major occupation groups, which I converted to 4 categories: Professionals and Managers (ISCO Major Category= 1,2,3), Associate Professionals and Administrative Workers(ISCO Major Category= 4,5,8), Semi-skilled workers in Agriculture and Industry(ISCO Major Category= 6,7), and Elementary Occupations(ISCO Major Category= 9).

wages. During the first period from 2002 to 2006, the overall demand for both high and medium skill increased, while the demand for low skill decreased. Therefore, relative demand shifted in favor of high skill men. When comparing between and within demand shifts, there is a slight decrease in relative demand shift for high skill, which is outweighed by the favorable demand shift within industries. This overall demand shift supported prediction that a favorable demand shift could explain increases in relative wages for high skill men. During the later period from 2006 to 2014, the overall relative demand shift favors high skill men concurrent with the positive supply shift. The decrease in relative wages suggests that the supply effect is dominant in the later period. However, there is an interesting movement within industries. Within-Industry relative demand in the later period shift towards low skill men, providing evidence that low skill men are in demand across occupations. This implies that there is an occupational upgrade among low skill men during the later period. Within industry demand shifts are in accordance with the expected demand shifts that support initial wage inequality trends.

These patterns are not necessarily true for women. During the early period, there is a slight positive relative demand shift favoring high skill women, but this change is small compared to the significant supply shift. On the other hand, relative wages for high skill women increased. This suggests that the demand effect caused the observed increase in relative wages. Despite the small overall demand shift, the relative between-industry demand shift favors high skilled in the same period. In terms of the second period, there is a significant overall demand shift favoring high skill women. However, the relative supply also increased rapidly at the time. The overall effect, similar to men, is due to an increase in relative supply, which supports the observed decline in relative wages in 2006-2014.

5.5 Potential Explanations for Demands Shifts

There were few labor market changes in Sri Lanka during and after 2005 that could help to understand the demand shifts and the observed changes in trends in wage inequality. Figure 9 shows the fastest growing industries in Sri Lanka during the 2006-2014 period. The construction industry employs about 19% of low skill men. Three major events helped the construction sector grow at a rapid rate. First, the tsunami that hit Sri Lanka in December 2004 destroyed much

of the coastal area, including several major cities. Following the tsunami, there was a large influx of foreign aid from international sources and increased domestic spending, funds that were primarily used for rebuilding efforts. Rebuilding work started in mid-2005 and continued for years. The second event is an increase in infrastructure investment after 2006/2007. A new, left-leaning government was elected in the 2005 elections, and they increased the spending on infrastructure projects and government ventures, which was supported through foreign debt finance. Most major infrastructure projects, which began in 2007-2008, were funded through the Chinese government, and large Chinese state-run entities mainly oversaw projects. The third event that rejuvenated the construction industry was the end of the 30-year civil war in 2009. This contributed to continuous growth in the construction industry through rebuilding efforts in war-affected areas. Growth in the construction sector increased the demand for low skill labor, and that could have played a role in observed changes in wage inequality. The other two industries that have shown significant growth post-2006 are fishing/mining and Utilities. Fishing/Mining industry mainly relies on low skill workers, and the Utility industry is a mix in terms of skills needed.

Another change in the Sri Lankan economy follows the receipt of the GSP-tariff concession from the European Union in 2005. This mainly benefited the Garment and Textile Industry, which accounted for about 50% of the industrial exports from Sri Lanka in 2016. The export of garments and textiles increased rapidly from USD 2.75 billion in 2005 to USD 4.6 billion in 2014. The textile industry primarily employs low and mid-skill women.

These two industries, Construction and Textile, received significant foreign direct investments and benefited from the lower tariff. However, literature provides evidence on the positive relationship between trade liberalization and increase wage inequality. Beyer et al. (1999); Hanson and Harrison (1999); Pavcnik et al. (2004) study Brazil, Chile, and Mexico and provide evidence for such a positive relationship. Moreover, there is evidence for a positive relationship between foreign direct investments (FDI) and wage inequality. Feenstra and Hanson (1997) find that FDI increased the skilled wage premium in Mexico. Velde et al. (2004) find that Thailand also showed higher wage inequality following the FDI. However, Velde et al. (2004) also look at South Korea, Hong Kong, Singapore, and The Philippines, and they do not provide strong evidence

for a relationship between FDI and wage inequality. These mixed results could question the validity of changes in Sri Lanka FDI and tariff structure as an explanation for the decline in wage inequality after 2006.

However, Kumar and Mishra (2008) find that trade liberalization has a strong and robust negative relationship with wage inequality in India after their trade liberalization policies in 1991. Kumar and Mishra (2008) further argue that the decline in wage inequality in India is significant in the industries with a higher proposition of unskilled labor. Sri Lanka could potentially come under the same umbrella. Industries that receive FDI and benefit from tariff reduction largely employ low skilled workers. This could imply that improvement in productivity within industries could greatly benefit low skill workers. These improvements could explain wage inequality decline after 2006, but this relationship requires further study.

6 Conclusion

Wage inequality in Sri Lanka increased from 1996 to 2006 and then rapidly declined from 2006 to 2014. The decline in the later period was mainly driven by significant wage increases for workers at the lower end of the wage distribution. Specifically, workers in the 10^{th} percentile of the wage distribution recorded about 25% additional gains in real wage compared to the workers in the 90^{th} percentile. Wages based on skill groups follow a similar trend. High skill workers have higher wage growth in the earlier period compared to low skill workers. However, low skill workers have gained significantly more in real wage than high skill workers in the later period. This differential growth in wage trends for skill groups contributed to the observed changes in wage inequality. I explored supply and demand for skills in an established framework to explain the observed trends.

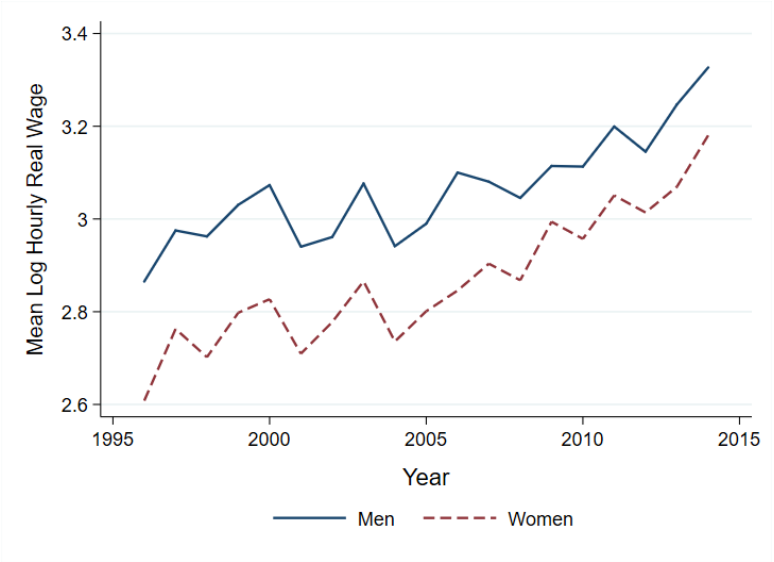
Findings suggest that changes in relative supply alone did not explain the differential trends in relative wages. The relative supply of high skill workers has increased in both periods. However, relative wages of high skill workers increased in the earlier period and declined in the later period. Increased relative wages in the earlier period occurred while relative supply was also increasing, suggesting there should be a demand shift that favors high skill workers. Analysis of demand

