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The Wage Labor Market and Inequality in Vietnam in the 1990s

John Luke Gallup

Abstract

Has the expansion of wage employment in Vietnam exacerbated social inequalities, despite its contribution to income growth? Gallup uses the two rounds of the Vietnamese Living Standards Survey (VLSS) to evaluate the contribution of wage employment to inequality and income growth over the period of rapid economic growth in the 1990s following market reforms. If Vietnam sustains its economic development in the future, wage employment will become an ever more important source of household income as family farms and self-employed household enterprises become less prevalent. Observing the recent evolution of wage employment compared with farm and nonfarm self-employment provides clues as to how economic development will change Vietnamese society, in particular its impact on income inequality within and between communities.

Gallup shows that standard methods for calculating income inequality can be severely biased due to measurement error when decomposing the contribution of different sectors, regions, or groups to overall inequality. A new method for consistent decomposition of inequality by income source shows that despite the rapid growth of wages in the 1990s, wage inequality fell

modestly. Contrary to the results of uncorrected methods, wage employment contributes a roughly similar amount to overall income inequality as other nonagricultural employment (household enterprise and remittances, mainly). Agricultural income actually reduces overall income inequality because inequality between agricultural households is much lower than inequality between nonagricultural households, and agricultural income has a lower correlation with other income sources. Wage employment has not been the locus of growing disparity between the haves and the have-nots in Vietnam.

A declining share of agriculture as the economy grows in Vietnam means that income inequality will rise, assuming that within-sector inequality does not change. This rising inequality, due to the shrinking share of agriculture, will be difficult to avoid without giving up economic growth and rapid poverty reduction in Vietnam. Historically, the process of economic development has always brought about a transition out of small farms and household enterprises into wage employment as worker productivity increases and non-household enterprises dominate the economy.

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I. Introduction

Vietnam has had very rapid economic growth since the implementation of the Ðổi Mới, or Renovation, policies in the late 1980s, despite a sometimes fitful process of market reforms. This fitfulness has been due to ideological doubts about moving towards a market-based economy as well as concern about the social impact of the transformation. The changes have indeed been dramatic. Output per person grew at an average rate of 5.5 percent per year from 1988 to 1998, raising the average level of output per person by 73 percent in a decade (see Figure 1).[1] A transformation of this magnitude has touched all facets of society, and dramatically reduced poverty.

Family farms and small-scale household enterprises still dominate the income-generating activities of Vietnamese, and much of the initial change due to Ðổi Mới occurred in these sectors. But wage employment is the future. Historically, the process of economic development has always brought about a transition out of small farms and household enterprises into wage employment as worker productivity increases and non-household enterprises dominate the economy. Scrutinizing the evolution of the labor market in the 1990's gives us clues about how economic development in Vietnam will continue to affect households and society in the future.

The economic transformation in Vietnam, despite its positive impact on poverty, could bring about rising inequality. If that occurrs, the labor market is likely to be the source of the disparity. In cities, the development of private enterprise could create a polarization of workers between those in high-paying skilled jobs and others, often immigrants from the countryside, who take low-skilled, low-paying jobs. If employment creation is concentrated in the cities, it would widen the gap between rural and urban dwellers. If there was a lack of opportunity for the poor and an increasing disparity of income, it could contribute to many social problems.

This paper uses the two rounds of the Vietnamese Living Standards Survey (VLSS) to evaluate the contribution of wage employment to inequality and income growth over the period of rapid economic growth in the 1990s following market reforms. Has the expansion of wage employment in Vietnam exacerbated social inequalities, despite its contribution to income growth? If Vietnam sustains its economic development in the future, wage employment will become an ever more important source of household income as family farms and self-employed household enterprises become less prevalent. Observing the recent evolution of wage employment compared to farm and non-farm self-employment provides clues as to how economic development will change Vietnamese society, in particular its impact on income inequality within and between communities.

The paper shows that standard methods for calculating income inequality can be severely biased due to measurement error when decomposing the contribution of different sectors, regions, or groups to overall inequality. An alternative consistent method for decomposing income inequality is proposed, which is easy to calculate.

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[1] Output per capita is measured by real GNP per capita in 1995 US $ (World Bank, 2000b).

The next section reviews developments in the Vietnamese labor market in the 1990s, focussing on wage employment (rather than self-employment). Section III explores the determinants of wages to find the individual and community characteristics that explain why different people are paid different wages. Section IV presents standard inequality measures. It discusses the important impact of measurement error on inequality statistics and proposes a new statistic that is not subject to the biases of standard inequality measures. Section V describes recent wage inequality in Vietnam, and how it has changed during the 1990s. Section VI measures the contribution wage employment to overall income inequality. Section VII uses the relationship between income sources and overall inequality to predict future changes in income inequality. The last section is the conclusion.

II. The Vietnamese Labor Market in the 1990s

This section evaluates how the rapid economic changes in Vietnam have affected labor force participation, unemployment, sectoral shifts in employment, and the growth and regional differences in wages.

Labor Force Participation and Unemployment
In Vietnam, a high percentage of the working age population works. Even when we exclude housework (but include work on the household farm or household business), 81% of all Vietnamese women and 85% of men aged 16 to 60 were working in 1993 (see Table 1).[2,3] As income rose during the 1990s, participation rates rose by 2% for women and were unchanged for men.

