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Dynamics of wage inequality during the pro-long economic transformation: The case of Vietnam

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Abstract

Using the RIF-decomposition to explore changes in wage inequality during the economic transformation in Vietnam, we find that real wages increased substantially during the period 1998-2010, but wage growth slowed down in the following period 2010-2020. Wage inequality increased in the former period, but declined considerably in the later one. Overall changes in wage inequality over the former period was mainly contributed by changes in labor market, job and workers' observed characteristics, but in the later period the change was mainly contributed by the changes in returns to job and workers' observed characteristics (wage structure effect). The economic structure change and increased supply of higher educated workforce have substantially contributed to the changing wage inequality over the past two decades. A rapid increase in supply of higher educated workers in the later stage of economic transformation has resulted in declining returns to education and thus has contributed to a decline in wage inequality.

Keywords: Economic transformation, skilled labour supply, wage inequality, RIF-decomposition

JEL codes: J22, J31, P21, P30, I26

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1. Background and literature

The transition from a command to a market economy during the past 30 years has brought great opportunities for economic growth and the development of the labor market in Vietnam. The launch of economic reform, initiated in 1986 and formalized in the early 1990s, gradually privatized state-owned enterprises and eased restrictions on private sector development and trade, and labor market. Opening up the economy to foreign investment and international trade has created great economic opportunities, and investment and trade become some of the main drivers of the economic growth miracle over the past three decades in Vietnam (World Bank, 2016).

The economic structure change has played a crucial role in the development of the labor market in Vietnam. According to the ILO report (ILO, 2020), in the early 2000s most Vietnamese workers worked in the agricultural sector, but after opening up to international trade in the mid-2000s, the employment share of the agriculture sector in total country's employment has substantially declined, from over 70% in the 2000s to less than 40% in 2018. Wage earnings were also observed to be improved significantly during the same period. Consequently, the economic reform and international trade spurred a higher demand for skilled labor in the manufacturing sector (ILO, 2020).

Industrialization and internal migration from rural to urban areas contributed to this fast changing employment structure, and resulted in a higher demand for skilled workers in large economic hubs in the Southeast and Red River regions. Wage-earning employment increased rapidly from 19% in 1998 to 29% in 2008 and 44% in 2018 (Doan et al., 2018; ILO, 2020). In addition, compared to most middle-income countries, Vietnam currently has a higher proportion of medium and high-skilled workers in wage-earning employment. More than half of Vietnam's employed workforce have medium skills, about 12% are highly skilled, but only 35% are low-skilled (ILO, 2020). Vietnam's relatively better workforce can be attributed to

higher educational achievement. This favorable employment structure affects (lowering) returns to education especially for higher education and wage inequality (Doan et al, 2018; McGuinness et al, 2021).

After the introduction of economic reform which allowed the market to set prices, changes in wage policies were introduced to adjust for the fast-rising cost of living. In September 1987, the Council of Ministers decided to increase the *basic* salary (Decision No. 147/HDBT) (see Table 1 in Nguyen, Pham & Nguyen, 2018 for further government decisions on basic minimum wages). Over the following two decades, the annual nominal basic wage (or minimum wage by regional wage scales) rose considerably (about 19%), but the wage growth has slowed down in recent years (less than 10%) due to stability in inflation at lower rates. Since 2004, the average growth rate of the minimum wage has been higher than both GDP growth and the inflation rate, resulting in positive real wage growth. Average real wages also increased rapidly during the period 2004-2017 (Nguyen et al., 2017). The wage policy reforms introduced in recent years have been aimed at simplifying complex wage scales and ensuring adequate income for workers and their families, and reducing the burden on the government budget (Nguyen, et al., 2018).

Unlike wage setting under the command economy, which wage differentials were kept at a minimum level, the economic reform, trade liberalization, economic growth and market-oriented wage setting in the 1990s and 2000s derived higher demand for skilled workers and hence higher wage premium for higher skilled workers, wage inequality was therefore expected to increase. However, the labour market intervention such as minimum wage policies may curtail the potential rise in wage inequality. For example, Liu (2003) looked at the gendered wage gap in Vietnam for the early stage of the economic reform in 1990s and found that the wage gap had changed little during the period. Gallup (2002) also looked at

wage inequality in the Vietnamese labor market in the 1990s found that the returns to education and growth in the returns were both very low during the period. The wage inequality was still low despite the rapid growth in wages during the period (Gallup, 2002). Furthermore, Sakellariou and Fang (2014) explored the Vietnamese labor market from 1998-2008 and found that wage inequality in fact declined in the private sector but not in the state-owned sector. They also observed a link between the minimum-wage policies and the lower wage inequality. Sakellariou and Fang (2010) showed that wage growth between 1998 and 2008, in Vietnam could be attributed to improved worker's characteristics (mainly education), and changes in the wage structure (mainly experience), and the change in the returns to experience (for women).

Unlike the 'big-bang' economic transition observed in the former Soviet economies, in Vietnam after the economic reform introduction the transformation was gradual and the state-owned sector was still dominant. This consequently affected the pace of labor market transformation and wage inequality. For example, using data from VHLSS 1993-2008, Phan and Coxhead (2013) investigated changes in the wage structure and wage premia and showed that state-owned enterprise workers earned higher salaries. They argued that inexistence of persistent capital market segmentation and the predominant economic activities of the state-owned sector depressed returns to skills in the non-state sector and crowded out more skill-intensive forms of private sector growth. They pointed to the high costs attributable to incomplete reform in Vietnam that slowed economic growth directly as a result of diminished allocative efficiency and reduced incentives to acquire education, and indirectly by higher wage inequality.

The existing literature on wage inequality shows that workforce age, education, skills, returns to education and returns to skills, the impact of market competition including labour

market competition, technical changes, economic structure or institutional changes, and factors mobility are key drivers of changes in wage inequality over time (Autor et al., 2006; Lee & Wie, 2015; Kijima, 2006; Pi & Zhang, 2018b; Arabage & Souza, 2019; Antonczyk, DeLeire, & Fitzenberger, 2010; Acemoglu & Autor, 2011; Autor et al., 2014, Lemieux, 2006, 2008).

Changes in wage inequality during *economic transformation* are mainly attributed to structural and institutional reforms (e.g., Pi & Fan, 2021). Privatization is a common phenomenon in transitional economies that enables the development of private business and free markets, thereby promoting competition between firms, sectors and industries for skilled labor (Pi & Zhang, 2018a; Tyrowicz & Smyk, 2019). Privatization would thus increase the wage gap. Additionally, changes in the supply of skilled labor leading to change in the returns to education was found to be among the main contributors to wage inequality in transitional economies (Appleton, Song & Xia, 2014; Laporšek et al., 2021; Mitra & Yemtsov, 2006; Milanovic, 1999). Changes in economic structure, economic transition to market economies, and higher competition for skilled labor have led to greater wage inequality in post-communist economies. For example, using data from Slovenia's early economic transformation (1987-1991), Orazem and Vodopivec (1995) found that wage inequality and employment increased for the most educated workers and decreased for the least educated, and the returns on education were found to increase during this early economic transition. Similarly, Newell (2001) showed that most Central and Eastern European (CEE) transitional economies experienced rising wage inequality during the initial stage of economic transition. Sectoral employment shift, inter-industry wage differentials, structural change, and an increased wage premium for education contributed to rising wage inequality. In China where the economic reform is fairly similar to Vietnam's economic

transformation, Appleton, Song, and Xia (2014) using data from 1988 to 2008 found a sharp increase in wage inequality, largely due to changes in the wage structure.

However, the rising wage inequality is found to reverse in later stage of the economic transformation. In recent studies, wage inequality was in fact found to decline in many post-communist economies. For example, using data for 1991-2015, Laporške *et al.* (2021) showed that wage inequality in Slovenia declined after 2000. The rising supply of young skilled workers is found to contribute to the overall decline in wage inequality. The increase in tertiary graduates outpaced the rise in demand for skills, resulting in declining returns on education. Similarly, using data from the CEE countries between 2002 and 2014, Magda, Gromadzki, and Moriconi (2019) showed that wage inequality had declined in almost all CEE countries in the recent years. The reduction in wage inequality was attributed mainly to the relative increase in wages at the bottom of the wage distribution and the decrease in inter-firm wage disparities. The reduction in wage inequality was largely driven by the wage structure effect rather than the composition effect.