shifts based on industry and occupations supported this demand shift during the period from 2002 to 2006. During the later period from 2006 to 2014, where wage inequality was declining, there was a significant increase in relative supply. However, there is evidence for favorable overall demand shift for high skill workers in the later period. One noteworthy finding was the existence of within-industry demand shifts that favor low skill men during the later period. This suggests that there is some occupational upgrade among low skill men. Further investigation, specifically within the construction and textile industries, could provide an explanation for the reversal of wage inequality trends in Sri Lanka.

7 Table and Figures

Figure 1: Mean Log Hourly Real Wages

(a) Without normalization

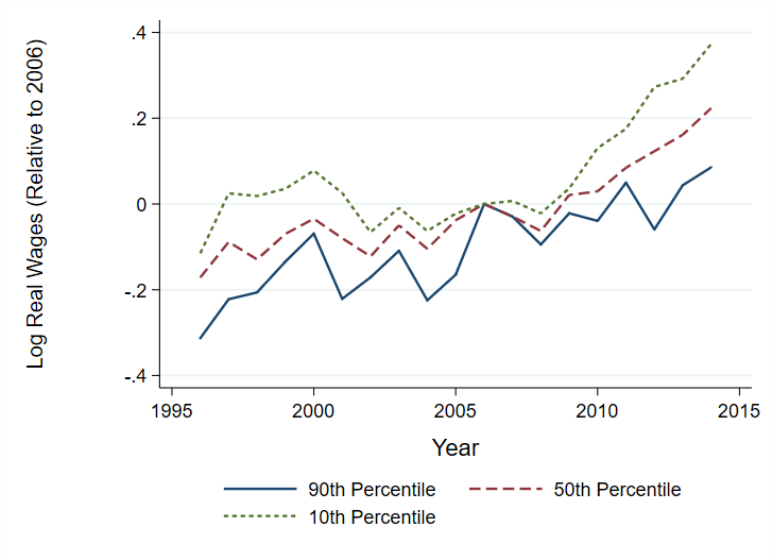


(b) Normalized to 1996

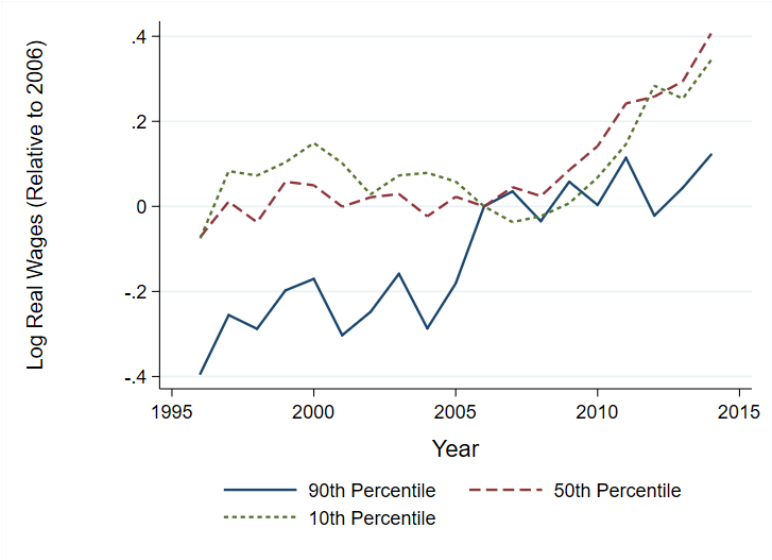
Notes: Figures 1 shows the changes in mean log hourly wages from 1996 to 2014. The vertical axis represents the mean log hourly real wage. The sample is restricted to full-time wage earners(employees) aged between 15 -65. Two lines in each figure represent men and women. Panel A shows wages over time. Panel B shows wages relative to 1996.

Figure 2: Mean Log Hourly Real Wages - Normalized to 2006

(a) Men



(b) Women



Notes: Figures 2 shows the changes in mean log hourly wages from 1996 to 2014. The vertical axis represents the mean log hourly wage. Wages are normalized at 2006. Wages are indexed to 2006. Each panel has three lines for the 10^{th}, 50^{th} and 90^{th} percentile of the mean log hourly wage distribution. The sample is restricted to full-time wage earners(employee) aged between 15 -65. Panel A and Panel B represent men and women.