In rural villages, participation rates are even higher, at 83% for women and 87% for men in 1993. Rural participation rates jumped by 4% for women, and stayed unchanged for men, so that both rural men and rural women had the same 87% participation rate in 1998.

Participation rates were lower in urban areas than in rural areas in 1993, at 74% for urban women and 78% for urban men. Unlike rural women, urban women's participation fell

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[2] The data for this paper comes from two rounds of the Vietnamese Living Standards Survey (VLSS) fielded in 1992-3 and 1997-8. The VLSS is a nationally representative stratified random sample large enough to provide good region-level estimates. 4800 households were interviewed in 1992-3 (subsequently referred to as the 1993 survey), and 6000 households were interviewed in 1997-8 (the 1998 survey), with over 4300 households interviewed in both surveys. The survey has extensive coverage of labor market activities of household members, farm and non-farm self-employment as well as a wide range of other topics. The survey includes the information to make a detailed calculation of household income as well as a full household expenditure survey. The 1993 survey sampled households proportionally to the population in each region, but the 1998 survey oversampled certain areas, requiring the use of sampling weights to calculate representative statistics. The VLSS is described in more detail in Chapter 1 of this volume and World Bank (1995, 2000a).
[3] Labor force participation used in Table 1 refers to the seven days previous to the survey interview. If we include people who were not working during the past week, but worked at some time during the year, total participation rises to 89% in 1998.

substantially by 3% to 70% in 1998. Urban men's participation also fell slightly to 77% in 1998.

Unemployment, that is, people looking for work but not having a job, is very low in Vietnam. The unemployment rate was half a percent in rural areas, and one and a half percent in urban areas (Table 2). Unemployment fell by the a tenth of percentage point from 1993 to 1998, an insignificant change. The absence of unemployment is probably due to a combination of Vietnam having too low an income level to permit people not to work while job searching, and the wide availability of self-employment on a household farm or enterprise.

The Composition of Employment
Vietnam is still a highly agricultural country, with half of all workers working on family farms, but the share of agricultural employment is shrinking.

We define "self-employment" in an unconventional way because of inconsistencies between the two rounds of the VLSS. The survey question asking whether the survey respondent was self-employed in their main job in the previous seven days was changed from the 1993 to the 1998 survey. Using this self-employment question results in dramatic, but spurious, changes in self-employment between 1993 and 1998. To ensure comparability, Tables 3, 4 and 5 use the questions about whether the respondent has worked in any job in the three sectors (wage employment, non-agricultural self-employment, and agricultural self-employment) during the previous week, so that the sector designations are not mutually exclusive. To make the sectors mutually exclusive, "wage employment" includes anyone who has worked in wage employment whether it was their main job or not. "Non-agricultural self-employment" excludes anyone who has done any wage employment, and "agricultural self-employment" excludes anyone with any other employment. This tends to exaggerates the number of wage employees and non-agricultural self-employed at the expense of the agricultural self-employed, but should not bias the rate of change over time.

The share of agricultural self-employment (family farms) fell from 52% in 1993 to 50% in 1998 (Table 3). The two percentage point drop in the employment share of agricultural self-employment was equally shared by increased wage employment and non-agricultural self-employment. Wage employment and agricultural self-employment each grew to 25% of total employment.

Rural men's employment changed more decidedly towards the wage labor market than overall employment. Of the three percentage point fall in agricultural self-employment, two percentage points went into wage employment, but only one percentage point into non-agricultural self-employment from 1993 to 1998.

Rural women's employment is the most highly agricultural, with two-thirds of employment on family farms. It also fell the least, by one percentage point. Rural women's wage employment also fell slightly, while non-agricultural self-employment expanded by one percentage point.

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The changes in the urban sectoral composition of employment were more dramatic (Table 5). For urban men, agricultural self-employment still accounted for thirteen percent of employment in 1993, but it fell by five percentage points by 1998. There was a roughly equal transfer of employment into non-agricultural self-employment and into wage employment, which made up 53% of all employment by 1998.

Urban women saw the greatest increase in wage employment, of almost three percentage points from 1993 to 1998. The expansion of the wage employment came from a sharp reduction in agricultural self-employment and a small reduction in non-agricultural self-employment.

Agricultural employment shrank for everyone between 1993 and 1998. It fell twice as much in urban areas as rural areas, and twice as much for men as for women. Where the agricultural workers went differed for men and women. Men's employment expanded roughly equally into wage employment non-agricultural self-employment in both urban and rural areas. For women in rural areas, the movement of women out of agricultural was entirely absorbed by non-agricultural self-employment, while in urban areas, the reduction of women in agriculture went entirely into wage employment.

This paper will focus on wage employment of adults and its impact on inequality. Questions of agricultural and non-agricultural employment are left aside for the rest of the paper, but other chapters in this volume focus on agriculture (Benjamin and Brandt) and household enterprise (Vijverberg).

