Long-Term Changes in the Wage Structure of Taiwan
(Very Preliminary)

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May 30, 2012

Abstract

We document long-run changes in the wage structure of Taiwan using data from Manpower Surveys 1978-2010. We have four findings: (1) The average hourly wage of Taiwan has been growing steadily since 1978 but started stagnating around 1994 for men and 2002 for women. This leads to a secular convergence in the gender wage gap during the late 1990s. The gender convergence is particularly rapid for the upper tail of the distribution. (2) Contrary to the polarization of the U.S./U.K. with the top quintile growing and the bottom quintile falling while the median stagnating, Taiwanese version of polarization exhibits an upward trend for the bottom quintile, accompanying

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with an early slowdown for both the median and the top quintile. (3) The wage gap between high school and college-trained workers are narrowing. We see a swift convergence in educational wage differentials between academic and vocational educations. (4) Education premiums show no upward trends at all educational levels, except for post-secondary education. Wage premium for a post-graduate degrees was historically lower than that for a university degree, but this trends began to reverse and has been widening rapidly since 2005.

1 Introduction

In 2011 Taiwan has the world's lowest birth rates, falling below one baby per woman. The country has been experiencing a rapid decrease in family size since 1970s, even with no governmental enforcement of birth control such as China's One Child policy. Family composition in Taiwan was used to be dominated by extended families mostly with at least two children but not any more. With the great fertility drop and the rapid transition of family composition, family members are now typically much fewer and older.

This drastic transition in family composition has significant implications for income inequality over time and across cohorts (see, e.g., Fei, Ranis and Kuo 1979). Deaton and Paxson (1994) have noted that within-cohort inequality of household income rise with age in Taiwan, in addition to those in U.S. and Great Britan. Consistent with this, Chu and Jiang (1997) suggested that family income inequality in Taiwan at least until the mid 1990s was driven largely by the shift in age-specific composition of family members over years and across cohorts. No wonder Kuznets (1989, p230) said "it makes little sense to talk about inequality in the distribution of income among families or households when the sizes of the underlying units have significant variation." Some studies attempt to resolve this by controlling for endogenous family size, but fertility is an individual choice, which truncates the wage distribution and leads to an understatement of residual wage inequality (Heckman and Honore 1990). To isolate wage inequality from the variation in family composition, contemporary analysis on income equality focuses primarily on individual earnings, rarely using family as a unit of income measurement. See Katz and Autor (1999) and Acemoglu (2002) for

literature reviews.

Two of the most pressing economic issues in Taiwan today are wage stagnation and rising inequality. Pay and salaries have been lagging in recent decades (prior to the recent financial crisis) but little systematic evidence showed how and when the stagnation started in Taiwan. The widening wage inequality is a far more serious problem because of the coincidence. In this paper we summarize the trends in wage gaps between genders and across education levels in the past three decades. We also review the recent literature as a starting point of our investigation.

The rest of this paper is organized as follows. Section 2 introduces the Manpower Surveys and key variable definitions. Section 3 uncovers the problems of the wage stagnation for workers at various parts of the wage distribution. Section 4 discusses the recent decrease in gender wage differentials. Section 5 shows a pattern of polarization that arises in the mid 1990s, with diverging trends in the upper and lower -tails of wage inequalities. Section 6 reports the time series of educational wage differentials in the past three decades, and Section 7 concludes. At the end of each section, we briefly summarize related literatures.

2 Data

Our analysis begins with plotting time series of wage variables using the Manpower Survey 1978-2010, which is a 2.6 percent of random sample of all households and group quarters by town and city, excluding military and correctional institutions. The survey started in 1962 but only after 1978 it

was digitalized with an improved sampling frame. It contains information about individual civilian earnings, education, employment, demographics, and hours of work of individuals at the age of 15 to 64. We include 848,363 full-time employees (at least 35 hours in the previous week of the survey day) in both public and private sectors, who had positive earnings and were 15 to 64 years old. Earnings are deflated by the Consumer Price Index, measured against the 2000 base year, so the wage levels in this paper are all in real terms.