Figure 3: Log 90^{th} to 10^{th} Hourly Wage Differentials

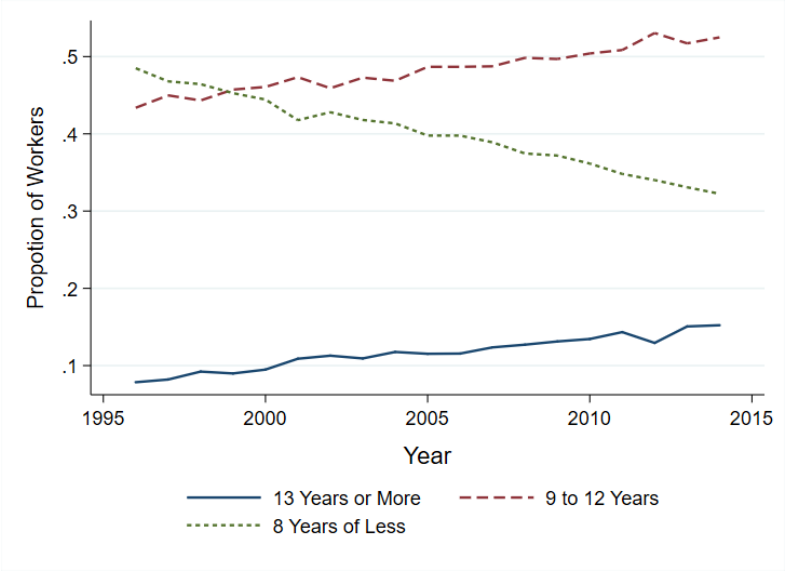
(a) Wage Differentials

(b) Residuals

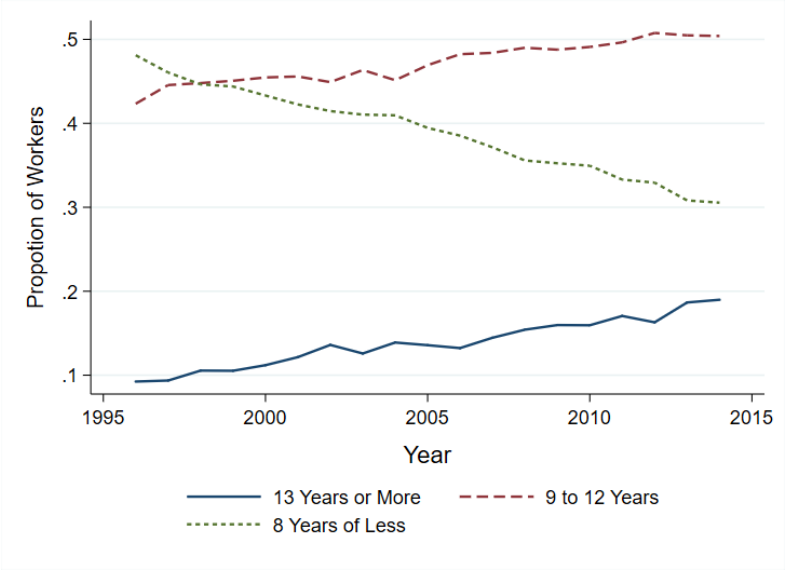
Notes: Panel A of Figure 3 shows the log differentials of between 90^{th} and 10^{th} percentile of mean log hourly real wages from 1996 to 2014. Panel B of Figure 3 shows the residuals of standard mincer regression. The outcome variable, log real wages is regressed on education group indicator variables and potential labor market experience. 2005 data are dropped since the survey does not cover all island. The sample is restricted to full-time wage earners(employee) aged between 15 -65.

Figure 4: Share of Workers based on Education

(a) Men



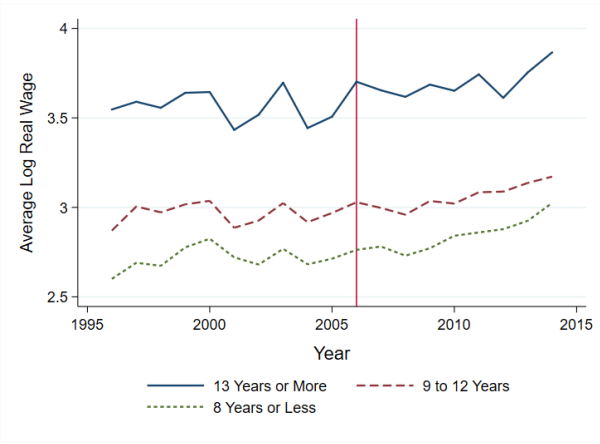
(b) Women



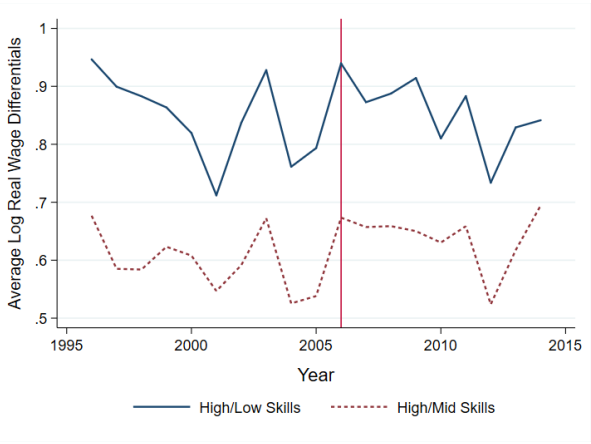
Notes: Figure 4 shows the share of workers in the labor force based on education from 1996 to 2014. The sample includes all full-time workers aged between 15 -65. Three educational categories are based on years of schooling; 8 years or less, 9 to 12 years, and 12 years or more. Each group is identified as Low, Mid, and High skill group. Panel A represents men. Panel B represents women.