Wage Growth
We have seen that there was a steady expansion of wage employment in Vietnam in the 1990s for men and urban women. What happened to wages as this expansion occurred? Despite the expansion of wage employment, wages in Vietnam grew extremely rapidly in the 1990s. Average hourly wages increased by 10.5% per year in real terms between the 1993 and the 1998 VLSS surveys (Table 6). Wage levels increased by two-thirds in just five years. Wage growth was considerably faster than the growth in household income per person in the same period, which grew at 8.7% per year, as well as output per person in the economy as a whole which grew at 6.0% per year.[4,5]

Regional Wage Differences
Wage growth and wage levels were distributed unevenly across in different regions of the country, with a split between the two primary cities and the rest of the country (Table 6).[6] Ho Chi Minh City and Hanoi had higher wages than the rest of the country in 1993 and their wages grew much faster up until 1998.

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[4] Household income per capita growth is calculated from VLSS93 and VLSS98 data.
[5] Output per capita growth is measured by real GNP per capita growth in 1995 US $ (World Bank, 2000b).
[6] Wages here are hourly total compensation from the main job in the past seven days (or from the main job in the past twelve months if there is no main job in past seven days). This includes the value of compensation in kind as well as money wages.

In 1998, average Ho Chi Minh City and Hanoi wages were more than 50% higher than in all the other regions. Ho Chi Minh City wages started out 37% higher than all other regions in 1993 and, and grew one percentage point faster than overall wages until 1998. Wages in Hanoi were not much higher than wage levels in other parts of the country in 1993, but grew by 19% per year to become the highest wages in the country, even 5% higher than Ho Chi Minh City wages in 1998.

Ho Chi Minh City and Hanoi together make up a significant part of Vietnam's wage labor market, accounting for 25% of all wage jobs in the 1998 VLSS survey although they only account for 8% of the country's population (18% of all wage employment is in Ho Chi Minh City and 7% in Hanoi).[7]

Outside of Ho Chi Minh City and Hanoi, average wages in Vietnam were surprisingly similar across regions in 1993, and they became more so by 1998. Regions with lower wages in 1993 are the ones that saw the biggest wage increases in the 1993-1998 period, and the regions with the highest wages initially tended to grow more slowly. Medium-sized urban and rural central regions had the lowest average wages in 1993 and saw the largest increase in wages by 1998. The rural south, which had the highest wages outside of the two largest cities in 1993 saw the lowest increase in the following five years. With the exception of the two biggest cities, labor markets seem to be equilibrating over this period, with wages becoming more similar over the course of the 1990s,.

The divergence of the biggest cities from the rest of the country could be due to the fact that the demographic characteristics of workers and kinds of employment are different in different parts of the country. If the best-educated, most productive workers are drawn to the main cities, the wage disparity could be due to differences in worker characteristics rather than differences in wages for the same kinds of workers. Table 7 makes wage rates more comparable across region by restricting wages of those workers with at least a lower secondary school education, working for a private non-governmental or non-state-owned business, and a non-agricultural business. Skilled, private, non-agricultural wages show even faster growth over the 1993-1998 period, and a stronger convergence across regions than overall wages, again with the exception of the two primary cities. Hanoi had the lowest level of skilled private wages of any region in 1993 but caught up so fast that it had the highest wages of all by 1998, with wage growth of 27% per year.[8] When we look at workers with high education and private, non-agricultural employers, Hanoi and Ho Chi Minh City still have over a 50% wage premium. Except for the rural south, the two biggest cities have a 75% wage premium over the rest of the country for skilled private employment.

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[7] The urban population of Ho Chi Minh City was 4.4 million in 2000, and Hanoi had 1.6 million people out of a total population of Vietnam of 77.9 million. Ho Chi Minh City made up 5.6% of the population and Hanoi made up 2.1% (World Bank, 2000b).
[8] Some of the regional changes in Table 7 may be due to small sample sizes. In the worst case, there were only 20 skilled, private, non-agricultural wage observations for Hanoi in 1993. Averages in all other tables come from sample sizes of over 200 observations with the exception of Hanoi in 1993 for wage-related tables with a sample size of 136.

Hours Worked

At the same time that hourly wages grew extremely rapidly and employment shifted towards the wage labor market, hours worked in wage labor also increased rapidly, all of which contributed to the large rise in wage income. On average, hours worked in wage employment increased by 18% from 1993 to 1998 (Table 8). In 1993 there was a sharp difference between rural and urban wage employment in terms of total hours worked. Workers in medium and large cities worked about 50% more hours per year than rural wage laborers on average. Workers in Ho Chi Minh City worked the longest hours in 1993, averaging 2176 hours per year. Assuming an eight hour work day and a five day work week, this works out to 272 work days, or 54 work weeks.[9] These are long hours by any standard. Despite this, by 1998 working hours in Ho Chi Minh City had grown by nine percentage points. Ho Chi Minh City, Hanoi, and medium urban centers had the highest working hours in 1993, but had increases in working hours much more modest than rural and small urban increases. Rural and small urban areas partially caught up with the working hours in the medium and large cities between 1993 and 1998, with increases in rural wage labor working hours much larger than the increases in large cities.

Wage Employment Patterns

In sum, wage employment shows remarkable growth in wage levels, hours worked, and a more modest increase in the fraction of workers employed outside the home. Hanoi and Ho Chi Minh City maintain large wage premia, probably due to the residency permit restrictions in these cities that keep out people not born in the city.