We exclude individuals whose monthly wage is lower than half of the minimum wage or greater than the hourly wage of the top-coded given 35 hours of work a week. In our sample 428 individuals are top-coded. For sample selection we closely follow the Autor, Katz and Kearney (2006, 2008) study. We have also experimented Chen and Hsu's (2001) sample selection rules, which exclude workers in public sectors or in agriculture, forestry, and fishing industry sectors. We find the overall trends in these two selected samples are similar although the contrast between upper- versus lower-tail wage inequalities (see the discussion below) which appears in the Autor, Katz and Kearney (2006) study would be less evident in Chen and Hsu's sample.

In this paper we study the trends in log hourly wages, instead of log monthly wages, in order to focus on changes in the wage distribution, putting aside the issues on changes in employment and work hours. We document the structural changes in the wage structure by gender or by education. The education system of Taiwan separates two paths starting at grade 7: one path preparing pupils for vocational education, and the other for university education. As a result, the number of years of education in one path is

typically not equivalent to that in the other. Researchers wishing to use "the number of years of education" or "the highest grade completed" must impose various formulas to create a continuous education variable using the observed categorical variables.

As the imposed number of years of education might be misleading, we adopt self-reported education levels which include the following categories: (1) less than middle school, (2) middle school education, (3) vocational high school education, (4) general high school, (5) vocational college, and (6) university. For respondents in the post-2007 surveys, we add one additional category - postgraduate education because questionnaires of those year add the information about post-graduate education.

It's noteworthy that a large portion of respondents in our sample have less education than middle school, although middle school education has become part of compulsory education since 1968. A possible explanation is that the school entry laws were not strictly enforced. In addition, for respondents prior to 2007 we cannot distinguish drop-outs from graduates since education completion information was not in the questionnaire.

3 Recent Stagnation of Wage Growth

After enjoying decades of a steady growth in real hourly wages, the upward trend has been slowly waning. Although log hourly wages grew together for all parts of the wage distribution between 1978 and 1996, the upward trend for the 90th percentile ended in 2000, about five years sooner than that for the lower percentiles. Since the mid 1990s, there has been almost no change

in median log hourly wage for full-time workers, because nominal wage rose at far below the level of inflation. The real wages at the top percentile even showed a slight decline between 2003 and 2008. These results can be seen in Figure 1a, which echoes recent studies by, e.g., Huang (2011).

A stagnation in median wage growth in the U.S. between around 1973 and mid-1990s has been intensively documented, by, e.g., Katz and Autor (1999) and Acemoglu (2002). Guvenen and Kuruscu (2007, 2010) provided several potential explanations for the phenomenon of the wage stagnation: (i) the slowdown in the productivity growth of labor supply, (ii) the increased investment in job training which reduces productivity because the work time is crowded out by increased time spent in on-job learning, and (iii) the changes in educational composition effects on the labor force, with high ability workers choosing to enter university instead of the labor market. In addition, Acemoglu (2002) pointed out the importance of international trade and migration in explaining the changes in wage inequality. In future studies we will investigate the role of these potential factors using Taiwanese data.

4 Narrowing Gender Gaps

The gender wage gap has been falling since the mid 1990s, although the narrowing trend appears to be associated with a delayed stagnation of women's wage compared to men's. As Figure 1b shows, compared to their male counterparts, female full-time workers saw a relatively greater growth in log hourly wage during the 1990s and a slowdown of wage growth came at least five years later. While male full-time workers' log hourly wage started stagnating

around mid-1990s and even falling after 2003, female workers' wage growth continued until around 2003.