The above literature review from transitional economies shows that economic structure change, changes in skilled labour supply and hence lowering returns to education affect the changes in wage inequality. Furthermore, Doan, Le and Tran (2018), Doan and Gibson (2012), and McGuinness *et al.* (2021) indicate that returns to education increased remarkably during the early economic transition but began to decline after around 2010 in Vietnam. This suggests that the wage inequality would change its direction around 2010. For this reason, in using a longer period dataset (1998-2020), we break it down into two sub-periods, 1998-2010 and 2010-2020¹. The former period witnessed strong further economic reforms (after initial economic reforms introduced in late 1980s and 1990s), including promoting private sector development, liberalizing investment and trade, and further integrating into the world

¹We do not go back further to 1990s as there is consistent evidence that wage inequality increased little during 1990s but still low (Liu, 2003, Gallup, 2002).

economy, e.g., by joining the WTO. The later period witnessed slower economic growth, a greater supply of highly educated workers (see Figure 1),² and slowing wage growth.³

[Figure 1 here]

The current paper offers a more complete picture of changes in wage inequality during the economic transformation in Vietnam. The paper also makes use of the latest recentered influence function (RIF) decomposition method, which allows us to estimate the relative contribution of each factor to total changes in wage inequality over time. The method also allows us to construct counterfactual wage inequality using the base year information rather than estimate wage inequality measures for each year as conventional decomposition methods do (these methods often estimate wage inequality for each year then look at the trend, a time-series of wage inequality, to make an inference). The RIF decomposition enables us to consider the changing trend in wage inequality and changing role of each factor to the wage inequality so that it can capture the dynamics of the economy and its labor market between the comparison and base year.

Our paper aims to explore the following research questions: (1) How have wages changed (over time) during the economic transformation, as the Vietnamese economy has moved from the early transitional stage to the deeper integration into the world economy? (2) Has wage inequality risen (or fallen) during the economic transformation? (3) What contributes to the rise (decline) in wage inequality?

² Note that the fast rising uptake of gross tertiary education started in middle 2000s (2005-2006) lead to rising supply of higher educated supply started in late 2000s (2009-2010) as it generally takes four years to complete university degree in Vietnam.

³ <https://www.economy.com/vietnam/wage-and-salaries>

The paper is structured as follows. Next section presents data and methods. Section 3 presents results. Conclusion and discussion are presented in Section 4.

2. Methods and data

2.1 Methods

We focus on differences in the wage distributions of two groups in our case is two points in time: group 1 (comparison year) and group 0 (base year), for a worker i , let Y_{1i} be the wage that would be paid in Group 1, and Y_{0i} the wage that would be paid in Group 0. Since a given workers i is only observed in one of the two groups, thus for each i , we can define the observed wage:

$$Y_i = Y_{1i} \cdot T_i + Y_{0i} \cdot (1 - T_i) \quad (1)$$

where $T_i = 1$ if worker i is observed in Group 1, and $T_i = 0$ if workers i is observed in group 0. Wage is a function of observed characteristics (X_i) in both groups and unobserved characteristics (e_i) as below:

$$Y_{it} = \beta_t X_{it} + e_{it} \quad \text{for } t = 1, 0 \quad (2)$$

where $E[e_{it} | X_{it}, T=t]=0$

For group 1, wage distribution can be F_1 for $(Y_1 | T=1)$, and for group 0, wage distribution is $F_0 = (Y_0 | T=0)$. We need to identify the counterfactual wage distribution F_c (at $T = 1$), that is the wage distribution that group 1 would have if this group has similar characteristics of group 0. The difference in the wage distributions between the 2 groups can be estimated at particular point on the distribution or functionals such as at mean, median, the 90th quantile. The difference: $\Delta = F_1 - F_0$ can be decomposed as:

$$\Delta = F_1 - F_0 = (F_1 - F_c) + (F_c - F_0) \quad (3)$$

Several decomposition procedures have been developed to unravel the sources of changes in wage distribution in equation 3 (Firpo, Fortin and Lemieux, 2009; 2018; Machado and Mata, 2005; Melly, 2005; Chernozhukov et al., 2013).

The FFL decomposition (so named after its authors, Firpo, Fortin and Lemieux, 2018) is an extension of Oaxaca-Blinder decomposition that relies on Recentered Influence Function (RIF) regressions (Firpo, Fortin and Lemieux, 2009) to estimate the effect of covariates on wage inequality measures, such as percentile differences (e.g., interquartile gap) and ratios (interquartile ratio), the Gini coefficient, or the variance of log wages. The RIF was derived by Essama-Nssah and Lambert (2012) from inequality measures. The RIF for observation i of quantile q_τ for wage outcome Y can be written as below:

$$IF(Y_{ti}, q_{\tau t}) = q_{\tau t} + \frac{[\tau - \theta(y_{ti} \leq q_{\tau t})]}{f(q_{\tau t})} \quad (2)$$

Where $f(\cdot)$ is the density function at q_τ and $\theta(\cdot)$ indicates whether observed wage (Y) is at or below quantile q_τ . FFL (2018) shows that when RIF is approximated by a linear function of covariates X , it can be:

$$E[\text{RIF}(y_{ti}, q_{\tau t}) \mid X_{ti}] = X_{ti} \beta_i \quad (3)$$

where β is a vector of coefficients of variables X , which represents partial effects using an unconditional quantile regression (UQR), or the marginal effects of covariates X .

The decomposition of the wage inequality change between the comparison year ($T=1$) and base year ($T=0$) using RIF regression involves a two-stage procedure. The first stage constructs *counterfactual wage distribution* that workers in the comparison year ($T=1$) would have had if they had the same characteristics as in the base year ($T=0$). The difference between workers' *actual wage distribution* and their *counterfactual wage distribution* is attributable to differences in their characteristics between the comparison year (1) and the base year (0). This difference in wage distribution is the composition effect, or the changes in workers' characteristics over time. The difference between the workers' *actual distribution* in

the base year (0) and the *counterfactual distribution* is the wage structure effect, that is, the wage distribution change due to changing returns to the workers' characteristics over time. In the second stage, the composition and structure effects are further decomposed into separate contributions of each explanatory variable. This enables us to gauge contributions by specific variables to the change in wage inequality across two points in time.

The FFL (2018) decomposition method first decomposes the distributional statistic of interest into a wage structure and a composition component using a reweighting approach, then further divides the wage structure and composition effects into the contribution of each covariate. This is done using the regression-based method proposed by Firpo, Fortin and Lemieux to estimate the effect of changes in covariates on any distributional statistics, such as inter-quartile ranges, inter-quartile ratio, the variance, or the Gini coefficient. These are alternative measures of wage inequality.

In FFL decomposition, the dependent variable ($\ln Wage$) of a regression is replaced by the corresponding Recentered Influence Function (RIF) for the distributional statistics of interest, which is the average of the conditional expectation of the RIF given a set of covariates. Firpo, Fortin and Lemieux (2018) name it *conditional expectations RIF-regressions*. Average derivatives computed using the RIF-regressions yield the partial effect of a small location shift in the distribution of covariates on the distributional statistic of interest. The coefficients of these RIF-regressions indicate how much the functional (e.g., the quantile) of the marginal outcome distribution ($\ln Wage$) is affected by a very small shift to the right in the distribution of the covariates. For known changes in the distribution of covariates between two time periods, we can compute the associated total change in $\ln wage$ using OLS regression (Firpo, Fortin and Lemieux, 2018). The main advantage of using this RIF-regression method in an Oaxaca-Blinder type decomposition is that it provides a linear approximation of a highly non-linear functional, such as the quantiles, interquartile range, or

the Gini coefficient. This is very useful when we want to investigate the change in wage inequality over time, in our case the changing wage inequality in Vietnam's transitional economy over the past two decades.

Unlike sequential decomposition methods (Machado and Mata, 2005; Melly, 2005; Chernozhukov et al., 2013), the FFL decomposition provides a way of (1) decomposing changes in mean wages into a wage structure effect and a composition effect; and (2), further dividing these two components into the contribution of each covariate. Firpo, Fortin and Lemieux (2018) argued that the advantage of their decomposition method over sequential decomposition is that the former can be used to divide the composition effect into the role of each covariate in a way that is independent of the order of the decomposition. For these reasons, we employ the FFL decomposition in the current study to further investigate the contribution of each factor in the aggregate changes in wage inequality.