III. Determinants of Wages in the 1990s

Which individual characteristics or employment characteristics determine how much an individual earns in the labor market? Previous work shows that wages are typically positively correlated with education levels and with work experience (at a decreasing rate).[10] In other countries, wages are typically negatively correlated with being female or an ethnic minority. Wages also typically vary by regions within a country. In the case of Vietnam where much of wage employment is still offered by the state and there is still a large amount of agricultural employment, indicators of private and non-agricultural employment also explain wage levels.

Returns to Education and Experience

We explore the determinants of wages with a simple earnings equation:

$$\log(\textit{Wage}_i) = \beta_0 + \beta_1 X_{1i} + \cdots + \beta_K X_{Ki}$$

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[9] 54 weeks is more than a year, so the workers must have been working more than five days a week or eight hours a day. At the time of the two surveys, the standard Vietnamese work week was six days.

[10] See Berndt, 1991, Chapter 5 for an accessible explanation of wage determinants and the regression specification used below.

Where *Wage_i* is the wage of individual i, $X_{1i},..., X_{Ki}$ are the K correlates of wages (such as education, experience, etc.), and $\beta_0, \beta_1,..., \beta_K$ are the effects of the correlates on wages. log( ) is the natural logarithm. With certain assumptions, the coefficient on education (β_1) can be interpreted as the internal rate of return to an additional year of schooling (see Berndt, p. 162).

The estimated effect of education and experience on wages is shown in Table 9. The estimated rate of return of schooling in Vietnam in 1993 was quite low, just 2.9%. The rate almost doubled to 5.0% in 1998, but is still very low compared to other developing countries. Psacharopoulos (1985, p.588), for example, reports an average rate of return of 11% for Asian countries, 13% for Africa, and 14% for Latin America among a large number of similar studies using a similar model of wage determinants. The increase in the rate of return to schooling from 1993 to 1998 of 2.1% is statistically significant.

"Experience", which is actually years since completion of schooling, is strongly positively correlated with wages, but at a decreasing rate, as expected, and shows no sign of changing from 1993 to 1998.

Table 10 shows a broader group correlates of wages: being female, a member of a non-Chinese ethnic minority, having Chinese origins, working for a non-agricultural employer, working for a non-governmental employer, and indicators of living in the two primary cities in Vietnam. The correlation of real wages with years of schooling is still strongly positive, though even lower with the inclusion of other correlates, and it still has a statistically significant increase from 1993 to 1998. Experience has a stable positive, but decreasing correlation with wages.

Women in Vietnam earn much less then men with the same observable characteristics, although the difference became smaller between 1993 and 1998. In 1993, wages for women were 31% less than their male counterparts, even after controlling for education and experience. The gap between men's and women's wages in Vietnam became smaller by 1998, when women's wages were 17% smaller.[11] The wage gap between men and women halved between 1993 and 1998, a statistically significant change.

Non-ethnic-Vietnamese (that is, non-Kinh) and non-chinese ethnic minorities do not show lower wage in 1993, but do show a 10% lower wage in 1998. Ethnic Chinese in Vietnam show the opposite pattern. They had a 25% wage premium in 1993, but this all but disappeared by 1998.

In both 1993 and 1998, non-agricultural employers paid higher wages, and in 1998, private employers paid a statistically signficant higher wage than state employers.

The regression in Table 10 properly tests whether the two primary cities, Ho Chi Minh City and Hanoi, have significant wage premia, other things being equal. Residents of

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[11] The estimated effect of a dummy variable in the wage regression is $e^b - 1$, where b is the coefficient estimate.

both cities earn much higher wages than residents of other regions with the same characterstics. Ho Chi Minh City earned a remarkable 80% higher wage than rural or small and medium urban area residents with the same education, experience, etc. in 1998. Hanoi residents earned 47% higher wages in 1998 than Vietnamese living outside the two largest cities. There is no sign that the wage premia of Ho Chi Minh City and Hanoi fell during the period from 1993 to 1998.

It should be noted that the R^2 statistic indicates that only 18% and 22% of the variation of wages in 1993 and 1998, respectively, were explained by the correlates in Table 10, so the largest part of wage variation is due to other unidentified factors.

Table 11 shows the effect of correlates on wage levels in 1998 separately by seven regions. The regional differences are strong. The rates of return to schooling are especially low in the rural Central region, in Small Urban areas, and in the rural South, where the rate of return is not significantly different from zero. The rate of return to schooling in Hanoi and the rural North is more than double the level in the three lowest regions, approaching a respectable 8.5% in Hanoi and 6.9% in the surrounding rural North.

The disadvantage of being female is pretty similar around the country except in the rural North and the rural Central region, where women come closer to obtaining their male counterparts earnings. The disadvantage of being a woman is greatest in Hanoi, where average wages for women are 25% lower wages for men with similar characteristics.