Figure 5: Mean Log Hourly Real Wages based on Education - Men

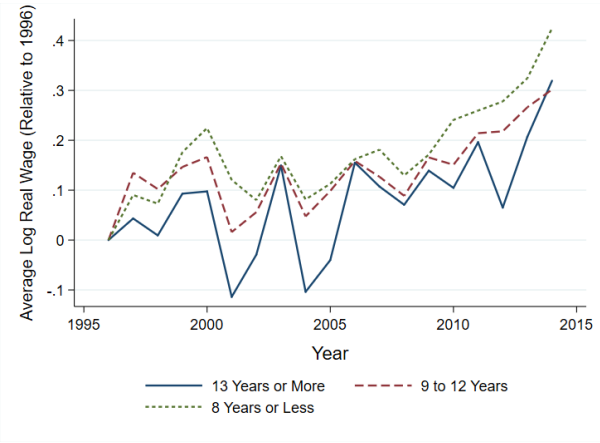
(a) Mean Log Hourly Real Wages



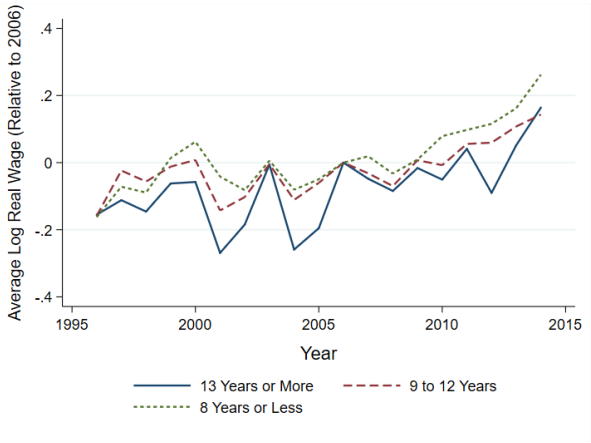
(b) Educational Wage Differential



(c) Normalized to 1996



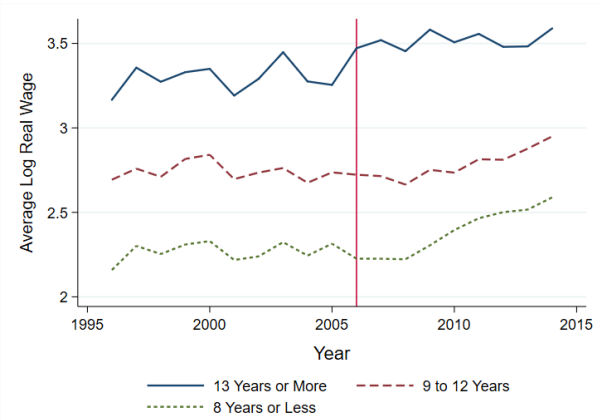
(d) Normalized to 2006



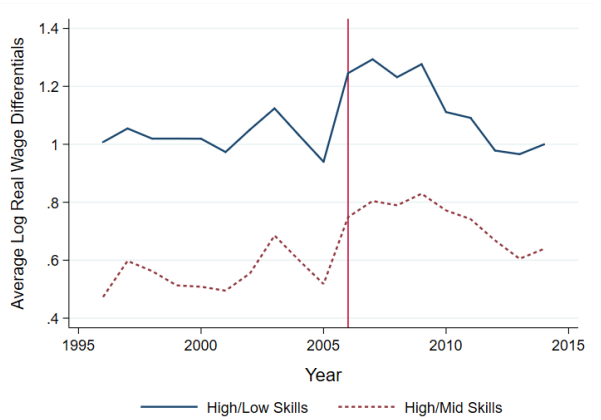
Notes: Figure 5 shows the mean log hourly real wages of men based on three educational categories from 1996 to 2014. The sample includes all full-time wage earners(employee) aged between 15 -65. Three educational categories are based on years of schooling; 8 years or less, 9 to 12 years, and 12 years or more. Each group is identified as Low, Mid, and High skill group. Panel A of the figures shows the mean log hourly real wage for three educational groups. Panel B shows the log wage differentials for High to Low skills and High to Mid skills. Panel C and Panel D shows the mean log hourly real wages normalized to 1996 and 2006.

Figure 6: Mean Log Hourly Real Wages based on Education - Women

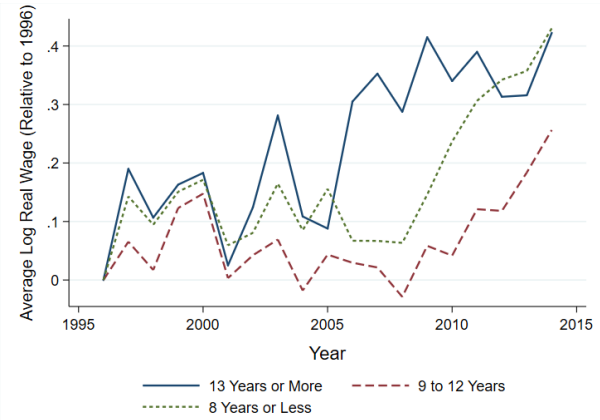
(a) Mean Log Hourly Wages



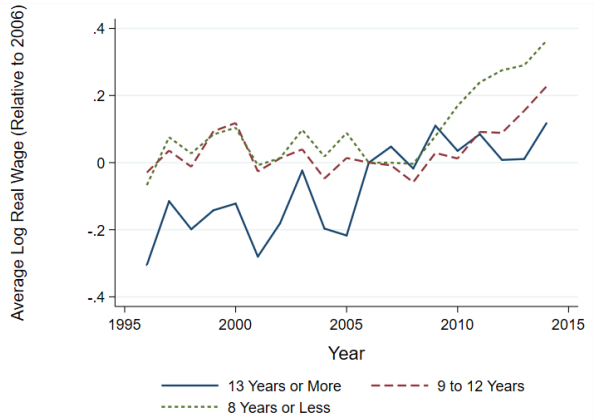
(b) Educational Wage Differential



(c) Normalized to 1996



(d) Normalized to 2006



Notes: Figure 6 shows the mean log hourly real wages of women based on three educational categories from 1996 to 2014. The sample includes all full-time wage earners(employee) aged between 15 -65. Three educational categories are based on years of schooling; 8 years or less, 9 to 12 years, and 12 years or more. Each group is identified as Low, Mid, and High skill group. Panel A of the figures shows the mean log hourly real wage for three educational groups. Panel B shows the log wage differentials for High to Low skills and High to Mid skills. Panel C and Panel D shows the mean log hourly real wages normalized to 1996 and 2006.

Table 1: Changes in Log Real Wages, 1996-2014

Group	Change in Log Real Wages * 100				
	1996 - 2001	**2001-2006**	**2006-2010**	**2010 - 2014**	**1996 -2014**
All	4.32	11.49	-.56	14.93	30.18
Panel A: Gender					
male	4.52	11.66	-.36	15.08	30.9
female	3.81	11.07	-1.08	14.54	28.34
Panel B: Education (Years of schooling) - Men					
8 or less	6.79	9.21	3.51	20.59	40.1
9 to 12	3.81	10.51	-.81	13.68	27.19
13 or more	3.24	16.73	-4	10.87	26.85
Panel C: Education (Years of schooling) - Women					
8 or less	3.43	2.67	14.76	18.84	39.71
9 to 12	.85	1.07	-2.75	17.2	16.37
13 or more	6.8	23.07	-7	10.15	33.02
Panel D: Experience (Men & Women)					
0 to 5	5.52	3.05	9.28	19.29	37.14
6 to 10	.89	13.5	.42	18.36	33.18
11 to 15	7.94	9.45	-3.09	19.09	33.4
16 to 20	5.67	12.71	-3.03	14.58	29.93
21 to 25	.25	12.21	1.64	7.06	21.16
26 to 30	5.82	14.96	-6.01	16.47	31.23
30+	8	12.74	-1.79	12.52	31.47
Panel E: Education & Experience (Men)					
8 or less years of schooling					
6 to 10	6.13	6.63	7.21	21.4	41.37
30+	8.6	8.2	11.52	14.99	43.32
9 to 12 years of schooling					
6 to 10	3.45	9.68	2.15	16.07	31.36
30+	.31	22.9	-7.07	8.41	24.56
13 or more years of schooling					
6 to 10	-6.59	18.88	2.87	9.95	25.11
30+	23.65	11.34	-14.55	10.35	30.79

Notes: Table 1 shows the changes in log real wages for different demographic groups. The sample is restricted to full-time wage earners aged between 15 -65. For each sex-education-experience group (cell) mean average real wage is calculated for each year (3 education groups, 7 experience groups, and male/female). The average wage for each broader group above is calculated using the weighted average of each cell of each group for each year, where the weight is average employment share of each cell over the 1996 - 2014 period. Education is measured in the number of years of schooling. Experience is measured by subtracting age when completing the highest education from age in the current year. Each panel shows the changes in wages for the stated broader group.