We applied the FFL decomposition to quantiles, inter-quantile ranges, and the Gini coefficient to investigate how wage inequality changes and what contributes to the change in wage inequality during the last two decades of economic transformation in Vietnam. We focused on changes in wage inequality over the past 20 years when Vietnam witnessed substantial changes in the labor market. We broke down the period into two sub-periods, 1998-2010 and 2010-2020, because there has been a fundamental change in skill supply (Doan et al., 2018; Nguyen et al., 2018; ILO, 2020), and in the effect of the 2008-09 global financial crisis on the economy and labor market. The returns to education peaked around 2008-2010, then declined thereafter (see Doan et al., 2018; Doan and Gibson, 2012;

McGuinness et al., 2021).⁴ Therefore, we use 2010 as the cut-off year to stratify the period into two sub-periods (1998-2010 and 2010-2020).

2.2 Data and variables

Data used in this paper is taken from the 1998, 2010, and 2020 waves of the Vietnam Household Living Standards Survey (VHLSS) conducted by the General Statistics Office of Vietnam (GSO). The surveys are nationally representative for the population. We would have liked to use data from 2000 to obtain two equal periods (2000-2010 and 2010-2020), unfortunately GSO VHLSS did not collect data in 2000. Moreover, VHLSS 2002 is not comparable to the other VHLSS waves as it contains a significantly larger sample and includes more poor households (see Doan et al., 2018). The sample summary is presented in Table 1 below.

A subsample of the working age population (15-60) is used in the estimation. Because wages are not observed for non-wage observations, these observations are excluded from our estimation. A consistent method of randomly stratified sampling across survey waves enables us to compare the results over time.

The wage measure used is an *hourly wage* measure computed by dividing monthly wage earnings by workhours. Table 1 below provides variable mean and differences across years.

[Table 1 here]

Overall, education of the workforce increased from 8.9 years in 1998 to 10.7 years in 2020, but a closer look shows that shares of vocational/college and tertiary educated workers increased between 1998 and 2010. Between 2010 and 2020, the share of vocational and

⁴ Because the VHLSS did not collect data in 2009, we are unable to determine exactly the peak year of the returns; it would be either 2008 or 2009.

college workers in the workforce declined, but the upper secondary educated workers significantly increased (Table 1).

The other key feature is that the wage-earning workforce became older (from 31.3 years of age in 1998 to 36.2 years of age in 2020), and more women participated in the workforce, from 38% in 1998 to 44% in 2020. The other striking feature is that the country's economic structure has changed substantially. During the former period (1998-2010), private sector employment increased by 11.6%, from 61.2% to 72.8%, but remained unchanged in the later period (2010-2020). In contrast, foreign sector employment did not change much during the former period, but rapidly doubled in size in the later period, from 5.8% to 11.9%. In contrast, state-owned sector employment declined in both periods but more rapidly in the former period. The contribution to total employment by the state sector declined significantly, from 33% in 1998 to 21.4% in 2010, and to 15.3% in 2020.

We also observed considerable change in occupation and industry composition for wage earners. In the former period, employment in Professionals, Machinery assembly and operators and drivers, and Manual workers increased, but employment declined sharply in Agriculture, forestry and fishing. In the later period, the decline in employment in Agriculture, forestry and fishing continued but at a slower pace, while the employment in Machinery assembly and operators and drivers' continued to rise, as it did also in Sales and personal service workers. We witnessed a large decline in the employment in Manual worker occupations in the later period after a large rise in the former period. This implies that the Vietnamese economy had entered into a different stage of economic development. The former period is characterized by the transition from a traditional economy based mainly on agricultural activities to a low-skilled labor-intensive economy, while the later period is marked by the transition from low-skilled to semi-skilled growth (not yet a high-skilled economy). We observed a moderate expansion in employment in Sales and personal service

sectors, and rapid expansion of employment in Machinery assembly, operators and drivers, and Craft/processing plant workers. We also observed rapid employment expansion in Manufacturing and Hospitality, but shrinking in employment in the agriculture, forestry and fishing sector in the later period.

3. Results

In this section, using kernel density estimation we consider first how real wages changed over the periods under consideration. We then employ OLS and unconditional quantile regression to provide an initial understanding of the contributions of covariates to wages and how they changed over time. Finally, we consider whether wage inequality has increased (or declined) over the last 20 years, and what contributed to the rise (decline) of wage inequality over time.

3.1 Wage change during the economic transition in the past 20 years

Table 1 (Section 3.2) shows that real hourly wages increased by 157% between 1998 and 2010, and by 64.2% between 2010 and 2020. Figure 2 also shows that wage densities have substantially shifted to the right over time, implying that real wages have increased significantly over the last two decades.

[Figure 2 here]

The influence of various factors on wages changed substantially during the study period (Table 2). The returns to work experience increased between 1998 and 2010, then declined between 2010 and 2020 (see OLS estimates). This trend is also observed for status of employment contract. The wage gap between ethnic majorities (Kinh and Chinese) and minorities, and the gap between the foreign and private sectors decreased linearly over both sub-periods. Contributions to wage earnings of higher education levels, such as vocational,

college, and tertiary education compared with none-education, increased in the former period (1998-2010) but declined in the latter (2010-2020).

[Table 2 here]

The contributions of sex, ethnicity, and higher education in wage earnings were greater in 1998 and 2010 than in 2020 for the top quintile (Q90) (Table 2). The role in wage earnings of higher education increased in the former period (1998-2010) but declined substantially during the later period (2010-2020). By contrast, occupation was less important for the wage earnings in 1998, but was much more important in 2010 and 2020, especially for the top quintile. Furthermore, wage disparities between agriculture, forestry and fishing (primary industry) and many other industries were very large in 1998, but became smaller during the second period (from a maximum of 61% in 1998 to a maximum of just 16% in 2020). Wage gaps between the primary industry and the other nine industries shrank or virtually disappeared in 2020. This suggests that exposing longer to competitive labor market mechanism leads to narrower wage disparity between sectors or between industries.

Table 3 provides estimates of how wages have changed across the years and what has contributed to that change.⁵ In this table we compare wage rates across the years (i.e., 2010 versus 1998, and 2020 versus 2010). In the comparison, the previous year is set as the base year (Group 0). The counterfactual of Group 1 (comparison year) was estimated using the characteristics of the base year – called Group C (counterfactual) (see top panel of Table 3).

[Table 3 here]

The wage (in log) difference between the comparison year and the base year was computed for various quantiles. The wage differences across years were very large and

⁵ We have not provided detailed estimates here concerning the contribution of each factor to changes in wages, since our paper focuses on changes in wage inequality over time. However, the detailed decomposition is available upon request.

statistically significant at the 1% level. The wage rate increased faster between 1998 and 2010 than between 2010 and 2020. Wage difference (G_1-G_0) was larger for the bottom (Q10) and top quantiles (Q90) in the earlier period. Generally, wages rose substantially in both periods, but faster in the former than in the latter period. Specifically, between 1998 and 2020, wages increased by 1.72 log points, including 1.04 log points between 1998 and 2010 and 0.68 log points between 2010 and 2020. In the former period, wages rose faster at both ends than in the middle of the wage distribution, while in the later period (2010-2020) wage growth declined across quintiles from the bottom to the top quantile (Figure 3).

[Figure 3 here]

The counterfactual was used to compute the composition effect (the wage gap change over time attributable to observed changes in worker and job characteristics) and wage structure effect (the wage gap changes over time attributable to changing returns to the job and worker's characteristics). The composition effect explains the wage gap between the comparison year group's actual wages (G_1) and its counterfactual wage (G_c) (the wages accruing to the comparison year if it had the same observed characteristics as the base year). FFL (2018) termed this the 'policy effect.' The policy variable (X) here means changing the distribution of X from its value at base year ($T=0$) to a new value at comparison year ($T=1$), holding the wage structure constant. The wage structure effect is the gap between the comparison year's counterfactual wage (G_c) and the base year's actual wage (G_0). The structure effect implies that given the same observed characteristics as of the base year, the comparison year's wages still differ from those of the base year. The wage difference is thus attributable to changing returns on characteristics across years. This also means the labor market values the characteristics differently across years.