The disadvantage of being a non-Chinese ethnic minority varies widely across regions.[12] Only in Ho Chi Minh City and the rural South did ethnic minorities have statistically significantly lower wages in 1998, 29% in Ho Chi Minh City and 18% lower in the rural South. In Hanoi, the wages of ethnic minorities were on average almost four times higher than the wages of non-minorities. This may be due to a small sample effect, since this reflects just 16 persons out the small Hanoi sample of 215 wage earners, but the coefficient remains significant and of similar size in a quantile regression.

Non-agricultural employers paid higher wages in all the regions, but the effect was most pronounced in Hanoi, the rural North, and small urban areas. Private employers only clearly paid a wage premium in the rural North and the rural Central region, which could be due to the traditionally strong communist roots in these two regions which could motivate workers to take government jobs despite low government wages.

The clearest result from exploring the determinants of wage levels is that the labor market rate of return to schooling in Vietnam is quite low, but seems to have improved during the 1990s. It points to a vicious cycle in low education regions, because the rate of return is lowest in those parts of the country with the lowest education levels (the South), and the rate of return to education is highest in the highest education regions (the North).

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[12] An indicator for Chinese ethnicity was not included in the regional wage regressions in Table 11 because a number of regions had no Chinese in the survey sample.

There is also a substantial male/female wage gap, but this seems to have diminished during the 1990s.

IV. Methods for Measuring Inequality

The previous sections explored the remarkable growth of Vietnamese wages in the 1990s. The rest of the paper will examine the impact of wage employment on inequality in Vietnam. We start by considering a number of different measures of inequality that have desirable properties.

We choose inequality measures according to three criteria: they satisfy the "principle of transfers", they are additively decomposable across subgroups, and they can handle negative income values.[13] The principle of transfers is the intuitively appealing requirement that a transfer of income from a poorer to a richer person will increase the measure of inequality, so long as the transfer is not so large as to reverse the two persons' relative positions. All the commonly used inequality measures satisfy the principle of transfers. In particular, the Gini coefficient, the Generalized Entropy measures and the Atkinson inequality measures all adhere to the principle of transfers.

The decomposition of inequality across a set of groups is useful for assessing how much of total inequality is due to differences within the groups and how much is due to differences between the groups. These groups can be any mutually exclusive subgrouping of the population, such as region of residence or a household characteristic. Among inequality measures with standard characteristics, only the Generalized Entropy measures of inequality are additively decomposable, where the inequality within subgroups and the inequality between subgroups sums to total inequality (Shorrocks, 1984).

The decomposition of inequality across the source of income is a different problem because the sources are not mutually exclusive categories. Many households have income sources from more than one sector, for example from farming and wage employment. The additive decomposition of inequality across sources or uses of income is possible for any inequality index, and Shorrocks (1982) shows that there is only one rule for decomposing the inequality that satisfies a small number of reasonable properties.

Only two of the common inequality measures that satisfy the principle of transfers are well-defined for negative income levels, such as occur when there are year-on-year losses to farm and enterprise self-employment: the Gini coefficient and one of the Generalized Entropy measures (I_2, which is half the squared coefficient of variation).

This study uses four measures of inequality: the Gini coefficient and three Generalized Entropy inequality measures (see Appendix A for formal definitions of the inequality measures). The Gini coefficient is probably the most commonly used inequality measure,

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[13] Deaton (1997, pp. 134-140) provides a good short explanation of inequality measures.

and can be defined as a multiple of the covariance of individual income and the rank of individual income divided by average income. The Gini coefficient ranges between zero (perfect equality) and one (perfect inequality).

The Generalized Entropy measures of inequality are designated I_α, where the more positive the α parameter, the more sensitive the index is to differences at the top of the income distribution rather than the bottom. We use I_0 (also known as the Mean Logarithmic Deviation), I_1 (a.k.a. the Theil index), and I_2 (½ the squared Coefficient of Variation).

For mutually exclusive groups of people, a Generalized Entropy income inequality index for the whole population decomposes into a weighted sum of the inequality indices of the groups that make up the whole. Generalized Entropy indices I_α can be written as the sum $I_\alpha = I_{\alpha W} + I_{\alpha B}$ of the total within-group inequality $I_{\alpha W}$ and between-group inequality $I_{\alpha B}$.[14] The formulas for $I_{\alpha W}$ and $I_{\alpha B}$ are in Appendix A.

The solution for decomposing the share of inequality from income sources is simpler and more elegant. For any J sources of income, overall income inequality can be decomposed into the inequality contributed by each source

$$I = \sum_{j=1}^{J} \frac{\mathrm{cov}(y_j, y)}{\mathrm{var}(y)} I ,$$ (1)

where cov( ) is the sample covariance and var( ) is the sample variance. Since the inequality index I appears on both sides of the equations, it implies that the shares of inequality sum to one, and that they are independent of any particular inequality index chosen. Since our interest is in the relative contributions of each income source, we can dispense with the actual inequality index entirely. Note that if the covariance of the income from a particular source is negatively correlated with total income, that income source makes a *negative* contribution to total inequality. In particular, income sources characteristic of poor households may contribute negatively to inequality because when these sources predominate in the household, total income is lower resulting in a negative correlation.