Table 2: Changes in Log Supply of Labor, 1996-2014

Group	Change in Supply of Labor * 100				
	1996 - 2001	**2001-2006**	**2006-2010**	**2010 - 2014**	**1996 -2014**
All	-6.41	.04	-3.48	-4.22	-14.06
Panel A: Gender					
male	-7.96	-2.92	-2.12	-6.46	-19.46
female	-2.53	6.86	-6.53	.74	-1.46
Panel B: Education (Years of schooling) - Men					
8 or less	-24.86	-9.73	-12.9	-21.28	-68.76
9 to 12	-.6	2.98	3.44	-1.42	4.41
13 or more	34.6	-3.89	6.57	7.9	45.18
Panel C: Education (Years of schooling) - Women					
8 or less	-26.71	3.12	-14.92	-22.82	-61.33
9 to 12	8.24	16.83	-7.57	7.13	24.63
13 or more	36.93	-7.37	11.43	19.65	60.65
Panel D: Experience (Men & Women)					
0 to 5	-15.68	-8.39	-25.27	-15.84	-65.19
6 to 10	-10.18	-6.13	-20.03	-21.74	-58.08
11 to 15	-17.46	-6.64	-5.29	-11.16	-40.55
16 to 20	-12.41	-8.92	-4.57	6.02	-19.89
21 to 25	-6.14	-4.74	-3.76	-3.74	-18.38
26 to 30	-6.92	2.05	-2.75	.62	-7
30+	8.97	3.8	9.83	-8.81	13.8
Panel E: Education & Experience (Men)					
8 or less years of schooling					
6 to 10	-42.91	-22.35	-58.82	-59.84	-183.92
30+	-16.56	2.52	5.66	-32.22	-40.59
9 to 12 years of schooling					
6 to 10	2.37	.02	-20.6	-23.86	-42.07
30+	17.16	-3.46	14.09	6.32	34.11
13 or more years of schooling					
6 to 10	21.12	-4.11	17.04	-11.94	22.11
30+	67.13	-3.89	14.07	2.57	79.88

Notes: Table 2 shows the changes in the log supply of labor for different demographic groups. The sample includes all workers aged above 15 and all who reported that they engage in economic activity and usual hours of work. (full/part-time; employees, own-account workers, unpaid family workers). There are 3 education groups, 7 experience groups, and gender groups. Supply is measured in terms of usual hours of labor supply by each person in a week and assuming all workers work 52 weeks a year. The average wage for each broader group above is calculated by multiplying the total supply of labor in each cell by corresponding weights (Details are presented in Section 5.2). Education is measured in the number of years of schooling. Experience is measured by subtracting age when completing the highest education from age in the current year. Each panel shows the changes in supply for the stated broader group.

Table 3: Relative Wage and Supply Changes (Men), 1996-2014

	1996 - 2006	2006-2014
Panel A: 13 years or more relative to 8 years or less of schooling		
Change in log wages	3.55	- 17.16
Change in log supply	65.33	48.65
Panel B: 13 years or more relative to 9 to 12 years of schooling		
Change in log wages	5.66	- 5.67
Change in log supply	28.32	12.45

Notes: Table 3 summarize the relative wage and supply changes for high skill men. Values represent relative percent change over the specified time period. The average wage for each broader group is calculated as weighted average where the weight is average employment share of each cell over the 1996 - 2014 period. Labor supply of each cell is presented in efficiency units, which are the total hours of work supplied in each cell weighted by the relative wages. Relative wages were calculated by deflating wage of each cell by the wage index. Panel A shows the high skill (i.e. 13 or more years of schooling) relative to the low skill (i.e. 8 years or less years of schooling). Panel B shows the high skill (i.e. 13 or more years of schooling) relative to the mid skill (i.e. 9 to 12 years of schooling).

Table 4: Relative Wage and Supply Changes (Women), 1996-2014

	1996 - 2006	2006-2014
Panel A: 13 years or more relative to 8 years or less of schooling		
Change in log wages	23.77	- 30.10
Change in log supply	53.15	38.98
Panel B: 13 years or more relative to 9 to 12 years of schooling		
Change in log wages	27.95	- 11.30
Change in log supply	4.79	31.52

Notes: Table 4 summarize the relative wage and supply changes for high skill women. Values represent relative percent change over the specified time period. The average wage for each broader group is calculated as weighted average where the weight is average employment share of each cell over the 1996 - 2014 period. Labor supply of each cell is presented in efficiency units, which are the total hours of work supplied in each cell weighted by the relative wages. Relative wages were calculated by deflating wage of each cell by the wage index. Panel A shows the high skill (i.e. 13 or more years of schooling) relative to the low skill (i.e. 8 years or less years of schooling). Panel B shows the high skill (i.e. 13 or more years of schooling) relative to the mid skill (i.e. 9 to 12 years of schooling).

Table 5: Inner Product of Changes in Relative Wages and Changes in Relative Supply

5 Year Centered Interval	1998	2002	2008
Panel A: Men			
Inner product of actual changes			
2002	-0.095		
2008	0.035	0.0135	
2012	-1.024	-0.515	-0.376
Panel B: Women			
Inner product of actual changes			
2002	0.0095		
2008	0.0673	-0.0383	
2012	-0.4191	-0.2958	-0.2013

Notes: Table 3 shows the inner product of changes in the relative wages and changes in relative supply of 48 demographic groups (2 gender, 3 education, and 7 experience). This follows the specification in Equation 2 to test the stable demand hypothesis.

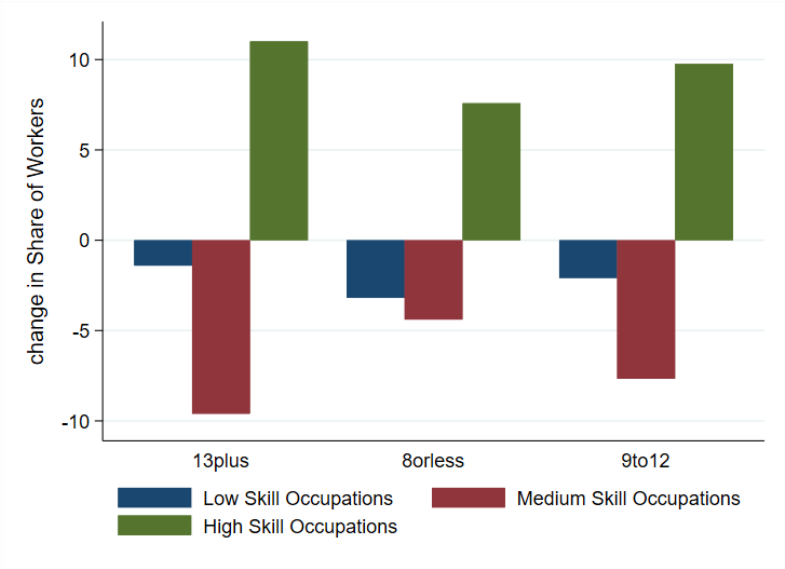
Table 6: Labor Share between Industries/Occupations (Overall), 2002-2014