Our specification error is relatively small (except at the top end of the distribution) in the composition effect, indicating the overall fitness and reliability of the model (Rios-Avila, 2020). The specification error is used to assess the importance of departures from linearity in the model specification of the RIF approximation. The reweighting error, used to evaluate the quality of the reweighting strategy (Rios-Avila, 2020), is also small for most quantiles of the distribution but larger (still relatively small) at the upper end of the distribution where there are fewer observations.

Our estimates show that the wage structure effect dominates the overall wage changes, accounting for 61%-79% in total wage changes from 1998 and 2010. In contrast, the composition effect contributes from 21-39% in total wage change between 1998 and 2010, and its contribution in total wage change is much less (5-18%) between 2010 and 2020 (see Figure 3). This suggests that variations over time in observed characteristics, such as education, employment contract, occupation, industry and sector, no longer contributed significantly to wage change in the later period. Instead, the variations in returns to these factors matter more. That means the labor market values the characteristics differently across the two sub-periods.

3.2 Changes in wage inequality over the past two decades

In Section 3.1 we showed that real wages increased in both periods, 1998-2010 and 2010-2020. In that section, we looked at the changes in wage inequality and what has contributed to these changes over the two periods in the past 20 years, when the Vietnamese economy experienced major change in the labor market, as discussed in the background section.

In this sub-section, we applied the FFL decomposition to estimate inter-quantile ranges, and the Gini coefficient⁶ to investigate how wage inequality changed and what has

⁶ One may also want to look at inter-quantile ratio and variance of coefficients over time.

contributed to the change in wage inequality during the past two decades of the economic transformation in Vietnam. The question in focus is ‘*Has wage inequality risen or declined during the two periods?*’.

The estimates in Table 4 show that wage inequality (the 90-10 quantile gap) did not change much during the former period (1998-2010). However, a closer look shows that wage inequality declined significantly (by -0.2337 log points) in the lower part of the distribution (the Q50-10 quantile gap), but increased significantly (by +0.2089 log points) in the upper part (the Q90-50 gap) of the wage distribution. This implies an increased demand for highly educated/skilled workers in this period (1998-2010). The Gini index, which considers cumulative wage earnings in relation to the cumulative population on the lowest wages, shows that wage inequality rose by 0.0186, from 0.3534 to 0.3721 during the period (1998-2010).

[Table 4 here]

The changing distribution of employment contract status, education and occupation in the period contributed significantly to the composition effect (columns 1 and 4 of Table 4). In addition to industry, these factors are key contributors to the composition effect in the “90-50 gap.” Rising wage inequality in this upper wage gap (the 90-50 quantile gap) can be attributed to variations in the covariates of employment contract (i.e., more workers have signed official employment contracts, leading to a decline in the wage gap), the rise in supply of highly educated workforce, and changes in occupations and industries (i.e., economic structure change) between 1998 and 2010. In the meantime, the wage structure effect for the upper gap (the 90-50 quantile gap) is relatively small and statistically insignificant. Taken together, this suggests that in the 1998-2010 period, changes observed in the economic structure, employment, labor market and workers’ characteristics play an important role in

explaining changes in wage inequality. It reflects the ‘policy effect’ of skills supply (education), employment status (contract status), and economic structure changes (occupation and industry shifts).

In contrast to the former period (1998-2010), wage inequality declined considerably during the later period (2010-2020), by -0.3229 log points for the 90-10 quantile gap. The decline was faster in the upper part of the wage distribution (by -0.2253 log points for the 90-50 quantile gap) than in the lower part of the distribution by -0.098 log points for the 50-10 quantile gap) (Table 5).

[Table 5 here]

Furthermore, the Gini index also shows a consistent trend that wage inequality increased from 1998 to 2010, then declined from 2010 to 2020 (by -0.087 log points). Specifically, the Gini increased from 0.353 in 1998 to 0.372 in 2010, and then significantly dropped to 0.285 in 2020.

The changing returns to labor market, jobs and workers’ characteristics (wage structure effect) are predominant in the decline in wage inequality during the later period. This reflects the changing landscape in the Vietnamese labor market in the later period, when the supply of educated labor considerably expanded, and the excess demand for skilled labor disappeared (McGuinness et al., 2021; Doan et al., 2018).

The composition effect accounts for most of the changes in wage inequality, and changes in employment contract status, education, occupation and industry contributed most to the composition effect during the former period. In contrast, during the later period the composition effect contributed modestly to total change in wage inequality. The role played by employment contract status, education, occupation and industry to the composition effect

declined considerably, while the wage structure effect accounted for most of the change (decline) in wage inequality. These results fit well with the pattern of changing returns on education in both periods, greater in the former period but lower in the later period.

In the former period, the demand for a more highly skilled workforce grew faster than that for unskilled labor (McGuinness et al., 2021), and the skilled labor supply also increased but at lower pace than in the later period (Doan et al., 2018). In the later period, the supply of skilled workers continued to increase but the demand for skilled labor stabilized (McGuinness et al., 2021). The excess demand for skilled labor evaporated because of the fast rising supply of educated workers and a slowing economic growth in the later period (Doan et al., 2018). The declining returns to higher education in the later period explain well the decline in wage inequality during this period, particularly in the upper part of the wage distribution. In line with Acemoglu and Autor (2011) who pointed out that the contribution of education to the wage structure effect was one of the key contributors to change in wage inequality over time.

Changes in wage inequality differ across the two periods. In the former period, wage inequality rose in the upper part of the distribution, whereas in the later period wage inequality declined rapidly, particularly in the upper part of the wage distribution. This would imply fiercer competition and an oversupply of educated workers in the labor markets at later stage of the economic transition.

4. Conclusion and Discussion

This paper employed the latest decomposition method (Firpo, Fortin, and Lemieux, 2018) to decompose changes in wage inequality over two periods of economic transformation in Vietnam. We find that real wages increased substantially from 1998 to 2010, but the wage growth declined over the following decade (2010-2020), and wage inequality increased in the

former period, particularly for those in the upper part of the wage distribution, but declined considerably in the later period, especially in the upper part of the wage distribution.

The overall change in wage inequality over time was mainly contributed by changes in the labor market, jobs and workers' observed characteristics (the composition effect) during the period 1998-2010, but chiefly by the wage structure effect in the later period 2010-2020. The economic structure change and shifts in supply and demand for skilled workers over the two periods resulted in changes in wage inequality. The transition from primary economic sectors (e.g., agriculture) to secondary sector, such as manufacturing and construction, and shifts in the supply of a highly educated workforce were the main contributors to changes in wage inequality in Vietnam during the past two decades.

Changes in the economic structure and the labor markets in the transitional economies, e.g., former communist countries in the CEE and China, have led to changes in wage inequality. The wage inequality increased during the early economic transformation in the 1990s thanks to an excess demand for skilled workers (Rutkowski, 2001; Mitra & Yemtsov, 2006). The rising wage inequality in early economic transition is due to the setting of wages that was moving away from the previous command economy wage setting (in heavily distorted labor markets at which wage differences between workers were minimized) (Orazem & Vodopivec, 1995; Colclough et al., 2010), and due to technical change in Vietnam (Abbott, Tarp & Wu, 2017). However, in the later stage of the transformation, a rapid increase in the supply of higher educated workers resulted in declining returns to education (Doan et al 2018; Laporsek et al., 2021), and hence contributed to the declining wage inequality.

Our finding is not so contrary to the stylised-fact of the economic transformation in most former command economies (e.g., CEE) that wage inequality increased in early stage of

transformation, and then declined the later stage when there is a rise in supply of educated workers. However, the difference is that the decline in wage inequality occurred earlier in the CEE economies than in Vietnam. For example, Laporsek et al. (2021) found the declining wage inequality in CEE economies in 2000s, whereas we found the declining wage inequality in 2010s in Vietnam. Similarly, the improvement in returns on education was slower in Vietnam than in the former CEE/Soviet economies in the early stage of economic transition. This would be because the economic reform policies were introduced gradually in Vietnam, while the ‘Big Bang’ reforms were applied in the EEC/former Soviet economies. Mitra and Yemtsov (2006) argued that the pace of the transformation in the labor markets of the European transitional economies determined when their economies and labor markets would mature. Furthermore, Laporsek et al. (2021) in a study of Slovenia and Doan et al. (2018) in a study of Vietnam found that the relative supply of a higher educated workforce coincided with a reduction in returns to education in both economies. The supply of higher educated workers in Vietnam took place later (see Figure 1) than in Slovenia (see Figure 2 in Laporsek et al., 2021).