Measurement Error
Measurement error is a serious problem when studying inequality, more than it is when studying other issues. Averages and growth rates of averages are typically unbiased in the presence of random measurement error due to the law of large numbers. Inequality measures, though, are typically *biased and inconsistent* in the presence of measurement error. Inequality is a measurement of variability, which is systematically increased by errors. Positive and negative errors balance out in the sample average, but both positive and negative errors add to the variance.

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[14] I thank Paul Glewwe for pointing out that the weights used to decompose the Generalized Entropy measure I_2 do not sum to one (unlike the decomposition weights for I_0 and I_1), which makes the decomposition of I_2 hard to interpret.

More important for this study than biases in the estimated level of inequality is that different income sources are likely to be suffer from very different levels of measurement error. Wage incomes are usually well-known by the survey respondent and others, making them easier to report accurately. Income from household farms and household enterprises are very difficult for the household and the researcher to calculate correctly. If household self-employment income has systematically large measurement error, wage employment could (spuriously) appear to contribute little to inequality while household enterprises appear to contribute a great deal to inequality, even when true income from both sources has the same inequality.

Most inequality indices depend on the variance of some transformation of income. The bias to inequality measures caused by measurement error is easily seen in the case of the I_2 inequality measure, which is the variance of income divided by its sample mean squared. Say that measured income y_i^* is equal to actual income y_i plus a mean zero measurement error ε_i, with variance σ_ε^2:

$$y_i^* = y_i + \varepsilon_i.$$

Actual income y_i has mean μ and variance σ^2, and is uncorrelated with the measurement error. Average measured income, $\bar{y}^*$, is unbiased: $E(\bar{y}^*) = E(\bar{y}) = \mu$, but the sample variance of measured income is biased: $\text{var}(y^*) = \text{var}(y) + \text{var}(\varepsilon) = \sigma^2 + \sigma_\varepsilon^2$. This causes inequality measures such as I_2 to be inconsistent when income is measured with error:

$$I_2^* = \frac{\text{var}(y^*)}{\bar{y}^{*2}}$$

$$\text{plim } I_2^* = \frac{\sigma^2 + \sigma_\varepsilon^2}{\mu^2} > \frac{\sigma^2}{\mu^2} = \text{plim} I_2.$$

The bigger the measurement error, the bigger the bias in the inequality index.[15]

Likewise if one calculates the relative contribution to inequality from different income sources using Shorrock's formula in Equation 1, the calculated contribution to inequality of income from sources that are poorly measured would be bigger than the calculated contribution of better measured income sources, simply due to measurement error. This is shown formally in Appendix B.

Measurement of household income is fraught with error, especially in low income countries. Survey respondents may have some reluctance to state their true income, and especially where household farm and non-farm enterprises predominate, as in Vietnam, households may not know even know their precise income. Calculating net revenue for household enterprises requires aggregating large numbers of recurrent input and labor costs and product sales as well as intractable practical and conceptual problems. How

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[15] This has interesting implications for cross-country inequality comparisons. Countries with worse-measured income data (which are probably poorer), will have a spuriously larger calculated inequality index.

does one account for home production, barter arrangements, and especially, large purchases of capital equipment that will provide services over many years? The VLSS makes a valiant effort to measure *all* of these items across hundreds of categories of inputs and outputs, but the overall aggregation of household net revenues nonetheless contains substantial errors. There are quite extreme positive and negative outliers in farm and non-farm household net revenues. There is no practical way to ensure that answers to all these questions about components of household net revenues add up to a consistent inventory of costs and revenues (although it would be interesting to confront the survey respondents with the calculated net result to see if they felt it corresponded to reality!). Researchers using the calculated household net income often resort to more or less arbitrary ways of trimming the outliers, but this does nothing to solve the problem of statistical bias caused by measurement error.[16]

The usual way that researchers work around this problem is to ignore the income data and use instead the better-measured household expenditure data. In fact, household expenditure, that is, consumption, is what we really want to measure anyway because it is a direct measure of the material well-being attained by the household.

Household expenditure can be thought of as an estimate of "permanent income" (Friedman, 1957). Household consumption decisions and well-being depend on the household's assessment of the smoothed expected income rather than the fluctuating annual transitory income. Since we care about the inequality in household well-being rather than inequality of transitory annual income, we could view the measured annual income as subject to two kinds of measurement error. One is the mismeasurement of annual income due to imperfect collection of household information. The other the mismeasurement of permanent income using accurately measured annual income data. In a context of highly variable annual income from year to year, inequality in well-being using household income data will be overestimated when households are able to smooth consumption.[17]

For this study, the simple solution of using household expenditure data rather than income data for inequality calculations does not work. Expenditure does not tell us how wage employment contributes to household income relative to other sources. Using income data directly for investigating the contribution of wages to inequality is especially problematic because while measurement errors are large for household self-employment earnings, the errors in wage earnings data are probably much smaller. Survey respondents usually know precisely what they are paid, and they know that people around them already have a good idea of what they earn, so they have less reason to hide what

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[16] This is certainly not a criticism of collecting detailed household production data in the VLSS and similar surveys. As noted, the mean income estimates are still unbiased. These data are very valuable to studying important questions of household production *per se*. And it is often possible to use the noisy income data to calculate consistent estimates of income inequality, as done in this paper.