	Labor Share Average Over Specified Period			
	2002-2006	2007-2010	2011-2014	Change from 2002-2006 to 2011-2014
Panel A: Industries				
Agri/Fishing/Mining	33.68	32.22	30.58	-3.11
Manufacture: Textile	7.58	7.28	7.40	-0.17
Manufacture: Non-textile	10.44	11.46	11.27	0.83
Utility/Transport/Comm.	5.80	6.31	6.60	1.22
Construction	5.40	9.78	10.32	1.97
Wholesale/Retail	12.68	13.10	13.33	0.65
Financial	1.31	1.59	1.87	0.56
Hotel/RealState/PersonalServ	3.46	3.32	4.65	1.19
Professional Service	1.35	1.50	1.38	0.03
Public Admin/Defense	7.37	6.85	7.45	0.08
Education/Health	5.20	5.72	5.59	0.39
Employed by Households	5.72	3.94	2.84	-2.87
Panel B: Occupations				
Professionals and Managers	18.92	19.33	17.48	-1.44
Asst. Professionals/ Administrative	21.28	21.66	25.77	4.48
Semi-skilled in Agriculture/Industry	33.37	34.46	34.16	0.79
Elementary Occupations	26.42	24.55	22.59	-3.83

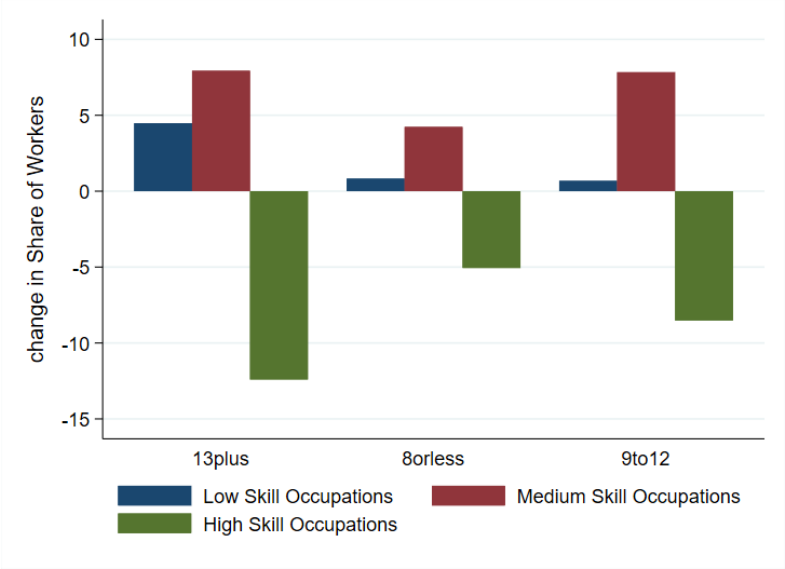
Notes: Table 6 shows the share of labor in each industry/occupation during the 2002-2014 period. Panel A presents the industry labor share. Panel B presents the occupational labor share. The sample includes all workers between age 15 and 65 who reported that engaged in economic activity in survey week and reported industry information. Years from 1996 to 2001 are omitted due to the inconsistency and the unavailability of industry/occupation codes. Industries were re-categorized based on the original ISIC coding system. The first three columns represent the average labor share in each industry over the given period in the column. The last column provides the change from the second column to the fourth column.

Figure 7: Changes in Occupational Labor Share - Men

(a) 1996-2006



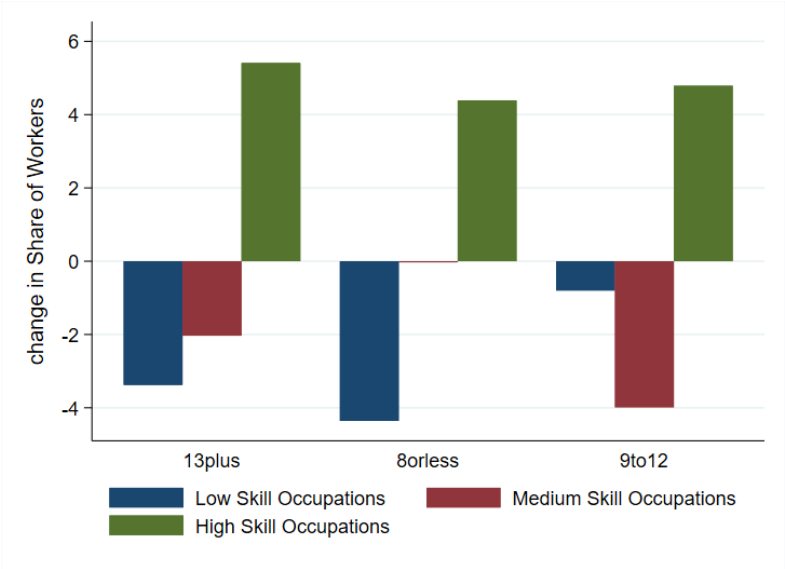
(b) 2006-2014



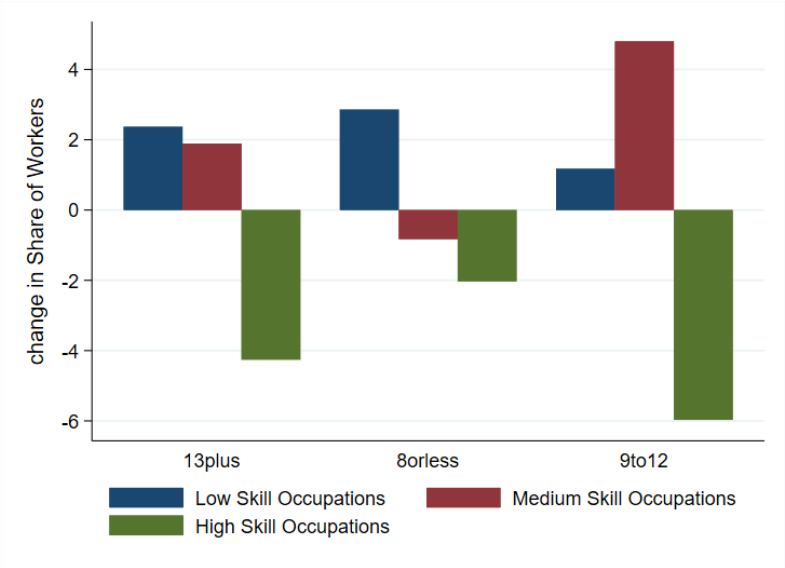
Notes: Figure 7 shows the share of workers (Men) with three educational levels in three occupational categories created based on skill levels. The vertical axis shows the change of labor share between respective years. The horizontal axis shows the three education groups. The sample includes all full-time workers aged between 15 -65. Three educational categories are based on years of schooling; 8 years or less, 9 to 12 years, and 12 years or more. Panel A represents the changes between 1996 and 2006. Panel B represents the changes between 2006 and 2016. The occupational skill categories are as follows. High Skill: Legislators, Senior Officials, Managers, Professional, Technical, Associate Professionals. Mid Skill: Clerks, Service Workers, and Shop and Market Sales Service Workers, Plant and Machinery Operates and Assemblers. Low Skill: Elementary Workers, Skilled Agricultural and Fishery Workers, Craft and related workers, and Armed Services (International Labour Office, 2012).