Combination of the delayed stagnation of female wages and the recent fall in male wages, the gender wage gap is seemingly falling at all parts of the wage distribution. As Figure 1c shows, the gender wage difference, based on median hourly wage for full-time workers, drops rapidly to 20 percent in 2010 from about 45 percent in 1990. The decreasing rate of the median of the gender wage gap is much higher than that at the top and bottom percentiles during the same period. In particular, the gender gap, based on the 90th (10th) percentile, decreases to 20 percent from 30 (40) percent.

Fernandez and Wong (2011) recently uncover a narrowing and eventually disappearing of the gender wage gap in the U.S. by comparing the 1935 and 1955 cohorts . They suggest that this phenomenon is associated closely with the convergence, or even a reversal, of gender gaps in education. We plan to investigate similar issues for the case of Taiwan, which the converging gender differences in educational achievement appears during the mid 1990s .

5 Polarization of the Wage Distribution

Since the mid 1990s Taiwan has exhibited a pattern of wage polarization, with widening gaps between median and the highest wage but narrowing between median and the lowest wage. An extreme and persistent polarization has long been a norm among female workers prior to 1978. In contrast, wage polarization among male workers just began in the mid-1990s, with relatively small but fast growing gaps.

Figure 2a shows the evolution of the upper and lower-tail wage inequalities for both men and women, measured by 90-50 and 50-10 log hourly wage differentials. The trends in upper-half and lower-half inequality exhibits a divergence in wage inequality in 1997, with the upper-half wage gaps dipped first and rose later, while the lower-half wage gaps exhibits a downward trend that last at least four decades. The upper-half inequality is now more than 20 percentage points greater than the lower-half inequality, although the gap was less than 5 percentage points between 1980 and 1997.

The recent rises in polarization of wages is a purely a male phenomenon, not female. Women also see polarization but it has occurred at least since 1978. Figures 2a-2c display male and female upper-half and lower-half wage inequality respectively. We find the trend in male wage inequality in both upper-half and lower-half is similar with overall wage inequality, and the divergence trend of upper-half and lower-half occurs in female wage inequality over the entire period. Unlike men's 90-50 and 50-10 inequality measures closely overlapped during the late 1980s and most of the 1990s, as Figures 2b shows, women's inequality measures have exhibit a serious polarization as early as in 1978. The pattern of polarization for female workers is much more serious and persist. The phenomena of polarization in the labor market has appeared in U.K. (see, e.g., Goos and Manning) and in U.S. (see, e.g., Autor, Katz and Kearney 2006). But few studies investigate such a big difference in polarization between genders. We plan to come back to this issue later.

Contrary to the earlier study by Fei et al. (1979) that documented a stable long-term growth in family income inequality since 1980 (measured by Gini coefficients), here we find substantial volatilities or even divergence in

upper-half (90-50) and lower-half (50-10) wage inequality from 1978-1997.

6 Inequality Between/Within Educational Groups

6.1 Divergence in Educational Premiums

The rest of the figures lay out the trend in the wage distribution by education levels over the past three decades. We plot the time series of educational wage premiums and compare the premiums in the academic education track to those in the vocational education track.

Figure 3a illustrates that the time series of wage premiums for higher education, defined by the difference in log hourly wage between higher education (including postgraduate and pooling both academic and vocational tracks) versus high school. We see a striking divergence in higher education premiums at the bottom and the top percentiles. The higher education premium at the *10th percentile* drops dramatically during the past a quarter century, from at least 40 percent in the 1980s to less than one half in 2010. The median of the education premium also drops though at a slower rate, from 48 percent to 29 percent during the same period. In contrast, the premiums at the 90th percentile exhibits fluctuates within the range between 30 to 40 percent.

Possible factors that may be contributed to the divergence in higher education premium between top and bottom percentiles are an increase in wage inequality either among workers with higher education or among those who are less educated. As figure 3d shows, it is the recent increase in wage inequality among workers who have a higher education that is the driver for the

divergence. In contrast, figure 3c shows that the degree of wage inequality among those who are only at the high school level is falling, not increasing. These changes in the degree wage inequality can be caused by changes in the degree of heterogeneity or the degree of wage uncertainty (see e.g. Chen 2008). We will investigate further this in future research.