One may wish to know how wage inequality changed before our current study period. There was evidence that wage inequality increased but was still low during the first decade of the economic transition (Liu, 2003; Gallup, 2002). This would provide a baseline if one wants to compare wage inequality across three decades after onset of the economic reform. However, the Vietnamese economy and its labor market experienced substantial changes in the 2000s and 2010s e.g., joining WTO in 2007, policy on higher education enrolment expansion (see, the Higher Education Reform Agenda in 2005 in Pham and London, 2010). Since our paper aims to capture these changes (policy effects) in wage dynamics and wage inequality during those decades, we have therefore not considered the outset period of the transition in the late 1980s and 1990s.

We did not consider quality of higher education due to huge enrolment expansion in 2010s which may lead to lower education quality, both admission selection and teaching quality (Doan, Le, Tran, 2018; Patros, Pham & Nguyen, 2018; Pham & London, 2010). This possibly lower quality would result in lowering returns to higher education and then narrowing the wage inequality (the 90-10 quantile wage gap). Future study may need to isolate this effect before considering the effect of changes in skilled labour supply on the wage and wage inequality.

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Table 1: Descriptive statistics for a sample of employed people, aged 15-60

Variable	1998	2010	2020	Diff2010/98	Diff2020/10
Hourly income (VND1000)	9.87	25.4	41.7	15.53**	16.30**
Log wage (lnwage)	2.05	2.98	3.57	0.93**	0.59**
SD of lnwage	0.73	0.67	0.54		
Experience	15.0	17.1	18.5	2.10**	1.40**
Age	31.3	34.2	36.2	2.90**	2.00**
Sex (male=1)	0.62	0.60	0.56	-0.02	-0.04**
Ethnicity (Kinh and Chinese=1)	0.93	0.84	0.83	-0.09**	-0.01**
Schoolyear	8.9	9.7	10.7	0.80**	1.00**
Education level (%)					
No education	5.3	11.9	6.6	6.60**	-5.30**
Primary	25.0	22.8	17.7	-2.20	-5.10**
Lower secondary	37.9	24.3	24.3	-13.60**	0.00
Upper secondary	18.0	16.0	22.2	-2.00**	6.10**
Vocational & college	7.3	13.6	10.9	6.30**	-2.70**
Tertiary education	6.5	11.4	18.3	4.90**	6.90**
With employment contract (yes=1)	0.13	0.55	0.57	0.42**	0.02
Occupation (%)					
Managers	4.1	2.5	1.8	-1.60**	-0.70**
Professionals	13.2	16.9	17.5	3.70+	0.50
Admin workers	4.7	3.4	4.0	-1.30**	0.60*
Sales and personal service workers	6.2	7.1	9.8	0.90	2.70**
Agr/forest/fishing workers	15.8	4.5	2.4	-11.30**	-2.10**
Craft/processing plant workers	25.9	19.1	21.1	-6.80**	2.00**
Machinery/assembly operators/drivers	3.3	8.1	17.0	4.80**	8.90**
Manual workers	26.9	38.3	26.5	11.40**	-11.80**
Industry (%)					
Agriculture, forestry and fishing	28.4	27.1	14.3	-1.30**	-12.80**
Mining	1.5	0.9	0.7	-0.60	-0.20
Manufacturing	23.2	23.3	33.1	0.10+	9.80**
Electricity, gas, water and waste manage	0.9	0.9	1.2	0.00	0.30+
Construction	11.3	13.8	14.4	2.50**	0.60*
Retail sales/vehicle repairs	5.1	7.5	8.2	2.40*	0.70**
Transport and warehousing	4.0	3.4	3.8	-0.60	0.40
Accommodation and food	1.2	2.7	3.9	1.50**	1.20**
Information & communications	0.5	1.0	0.8	0.50	-0.20
Finance and insurance	0.6	1.1	1.5	0.50	0.40*
Real estate/rental	0.2	0.3	0.6	0.10	0.30**
Professional, science and tech services	0.2	1.0	0.9	0.80**	-0.10
Public admin/safety, security/defense...	7.2	6.6	5.5	-0.60	-1.10**
Edu and training	7.0	6.4	6.4	-0.60	0.00
Healthcare and social support	1.7	1.9	1.9	0.20	0.00
Arts, entertainment, sports	1.2	0.4	0.7	-0.80**	0.30*
Other services	2.8	1.1	1.5	-1.70**	0.40**
HH production/services sector	2.7	0.6	0.6	-2.10**	0.00
Sector (%)					
Private	61.2	72.8	72.8	11.60**	0.00
State-owned	33.0	21.4	15.3	-11.60**	-6.10**
Foreign	5.8	5.8	11.9	0.00	6.10**

Note: lnwage was computed from the hourly wage discounted to 2020 price levels. Upper secondary education also includes elementary vocational education. Significant at 1% (**), 5% (*), 10% (+).