Figure 8: Changes in Occupational Labor Share - Women

(a) 1996-2006



(b) 2006-2014



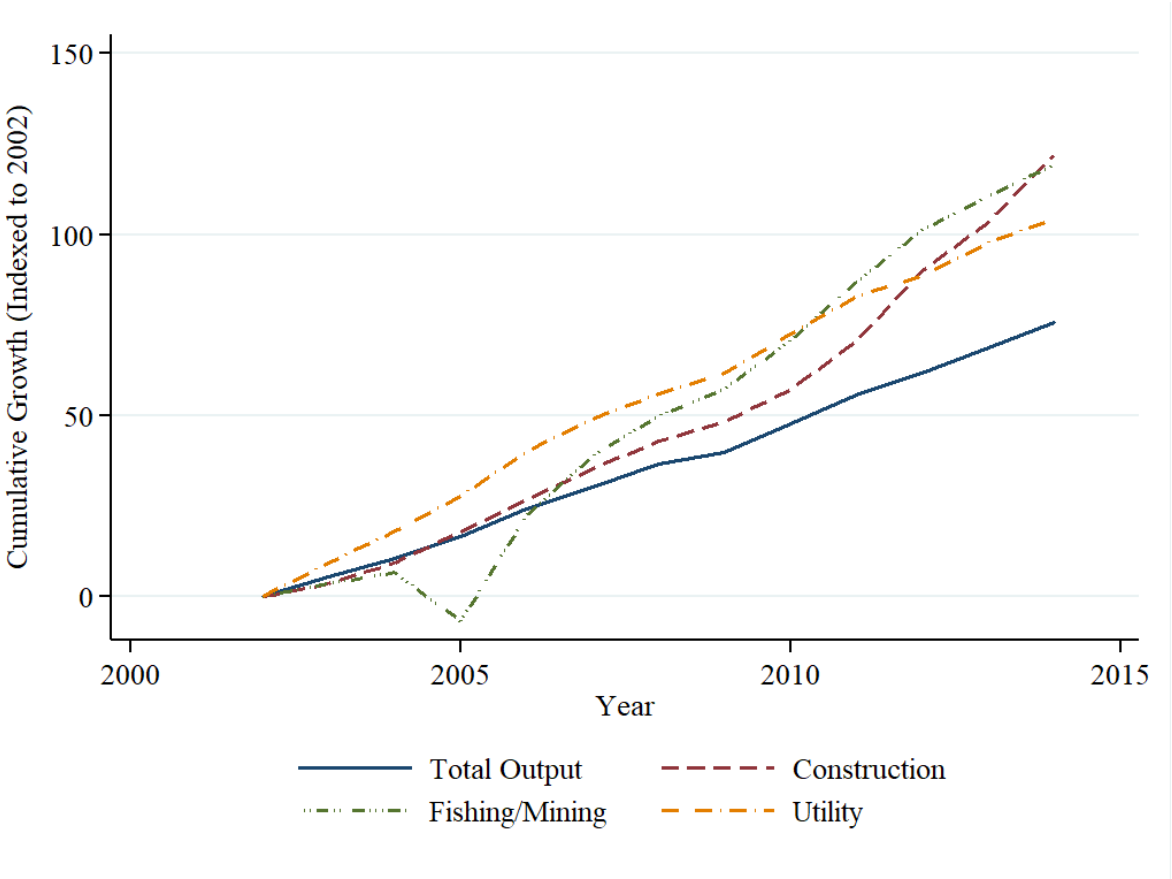
Notes: Figure 8 shows the share of workers (Women) with three educational levels in three occupational categories created based on skill levels. The vertical axis shows the change of labor share between respective years. The horizontal axis shows the three education groups. The sample includes all full-time workers aged between 15 -65. Three educational categories are based on years of schooling; 8 years or less, 9 to 12 years, and 12 years or more. Panel A represents the changes between 1996 and 2006. Panel B represents the changes between 2006 and 2016. The occupational skill categories are as follows. High Skill: Legislators, Senior Officials, Managers, Professional, Technical, Associate Professionals. Mid Skill: Clerks, Service Workers, and Shop and Market Sales Service Workers, Plant and Machinery Operates and Assemblers. Low Skill: Elementary Workers, Skilled Agricultural and Fishery Workers, Craft and related workers, and Armed Services (International Labour Office, 2012).

Table 7: Shifts in Demand: 2002-2014

	Change in Log Relative Demand								
	Between Industry			Within Industry (Occupation)			Overall (Industry & Occupation)		
Years of Schooling	2002-06	2006-14	2002-14	2002-06	2006-14	2002-14	2002-06	2006-14	2002-14
Panel A: Men									
8 or less years	-0.17	-9.34	-9.53	-1.87	4.09	2.14	-2.04	-5.25	-7.40
9 to 12 years	3.43	-2.07	1.43	-0.47	2.03	1.49	2.96	-0.04	2.92
13 or more years	-0.51	3.18	2.69	1.68	-1.99	-0.34	1.17	1.19	2.35
Panel A: Women									
8 or less years	-5.31	-13.16	-19.24	2.85	1.46	4.77	-2.46	-11.70	-14.47
9 to 12 years	0.22	-5.45	-5.22	0.08	3.76	3.83	0.30	-1.69	-1.39
13 or more years	-2.25	2.94	0.76	-0.13	5.16	5.15	-2.38	8.10	5.91

Notes: Table 7 shows the demand shifts for different skill groups. Panel A and Panel B show results for men and women. Three columns show the between-industry, within-industry, and overall demand shifts. Demand shift measure for group k (gender-education) is calculated by $\Delta D_k = \Sigma_j \alpha_{jk} (\Delta E_j / E_k)$. Where α_{jk} is the average employment share of group k in sector j over the 2002-2014 period, E_j is share of employment in sector j, and E_k is average employment share of group k over 2002 - 2014 period. Sector j is 33 2-digit industries in "between industry" measure. And Sector j is 132 industry-occupation cells in "overall change" measure. Within industry change is obtained by subtracting Between industry measure from Overall measure. The sample includes all economically active people between ages 15 and 65.