At the bottom parts of figures 3c and 3d, we see a clear and large divergence of the upper- and lower-half of wage inequality starts in 2004 among workers with higher education or less. Irrespective of having higher education or not, the difference in 90-50 and 50-10 inequality measures overlaps in 2004. After that, the gap in inequality between the upper and lower half distribution of log hourly wage starts to rise. In particular, it rises to more than 10 percentage points in 2010 for the high school group and 8 percentage points for those with college education or more.

6.2 Academic versus Vocational Education Premiums

Figures 4a-4c and figure 4d-4f make a parallel comparison in high school versus college educational premiums between academic and vocational tracks, at the various percentiles. Several findings stand out: (1) Educational premiums in the academic track, either at the high school or college level, have been always dominate those in the vocational track. (2) The high school wage premiums typically are much smaller than the college wage premium. (3) Since around 2003 the difference in college premiums between academic and vocational tracks started decreasing rapidly, particularly for workers whose educational premium at the median or bottom percentile. In particular, for the bottom 10th percentile, the college wage premium for the academic track

drops nearly to the level for the vocational track.

At the end of 1990s Taiwan had a largest scale of expansion in higher education. Many polytechnic or vocational schools were relabelled as academic universities, pushing the relative supply of skilled labor to historically the highest within just few years. On the other hand, the demand for skilled and unskilled labor has been shifted by different forces, including changes in policies about international trade and migration. In the future work we will examine the role of the education reform and evaluate the effect of those policy changes on the labor markets.

6.3 The Increasing Premium of a Postgraduate Education

Next we consider the evolution of the postgraduate and college wage premium plotted in figures 5. Workers with some postgraduate education saw a substantial decrease in wage premium of the advanced degree at all percentiles from 1988 to 1995. But the trends in the postgraduate and college wage premiums converged after 2005, with the former continued to rise steadily and the latter continue to fall. Since 2005, the trends in the relative wage premium have been diverging.

The wage difference between postgraduate and college increases probably due to three reasons. First, the technological change has driven rapid secular growth in the relative demand for more-educated and more- specialized workers. Now the skills that the job market needs is not just to learn how to operate the machine, but more importantly, is to develop a more professional technologies which are difficult to be replaced. Most colleges

have been unable to provide such resources to develop such capabilities for students. Second, given the higher education expansions implemented in the late 1990s, growth in college educational attainment has substantially increased and hence leads to an increasing wage premiums. Third, there are more and more Taiwanese businessmen to set up factories in mainland China especially in manufacturing, which may lead to an increase in unemployment of less-skilled workers.

7 Conclusions

The new evident trends in Taiwan wage structure during the past 33 years are stagnation and polarization. The less-educated full-time male workers at the bottom percentile of the wage distribution experience the stagnation the earliest. The greater wage growth and the delayed arrival of the stagnation help reduce the gender wage gaps in log hourly wage. The key fact about female wage inequality is the considerably larger gap between the median and the top percentile, coupled with an enduring contraction in the bottom part of the wage distribution. Educational premiums at the bottom half of the premium distribution have been falling, the gap in educational premiums between academic and vocational tracks is narrowing and disappearing. We see an upward trend in the inequality within the higher education group although it's slowing down in the past few years. In contrast, the inequality within the high school group is falling. The rises in the upper-tail inequality rises in the wage distribution of the overall sample, as well as within education groups. Finally, we see the upward surge of the wage premium of postgraduate edu-

cation since 1995, coupled with declining college wage premiums particularly for the bottom part of the distribution. The wage premium of a postgraduate degree has been exceeding that of a college degree. Plausible explanations for these phenomenon need more systematic studies.

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