Table 2: OLS and Unconditional Quantile Regression coefficients on log wages

	1998				2010				2020			
	OLS	Q10	Q50	Q90	OLS	Q10	Q50	Q90	OLS	Q10	Q50	Q90
Experience	0.0235** (0.0044)	0.0432** (0.0077)	0.0197** (0.0052)	0.0230** (0.0052)	0.0364** (0.0024)	0.0404** (0.0037)	0.0328** (0.0024)	0.0271** (0.0034)	0.0307** (0.0019)	0.0345** (0.0031)	0.0263** (0.0017)	0.0263** (0.0029)
Experience squared	-0.0005** (0.0001)	-0.0013** (0.0002)	-0.0004** (0.0001)	-0.0003+ (0.0001)	-0.0007** (0.0001)	-0.0009** (0.0001)	-0.0007** (0.0001)	-0.0005** (0.0001)	-0.0006** (0.0000)	-0.0007** (0.0001)	-0.0005** (0.0000)	-0.0005** (0.0001)
Sex	0.1846** (0.0264)	0.1479** (0.0456)	0.2092** (0.0254)	0.2118** (0.0337)	0.1958** (0.0175)	0.2203** (0.0293)	0.1775** (0.0160)	0.2100** (0.0263)	0.2098** (0.0120)	0.1927** (0.0178)	0.1934** (0.0110)	0.2080** (0.0218)
Ethnicity	0.1451** (0.0514)	0.0989 (0.0833)	0.1018* (0.0470)	0.1706** (0.0509)	0.1372** (0.0248)	0.1408** (0.0530)	0.0836** (0.0231)	0.1636** (0.0371)	0.1502** (0.0169)	0.1570** (0.0387)	0.0990** (0.0172)	0.1546** (0.0251)
Employment contract (yes=1)	0.1335** (0.0438)	0.0258 (0.0606)	0.2208** (0.0444)	0.2862** (0.0745)	0.1970** (0.0215)	0.2805** (0.0333)	0.1549** (0.0177)	0.1446** (0.0283)	0.1829** (0.0167)	0.1862** (0.0227)	0.1527** (0.0135)	0.1231** (0.0266)
<i>None education (base)</i>												
Primary education	0.0288 (0.0642)	-0.0768 (0.1321)	0.0156 (0.0405)	-0.0117 (0.0435)	0.0399 (0.0304)	0.1126* (0.0552)	0.0505* (0.0255)	0.0982** (0.0304)	0.0448+ (0.0243)	0.0344 (0.0602)	0.0418+ (0.0242)	0.0041 (0.0342)
Lower secondary	-0.0805 (0.0675)	-0.2995* (0.1438)	-0.0260 (0.0447)	-0.0542 (0.0492)	0.0391 (0.0316)	0.1088* (0.0503)	0.0437+ (0.0253)	0.1113** (0.0343)	0.0597* (0.0243)	0.0759 (0.0571)	0.0432+ (0.0235)	0.0161 (0.0356)
Upper secondary	0.1142 (0.0718)	-0.1493 (0.1455)	0.0749 (0.0510)	0.1438* (0.0644)	0.1684** (0.0351)	0.1943** (0.0596)	0.1408** (0.0297)	0.2704** (0.0415)	0.1361** (0.0259)	0.1441* (0.0578)	0.1113** (0.0230)	0.0820* (0.0375)
Vocational & college	0.0952 (0.0821)	-0.2579 (0.1673)	0.0827 (0.0717)	0.2341** (0.0871)	0.2904** (0.0416)	0.3931** (0.0690)	0.3055** (0.0376)	0.3435** (0.0636)	0.1466** (0.0301)	0.1798** (0.0621)	0.1428** (0.0326)	0.0658 (0.0426)
Tertiary education	0.5806** (0.0898)	0.2313 (0.1573)	0.5056** (0.0785)	0.5903** (0.0904)	0.6702** (0.0504)	0.7752** (0.0929)	0.6235** (0.0497)	0.6271** (0.0792)	0.3801** (0.0343)	0.3717** (0.0629)	0.3574** (0.0328)	0.3280** (0.0542)
<i>Managers (base)</i>												
Professionals	0.2361** (0.0900)	0.1140 (0.1742)	0.1960+ (0.1001)	0.0942 (0.0993)	0.0011 (0.0653)	0.1122 (0.1070)	-0.0945* (0.0435)	0.0066 (0.0990)	-0.0612 (0.0517)	0.0953 (0.1209)	-0.1265+ (0.0689)	-0.1105+ (0.0670)
Admin workers	0.1603+ (0.0955)	0.1101 (0.2044)	0.0606 (0.1077)	0.0738 (0.1272)	-0.2975** (0.0724)	-0.1739 (0.1218)	-0.3445** (0.0594)	-0.3354** (0.1123)	-0.2817** (0.0584)	-0.1143 (0.1248)	-0.3505** (0.0762)	-0.3312** (0.0842)
Sales and personal service workers	0.1349 (0.0978)	0.0556 (0.1994)	0.1142 (0.1245)	-0.1104 (0.0997)	-0.3890** (0.0709)	-0.2401* (0.1050)	-0.4116** (0.0563)	-0.4917** (0.1096)	-0.4569** (0.0590)	-0.2981* (0.1188)	-0.5224** (0.0799)	-0.5233** (0.0843)
Agri/forest/fishing workers	0.2540* (0.1113)	0.3632 (0.2222)	-0.0663 (0.1226)	0.0043 (0.1424)	-0.0660 (0.1029)	-0.0685 (0.1639)	-0.1780* (0.0790)	0.0083 (0.2043)	-0.3654** (0.0694)	-0.2947+ (0.1515)	-0.3605** (0.0855)	-0.5150** (0.1005)
Craft/processing plant workers	0.0909 (0.0971)	0.0607 (0.1932)	-0.0458 (0.1145)	-0.1619 (0.1067)	-0.3510** (0.0691)	-0.0805 (0.1122)	-0.3602** (0.0530)	-0.5203** (0.1067)	-0.3433** (0.0580)	-0.0371 (0.1254)	-0.3747** (0.0763)	-0.5089** (0.0823)

Machinery/assembly operators/drivers	0.3917** (0.1114)	0.3742+ (0.1978)	0.2969* (0.1282)	0.2544+ (0.1494)	-0.2284** (0.0717)	0.1021 (0.1141)	-0.2424** (0.0513)	-0.3944** (0.1077)	-0.2945** (0.0581)	0.0201 (0.1235)	-0.3335** (0.0770)	-0.4803** (0.0814)
Manual workers	0.0773 (0.0964)	0.0994 (0.1872)	-0.0928 (0.1151)	-0.2251* (0.1067)	-0.4097** (0.0703)	-0.1514 (0.1153)	-0.4371** (0.0518)	-0.5630** (0.1064)	-0.4708** (0.0584)	-0.2077+ (0.1255)	-0.5052** (0.0751)	-0.6307** (0.0813)
<i>Agri/forest/fish (base)</i>												
Mining	0.3832** (0.1162)	0.4709+ (0.2549)	0.2026+ (0.1158)	0.4332 (0.2855)	0.2853** (0.0723)	0.0319 (0.1195)	0.2103** (0.0724)	0.5999** (0.1750)	0.1246* (0.0553)	0.0352 (0.0938)	0.2126** (0.0587)	0.1648+ (0.0896)
Manufacturing	0.2277** (0.0528)	0.3093+ (0.1688)	0.0635 (0.0422)	0.2134** (0.0530)	-0.0798** (0.0305)	-0.2039** (0.0620)	-0.0739* (0.0292)	-0.0487 (0.0478)	-0.0106 (0.0251)	-0.0665 (0.0445)	-0.0010 (0.0221)	-0.0033 (0.0413)
Electric, gas, water and waste management	0.1229 (0.1939)	0.0098 (0.3330)	0.0752 (0.1177)	0.2473 (0.1989)	-0.0599 (0.0658)	-0.2276+ (0.1358)	-0.0502 (0.0550)	0.0487 (0.1208)	0.0174 (0.0462)	-0.0620 (0.1182)	0.0948 (0.0639)	0.0377 (0.0569)
Construction	0.2225** (0.0593)	0.4938** (0.1708)	0.0562 (0.0460)	0.1956** (0.0579)	0.0968** (0.0271)	0.1539* (0.0626)	0.0701** (0.0221)	-0.0023 (0.0490)	0.1016** (0.0231)	0.1448** (0.0390)	0.0935** (0.0203)	0.0051 (0.0390)
Retail sales/vehicle repairs	0.3168** (0.0695)	0.4708* (0.2023)	0.0707 (0.0661)	0.2903* (0.1130)	0.0645+ (0.0370)	-0.0412 (0.0672)	0.0540 (0.0345)	0.0514 (0.0572)	0.0610* (0.0288)	0.0245 (0.0520)	0.0807** (0.0252)	0.1113* (0.0505)
Transport and warehousing	0.2081** (0.0666)	0.4679* (0.1983)	0.0416 (0.0575)	0.1261+ (0.0747)	0.1449** (0.0399)	0.0434 (0.0716)	0.1062** (0.0334)	0.1274+ (0.0670)	0.0725* (0.0360)	-0.0592 (0.0429)	0.0820** (0.0293)	0.1377* (0.0590)
Accommodation and food	0.2233** (0.0822)	0.4742+ (0.2512)	-0.0114 (0.1010)	0.0912 (0.1010)	0.0505 (0.0536)	-0.0758 (0.0839)	-0.0022 (0.0437)	0.0022 (0.0656)	0.0595 (0.0384)	-0.0226 (0.0626)	-0.0018 (0.0281)	0.0828 (0.0663)
Information & communications	0.6043** (0.2109)	0.6308+ (0.3787)	0.5561** (0.1997)	0.8684** (0.2644)	0.1301+ (0.0734)	-0.1868 (0.1890)	0.1473+ (0.0753)	0.2071+ (0.1211)	0.2377** (0.0711)	-0.0336 (0.0967)	0.1527* (0.0655)	0.3201+ (0.1747)
Finance and insurance	-0.2143 (0.1402)	-0.1382 (0.3062)	-0.1486 (0.1677)	-0.2581* (0.1201)	0.2116** (0.0757)	0.0441 (0.0990)	0.2278* (0.1155)	0.3981** (0.0826)	0.2021** (0.0582)	0.0393 (0.0876)	0.1743** (0.0637)	0.2798** (0.0930)
Real estate/rental	0.0491 (0.2296)	0.1259 (0.3972)	-0.1637 (0.4394)	0.1669 (0.2928)	0.3311+ (0.1968)	-0.1349 (0.2986)	0.2926 (0.2740)	1.0474** (0.3839)	0.1879** (0.0712)	0.0229 (0.1207)	0.1914** (0.0649)	0.4065* (0.2022)
Professional, science and tech services	0.1627 (0.1808)	0.0723 (0.3996)	-0.0260 (0.2491)	0.7623 (0.4933)	0.1632 (0.1133)	-0.2689+ (0.1486)	0.1320 (0.0878)	0.1910 (0.2887)	0.0484 (0.0873)	-0.1447 (0.1374)	-0.0272 (0.0632)	0.1557 (0.1293)
Public admin/safety and defense...	-0.5462** (0.0877)	-0.6687** (0.1902)	-0.6816** (0.0851)	-0.2890* (0.1156)	-0.4065** (0.0556)	-0.6161** (0.0925)	-0.3936** (0.0381)	-0.2602** (0.0739)	-0.1883** (0.0434)	-0.2928** (0.0807)	-0.1202** (0.0417)	-0.1090+ (0.0648)
Edu and training	-0.3069** (0.0854)	0.0416 (0.1762)	-0.4171** (0.0779)	-0.4226** (0.1145)	-0.1191* (0.0521)	-0.1811+ (0.0937)	-0.0680+ (0.0364)	-0.0229 (0.0697)	0.0533 (0.0426)	-0.0506 (0.0635)	0.0675 (0.0462)	0.1843** (0.0658)
Healthcare & social support	-0.2148+ (0.1246)	0.0342 (0.3417)	-0.1726 (0.1242)	-0.0957 (0.1731)	-0.0889 (0.0631)	-0.1915 (0.1433)	-0.1037 (0.0639)	-0.0887 (0.1213)	-0.0383 (0.0520)	-0.1206+ (0.0691)	-0.0177 (0.0516)	-0.0570 (0.1133)
Arts, entertainment, sports	-0.2480* (0.1147)	-0.2019 (0.2195)	-0.4309** (0.1499)	-0.0150 (0.2055)	-0.2238* (0.1043)	-0.2485 (0.2332)	-0.2084* (0.1010)	-0.2335+ (0.1365)	-0.0404 (0.0665)	-0.3549* (0.1379)	-0.0887 (0.0918)	-0.0111 (0.1729)