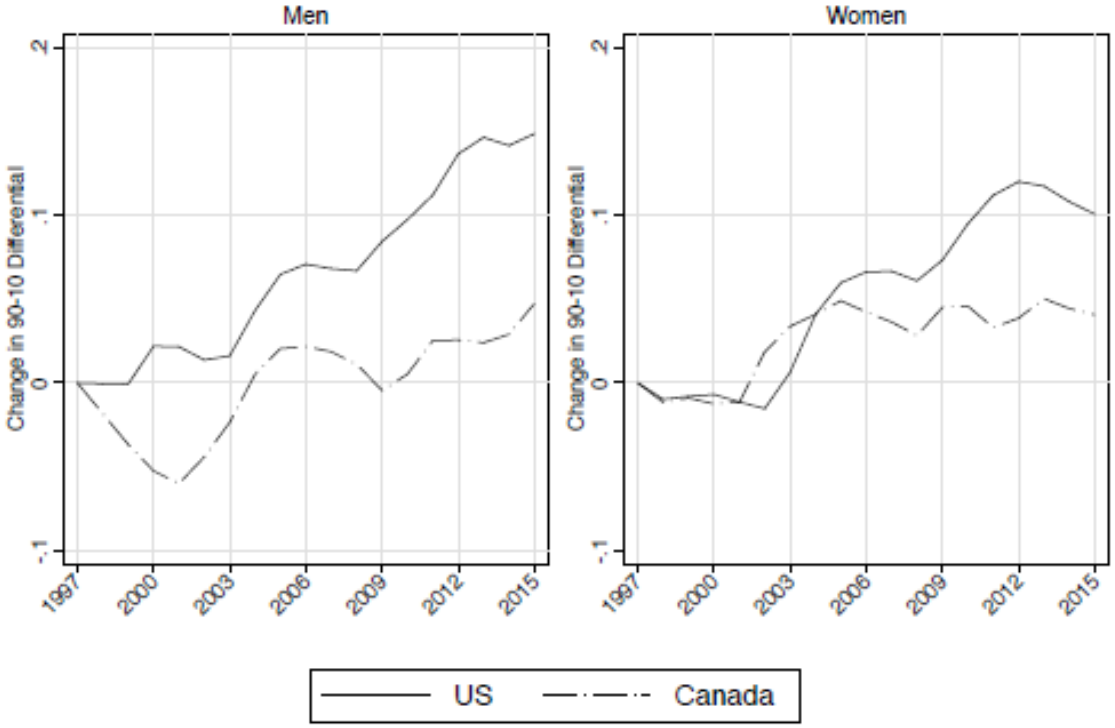
Figure 9: Highest Growing Industries in Sri Lanka (2002-2015)



Notes: Table 9 shows the three highest growing industries in Sri Lanka during the 2002-2014 period. The vertical axis shows the cumulative growth of each industry normalized to 2002. Source: Economic and Social Statistics of Sri Lanka, 2002-2014 (Central Bank of Sri Lanka, 2002-2014).

Appendix 2.1: Wage Differentials (USA/Canada)

Figure 10: Log 90-10 Hourly Wage Differentials (USA/Canada)



Notes: Source: Green et al. (2019). The figure shows the log differentials of between 90\{}ts{th} and 10\{}ts{th} percentile of mean log hourly real wages from 1997 to 2015 for Canada and the USA. Wages are normalized at 1997.

Appendix 2.2: Framework for Supply of Labor

Consider factor demands as a function of factor prices (W) and variables(Z) that contribute to the shifts in demand. Z represents the non-labor demand shifters such as changes in technology, product demand, etc. When X is a vector of labor inputs, we can write the factor demand as follows.

$$X_t = D(W_t, Z_t) \tag{11}$$

X_t = Labor input employed in the market in year t (Kx1 vector)
W_t = Market prices of labor inputs in year t (Kx1 vector)
Z_t = Demand shift variables in year t (mx1 vector)

In terms of differential factor demands can be written as,

$$dX_t = D_w dW_t + D_z \, dZ_t \tag{12}$$

When the aggregate production function is concave, cross-price on factor demands, D_ω, take the negative semidefinite form. This implies,

$$dW_t' \, (dX_t - D_z \, dZ_t) = dW_t' \, D_w \, dW_t \leq 0 \tag{13}$$

Equation 13 suggests that changes in factor supplies adjusted to the demand shifts should negatively covary with changes in wages. The discrete version of Equation is as follows.

$$(W_t - W_\tau)' \Big[(X_t - X_\tau) - \big(D(W_t, Z_t) - D(W_\tau, Z_\tau) \big) \Big] \leq 0 \tag{14}$$

Murphy et al. (1992) argue that if the stable factor demand hypothesis holds, i.e. there are no demand shifts affecting labor demand, then the changes in wages should arise from changes

in the supply of labor. These changes could be arising from demographic characteristics of labor supply, such as education. Within the above framework, stable factor demand suggest Z_t fixed, and therefore Equation 13 becomes,

$$dW_t' \, dX_t \leq 0 \tag{15}$$

Discrete version of Equation for years from t to τ can be written as,

$$(W_t - W_\tau)' \, (X_t - X_\tau) \leq 0 \tag{16}$$

This provides an empirical strategy to evaluate the changes in wages arising from supply shifts absence of demand shifts. If the negativity holds for any period, it suggests that changes are potentially explained by the changes in supply. However, the sign of Equation 16 is positive, then it suggests that supply alone does not explain the changes in wages.

Appendix 2.3: Framework for Demand Index

Here, I summarize the derivation of Equation 3, following Murphy et al. (1992). Consider an economy with j sectors and K labor inputs with a constant return to scale production across all sectors. Factor demand in sector j can be written as,

$$X_j = C_\omega^j(W) \, Y_j \tag{17}$$

Where Y_j is the output of sector j, and $C_\omega^j(W)$ is the vector of unit factor demand curves. Equation 17 can be written in terms of differentials assuming within sector demand is stable.

$$dX_j = C_\omega^j(W) \, dY_j + Y_j \, C_{\omega\omega}^j(W) \, dW \tag{18}$$

Equation 18 can be further simplified by using the fact that unit factor demands are homo-

geneous of degree zero in factor prices and multiplying both sides by W,

$$W' \, dX_j = W' \, X_j (dY_j / Y_j) \tag{19}$$

$$\frac{dY_j}{Y_j} = \frac{W' \, dX_j}{W' \, X_j} \tag{20}$$

Aggregating equation 18 over j sectors and substituting equation 20 gives,

$$dX = \Sigma_j X_j \frac{dY_j}{Y_j} + C_{\omega\omega} \, dW = \Sigma_j X_j \, \frac{W' dX_j}{W' X_j} + C_{\omega\omega} \, dW \tag{21}$$

Now, equation 21 can be written in the form of equation 13.

$$dW' \left(dX - \Sigma_j X_j \, \frac{W' dX_j}{W' X_j} \right) = dW' \, C_{\omega\omega} \, dW \leq 0 \tag{22}$$

Comparing to the equation 13 format demand shifts (dZ_t) can be obtained as,

$$\Delta D = \Sigma_j X_j \, \frac{W' dX_j}{W' X_j} \tag{23}$$

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