[17] Consumption smoothing is harder in Vietnam because financial institutions are poorly developed and over the years have undermined their credibility with arbitrary behavior. However, this does not prevent consumption smoothing through the saving of commodities and durable goods, informal credit and debt arrangements within the village, and financial savings often in the form of buried gold.

they earn.[18] This makes calculating the contribution to income inequality of wage employment versus household production misleading. Even with exactly the same distribution of income from wage employment as from household self-employment, measurement errors in the self-employment data would spuriously show that self-employment contributes much more to income inequality, giving the false impression that wage employment is an equalizing force. In addition, household farm and non-farm production revenues are inherently variable due to natural weather and market fluctuations whereas wage payments are relatively stable. Since the distribution of well-being is what we care about, estimating the inequality contribution of household production income versus wage employment income even with perfectly measured annual income data would also spuriously show that household production was disequalizing even when permanent income had the same inequality across the income sources.

We can still consistently estimate the contribution of wage employment versus household production to the distribution of household income. We start by estimating the share of each income source from income data, but then apply it to expenditure data. Because the measurement errors for income are generally uncorrelated with the measurement errors in expenditure, measurement errors cancel out as in averages, not accumulate as in variances. The result is a consistent estimate of the contribution of income sources to inequality, as shown formally in Appendix B.

V. Vietnamese Wage Inequality in the 1990s

We apply the methods described in the previous section to look empirically at the relationship between wages and distribution in Vietnam using the two VLSS surveys.

The distribution of wages equalized to some extent during the 1990s. We divide wage earners into the "rich", the highest 20% of wages, the "middle class" with the middle 60% of wages, and the "poor" with the lowest 20% of wages. The wages of the poor grew at 14% per year, which was faster than the growth in the wages of the middle class (10% per year) and the rich (12% per year) (see Table 12). Note that households in the rich, middle, and poor categories in 1993 are not necessarily the same households in those categories in the 1998.

Since the VLSS survey reinterviewed the same households in 1998 that were in the original 1993 survey, we can also see what happened to those who were in the poorest or richest quintile in 1993 (Table 13). There was a high degree of earnings mobility, both up and down.[19] Of those who started out in the poorest quintile in 1993, only 34% of

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[18] Household rice harvests and certain other staple crop yields are probably common knowledge in rural Vietnam, to other villagers as well as to the village tax authorities, but input costs are not, and a lot of the profit in household farming is in difficult-to-observe non-staple agricultural production. Non-farm household enterprises are also very difficult for outsiders to observe.
[19] As shown by Glewwe and Nguyen (this volume), measured mobility is highly sensitive to errors, so part of the apparent high wage mobility could be due to measurement errors.

them were among the poorest in 1998. Because of this wage mobility, average wages of the poorest 20% in 1993 grew on average 24% per year. On the other hand, of those in the richest 20% in 1993, only 54% of them were still among the richest wage earners in 1998, and average wages of the richest in 1993 grew by only 5% per year.

We can also look backwards from the perspective of those who ended up in the richest or poorest quintile of earners in 1998 (Table 14). The picture is quite different. Those who ended up the poorest actually saw their average wage decline by 1% in the previous six years, while those who were the richest saw their wages grow by 16% per year. How can the prospective view of the richest and poorest in 1993 look so different from the view in hindsight in 1998? Because the poor in 1993 was not the same group as the poor in 1998. Most of the poorest wage earners in 1993 did not stay poor, and most of the poor in 1998 did not start out poor in 1993. Only 34% of those who were the poorest in 1998 had started out poor in 1993. This great churning within the labor market showed that those who held a job throughout this period had many opportunities to succeed and to fail. There was a strong tendency of regression to the mean: receiving especially low or high wages was usually a transitory phenomenon.

The simple table of wages by lowest, middle, and highest wage rates in Table 12 suggests that the distribution of wages has become more equal over the 1990s. This is confirmed by the summary measures of wage inequality in Tables 15 and 16. The statistics calculated are I_0, I_1, I_2, and the Gini coefficient, as defined in Appendix A. Overall wage inequality in Vietnam has indeed fallen from 1993 to 1998 by all measures except I_2, which most strongly weights high wage earners.

The general pattern of decreasing wage inequality contrasts sharply with what happened in the medium and large cities. Hanoi, Ho Chi Minh City, and the second tier medium urban centers had by far the lowest wage inequality in 1993. They are also the only regions of the country to see a rise in wage inequality over the 1990s. Hanoi and Ho Chi Minh City's wage inequality rose quickly, while it stayed the same in medium urban areas, and fell sharply in the rest of the country. It is likely that this unusual pattern in wage inequality, like the wage premium in the two largest cities, is influenced by the residency permit restrictions that are enforced there. In fact, wage inequality was probably worse in 1998 than these statistics show because the VLSS sample does not properly cover illegal migrants into the two biggest cities who lack residency permits, since the survey sample was drawn from local residency records. The illegal migrants almost surely have among the lowest wages in the big cities.

Another factor that could explain the low inequality in 1993 and the high inequality in 1998 for the medium and large cities is the prevalence of government employment there. In 1993, government employment was likely a large part of the wage labor market which tends to equalize wages since government wage levels tend to be similar across jobs. These cities are also the locations that have seen the greatest structural transformation during the 1990s, so that government employment played a much smaller role in 1998.