Other services	-0.0630 (0.0944)	-0.1243 (0.2509)	-0.2765* (0.1185)	0.1360+ (0.0782)	-0.0880 (0.0649)	-0.1193 (0.1419)	-0.1195* (0.0559)	0.1185 (0.1622)	0.0041 (0.0588)	-0.1486** (0.0524)	-0.0358 (0.0563)	0.0903 (0.1003)
Household production	-0.2723** (0.0942)	-0.3054 (0.2660)	-0.3511* (0.1447)	-0.1083 (0.0749)	-0.1335 (0.0823)	-0.2233+ (0.1294)	-0.1810* (0.0796)	-0.1845 (0.1400)	0.1306 (0.0816)	0.0012 (0.1224)	-0.0008 (0.0586)	0.2463* (0.1081)
<i>Private sector (base)</i>												
State	-0.0090 (0.0432)	0.1441* (0.0690)	-0.0718+ (0.0381)	-0.0792 (0.0571)	0.0240 (0.0339)	-0.0327 (0.0515)	0.0481+ (0.0286)	0.0523 (0.0496)	-0.0859** (0.0294)	-0.0501 (0.0473)	-0.0670* (0.0323)	-0.0660 (0.0425)
Foreign	0.2034** (0.0491)	0.1449 (0.1034)	0.1858** (0.0440)	0.2091** (0.0739)	0.1850** (0.0367)	0.1587** (0.0474)	0.1327** (0.0323)	0.0988+ (0.0507)	0.0963** (0.0186)	0.1383** (0.0218)	0.1045** (0.0174)	0.0660* (0.0336)
Constant	1.4268** (0.1208)	0.8633** (0.2251)	1.7919** (0.1293)	2.1924** (0.1232)	2.4667** (0.0822)	1.6231** (0.1440)	2.6068** (0.0642)	3.1039** (0.1258)	3.0961** (0.0684)	2.3904** (0.1388)	3.2167** (0.0878)	3.7619** (0.1009)
Observations	3,028	3,030	3,030	3,030	7,147	7,147	7,147	7,147	8,681	8,681	8,681	8,681
R-squared	0.2380	0.1559	0.1219	0.2200	0.4047	0.1953	0.2404	0.2973	0.3653	0.2061	0.2119	0.2468

Note: OLS robust standard errors and quantile regression bootstrapped SEs with 500 repetitions are in parenthesis, significant at ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

Table 3: RIF decomposition of the wage change over time (ages 15-60)

VARIABLES	2010 vs 1998 (base year)					2020 vs 2010 (base year)				
	Q10	Q25	Q50	Q75	Q90	Q10	Q25	Q50	Q75	Q90
Group 1 (G_1 : comparison year)	2.3178** (0.0136)	2.6585** (0.0085)	2.9976** (0.0087)	3.4030** (0.0130)	3.8921** (0.0184)	3.0010** (0.0110)	3.2962** (0.0077)	3.5832** (0.0067)	3.8713** (0.0094)	4.2524** (0.0166)
Group C (G_c =counterfactual) (Counterfactual of G_1)	2.0031** (0.0363)	2.4146** (0.0278)	2.7930** (0.0143)	3.0965** (0.0174)	3.4916** (0.0379)	2.9640** (0.0116)	3.2538** (0.0083)	3.5483** (0.0072)	3.8252** (0.0094)	4.1886** (0.0156)
Group 0 (G_0 : base year)	1.2765** (0.0379)	1.8099** (0.0196)	2.1901** (0.0134)	2.5006** (0.0164)	2.8756** (0.0240)	2.3178** (0.0133)	2.6585** (0.0082)	2.9976** (0.0084)	3.4030** (0.0129)	3.8921** (0.0180)
Difference ($G_1 - G_0$)	1.0413** (0.0403)	0.8486** (0.0214)	0.8076** (0.0159)	0.9024** (0.0209)	1.0165** (0.0302)	0.6832** (0.0172)	0.6377** (0.0112)	0.5856** (0.0108)	0.4684** (0.0159)	0.3603** (0.0245)
Composition effect ($G_1 - G_c$)	0.3147** (0.0363)	0.2439** (0.0273)	0.2046** (0.0159)	0.3065** (0.0215)	0.4005** (0.0414)	0.0370** (0.0088)	0.0424** (0.0063)	0.0349** (0.0056)	0.0461** (0.0077)	0.0638** (0.0133)
Specification error	0.0340 (0.0412)	0.0702** (0.0258)	-0.0145 (0.0171)	0.0267 (0.0241)	0.1241** (0.0365)	-0.0056 (0.0078)	0.0076 (0.0051)	0.0087* (0.0041)	0.0061 (0.0061)	0.0166 (0.0107)
Wage structure effect ($G_c - G_0$)	0.7266** (0.0663)	0.6047** (0.0401)	0.6029** (0.0242)	0.5959** (0.0295)	0.6160** (0.0520)	0.6462** (0.0201)	0.5953** (0.0130)	0.5507** (0.0123)	0.4223** (0.0177)	0.2965** (0.0267)

Reweight error	0.0064 (0.0264)	-0.0129 (0.0208)	-0.0348** (0.0112)	-0.0711** (0.0138)	-0.1360** (0.0298)	0.0033 (0.0068)	0.0040 (0.0059)	0.0073 (0.0051)	0.0129+ (0.0069)	0.0204+ (0.0109)
Prob>Chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.3102	0.3102	0.3102	0.3102	0.3102	0.0883	0.0883	0.0883	0.0883	0.0883
Observations	10,175	10,175	10,175	10,175	10,175	15,828	15,828	15,828	15,828	15,828

*Note: Robust standard errors in parentheses, significant ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$*

Table 4: Wage inequality change between 1998 and 2010 (base year: 1998)

Inequality measures	90-10	50-10	90-50	Gini
G ₁ -comparison year	1.5743**	0.6798**	0.8945**	0.3721**
G _c -counterfactual for G ₁	1.4885**	0.7898**	0.6986**	0.3668**
G ₀ -base year	1.5991**	0.9136**	0.6856**	0.3534**
Difference (G ₁ -G ₀)	-0.0248	-0.2337**	0.2089**	0.0186*
<i>Composition effect</i>	0.0858	-0.1100**	0.1959**	0.0053
Experience	-0.0240	-0.0224	-0.0016	0.0017
Experience squared	0.0373+	0.0264+	0.0108	0.0030
Sex (male=1)	-0.0001	-0.0002	0.0001	-0.0001
Ethnicity (majority=1)	-0.0014	-0.0014	-0.0000	-0.0000
Employment contract (yes=1)	-0.1366**	-0.0760**	-0.0605*	-0.0286**
Education	0.0614*	-0.0096	0.0710**	0.0164**
Occupation	0.1090**	0.0229	0.0861**	0.0234**
Industry	-0.0475*	-0.0025	-0.0450**	-0.0081
Sector	-0.0023	0.0012	-0.0034	-0.0007
Specification error	0.0901	-0.0485	0.1385**	-0.0019
<i>Wage structure effect</i>	-0.1106	-0.1237+	0.0131	0.0134
Experience	-0.1993	-0.3593	0.1599	-0.0342
Experience squared	0.0679	0.1199	-0.0520	0.0097
Sex (men=1)	-0.0332	-0.0861	0.0529	-0.0198
Ethnicity (majority=1)	0.2086	-0.0365	0.2451*	0.0608
Employment contract (yes=1)	-0.0312	-0.0475*	0.0162	-0.0155*
Education	-0.1581	-0.4249*	0.2668	0.0095
Occupation	-0.0355	0.1348	-0.1703	0.0125
Industry	-0.6810	1.2260	-1.9069+	-0.2548
Sector	-0.3013	-0.1101	-0.1912	-0.0671
Constant	1.1946	-0.4992	1.6938	0.3490
Reweighting error	-0.1422**	-0.0409+	-0.1013**	-0.0364**
Prob > chi2	0.0000	0.0000	0.0000	0.0000
Pseudo R2	0.3102	0.3102	0.3102	0.3102
Observations	10175	10175	10175	10175

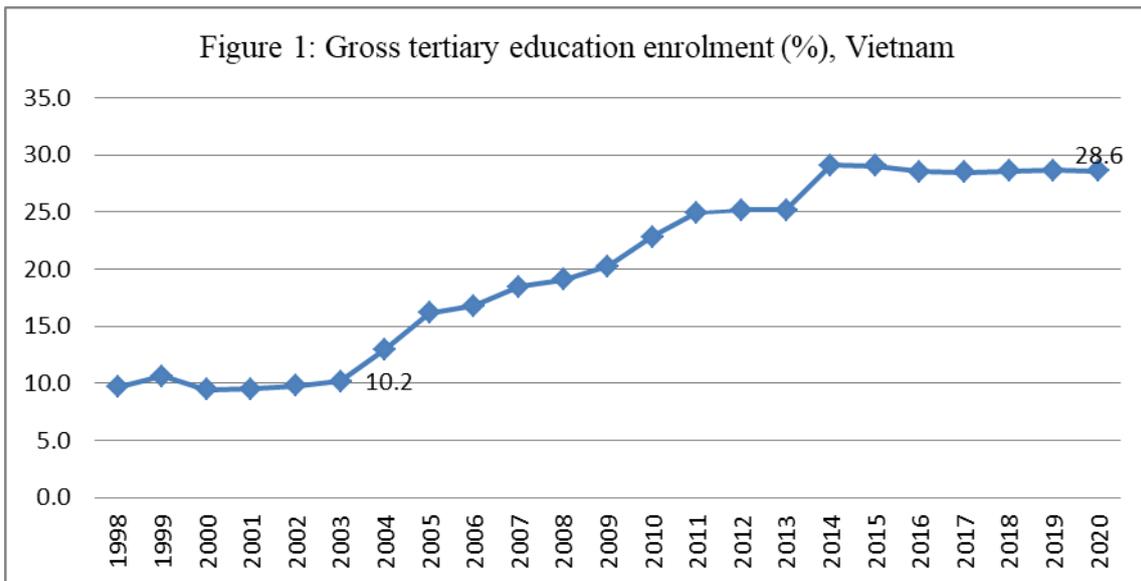
Note: For brevity, robust standard errors are not reported here. Significance ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Coefficients of series dummy variables of education level, occupation, industry and sector are aggregated using linear combinations of parameters (lincom).

Table 5: Wage inequality change between 2010 and 2020 (base year: 2010)

Inequality measures	90-10	50-10	90-50	Gini
G ₁ -comparison year	1.2515**	0.5822**	0.6692**	0.2845**
G _c -counterfactual for G ₁	1.2247**	0.5844**	0.6403**	0.2818**
G ₀ -base year	1.5743**	0.6798**	0.8945**	0.3720**
Difference (G ₁ -G ₀)	-0.3229**	-0.0976**	-0.2253**	-0.0876**
<i>Composition effect</i>	0.0268+	-0.0021	0.0289*	0.0027
Experience	0.0080	-0.0165*	0.0245**	-0.0008
Experience squared	0.0049	0.0149*	-0.0100	0.0025
Sex (male=1)	-0.0008	0.0034*	-0.0042*	-0.0001
Ethnicity (majority=1)	0.0118**	0.0086**	0.0032+	0.0020**
Employment contract (yes=1)	-0.0054**	-0.0044**	-0.0010	-0.0013**
Education	0.0217**	-0.0017	0.0234**	0.0036**
Occupation	-0.0509**	-0.0063	-0.0445**	-0.0114**
Industry	-0.0065	-0.0069	0.0004	0.0009
Sector	0.0219	-0.0075	0.0293*	0.0044
Specification error	0.0222+	0.0143+	0.0079	0.0029
<i>Structure effect</i>	-0.3496**	-0.0954**	-0.2542**	-0.0903**

Experience	0.2982+	0.0126	0.2856*	0.0004
Experience squared	-0.1775+	-0.0345	-0.1430*	-0.0049
Sex (male=1)	0.0393	-0.0072	0.0465	0.0107
Ethnicity (majority=1)	-0.3305**	-0.1517+	-0.1788**	-0.0656**
Employment contract (yes=1)	0.0684	-0.0109	0.0793*	0.0103
Education	0.1980	-0.0048	0.2029	0.0705*
Occupation	0.2741	0.1452	0.1288	0.1008
Industry	0.0547	0.058	-0.0033	0.1911
Sector	0.1751+	0.0056	0.1695+	0.0015
Constant	-0.9665	-0.1118	-0.8547	-0.4086*
Reweighting error	0.0171+	0.0041	0.0131+	0.0034*
Prob > chi ²	0.0000	0.0000	0.0000	0.0000
Pseudo R ²	0.0883	0.0883	0.0883	0.0883
Observations	15,828	15,828	15,828	15,828

*Note: For brevity, robust standard errors are not reported here. Significance ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$. Coefficients of series dummy variables of education level, occupation, industry and sector are aggregated using linear combinations of parameters (lincom).*



Source: World Development Indicators, available at <http://data.worldbank.org/indicator/SE.TER.ENRR/countries/VN-4E-XN?display=default>

Figure 2: Epanechnikov kernel function of log wage

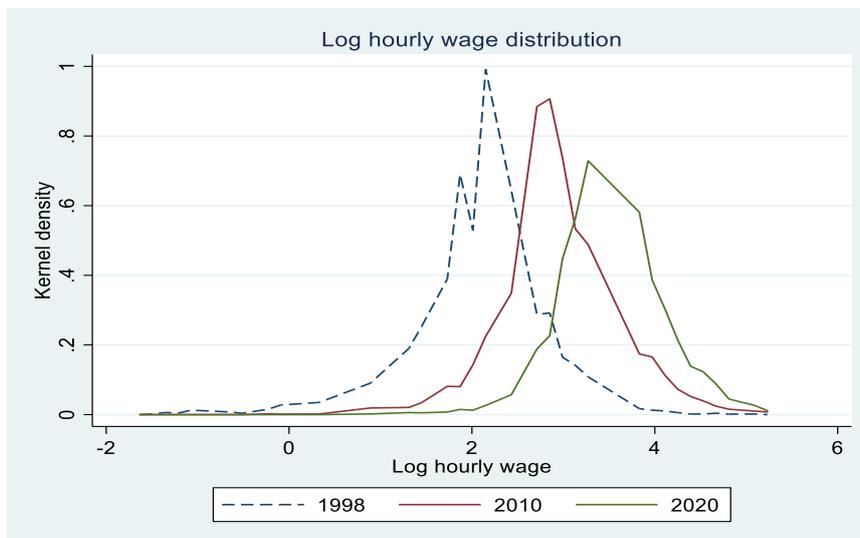


Figure 3: Decomposition of wage change over time into composition and structure effect