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The three Generalized Entropy inequality indices I_0, I_1, and I_2 allow us to compare the within-region inequality in wage rates versus between-region inequality. Despite the wage premium in the two biggest cities, between-region inequality accounts for only between 12% and 15% of overall wage inequality in 1998, depending on the index (Table 16). All the rest of the inequality is due to variation within regions. Eliminating the cross-regional differences in wages would have some effect on wage inequality, but most of it would remain.

VI. Wages and Income Inequality

If wage inequality fell between 1993 and 1998, what happened to the contribution of wages to overall income inequality? In this section we measure the impact of wages on income inequality, both using the simple, but biased, method in Equation 1 and the consistent method derived in Appendix B.

The inequality of household expenditure per person (as a measure of permanent income) rose from 1993 to 1998 (Table 17) at the same time that the inequality of wages was declining. Depending on the inequality measure, inequality rose by 5% to 13%. Wages are the major source of income for only a minority of Vietnamese households (only 18% of households in 1998, accounting for 21% of average household expenditure per person - see Table 18). Fifty-four percent of households depend in farming for their main income source, and another 18% rely on income from a household enterprise for the main income. The remaining 10% get their most of their income from other sources in a given year, mostly overseas remittances and other gifts, with some interest and leasing income.

Farming households have the lowest average per capita expenditure, only 60% of the income of predominantly wage employment households. But the average expenditure of wage-earning households are not the highest. Households running their own business had an average expenditure per person 13% higher than wage-earning households, and households who receive their main income from other sources do even better on average.

As discussed above, household income data suffers from substantial measurement errors, especially for farms and household enterprises since income must be netted out of the a large number of costs and revenues. Measurement errors tend to be large (and less obvious to survey respondents) when the measurements are the differences between much larger numbers, like costs and revenues.

Table 19 and 20 present the biased calculation of the share of inequality attributed to each income source using the formula in Equation 1 (in the column "No Correction"). The second column in Tables 19 and 20 present the consistent calculation of inequality shares using the formula in Appendix B (in the columns "Consistent Estimates").

There are large differences between the uncorrected estimates and the consistent estimates of inequality shares. The contribution to inequality of farming is underestimated by the biased calculation, and the contribution of wage employment and

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other income is underestimated. In both 1993 and 1998, the biased estimate shows that farming contributes to inequality, which the consistent estimate shows that equally distributed farm income actually reduces income inequality. In 1998, the differences are especially dramatic. The biased calculation shows that farming contributes about as much to total income inequality as wage employment. In fact, the consistent estimates show that wage employment contributes 33 percentage points more of total inequality than farming income does. Whereas wage employment accounts for 29% of total income inequality in 1998, farming income reduces inequality by 3%. The consistent estimates also show how important "other income", which is largely overseas remittances, is to income inequality, contributing almost half of all inequality in 1993, despite contributing the smallest share of income at 16%. The income share of other income rose to 18% in 1998, but its contribution to inequality fell to one third of the total, presumably because remittances are being spread more equally among households in 1998.

The share of inequality due to wage employment increased from 26% in 1993 to 33% in 1998, at the same time that the inequality of wages itself declined. This is possible because wage income was strongly negatively correlated with other income sources in 1993, but essentially uncorrelated with other income sources in 1998.[20] In other words, high wage earners are more likely to be in households with high incomes from other sources, such as farming and household businesses, in 1998 compared to 1993. In fact all income sources have become both less negatively correlated with other sources and less variable from 1993 to 1998, but the negative correlation of wage income fell more than for the other sources. This pattern suggests a diversification of economic activity within the household that one would expect from the period of rapid development that Vietnam has experienced.

Another way of quantifying the contribution of wage employment to household inequality which proves useful for projecting future inequality below is to divide households according to their primary income source and decompose household expenditure inequality by type of household. Tables 21 and 22 show that predominantly farming household expenditure is much more equally distributed than non-farm household expenditure. Inequality in household expenditure between other kinds of households are roughly similar, with the highest inequality among predominantly wage employment households. Wage employment households had the highest inequality among household types in 1998, even though the previous analysis showed that wage employment income is responsible for a smaller share of household inequality than enterprise income (Table 20), because high income wage employment households are more likely to have extra income from non-wage sources. Predominantly wage

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[20] The share of inequality of one income source compared to another depends on the ratio of the covariance of each income source with total income (see Appendix B). For the case of wage income, its share of inequality is bigger the bigger the covariance of wage income with total income. Since $cov(y_w, y) = var(y_w) + cov(y_w, y_s)$, where y_w is wage income, y is total income, and y_s is income from other sources, the share of wage income in inequality depends both on the inequality of wage income itself ($var(y_w)$) and how correlated wage income is with other income sources. Because income is measured with error, the consistent estimates inequality use total expenditure as an instrument for total income in the covariance calculations.

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employment households had higher inequality in 1998 than 1993 due to earning income from other sources, not from high inequality of wages themselves.

The consistent estimates of the contribution of each income source to total income inequality show that wage employment contributes almost a third of income equality about on par with household enterprise income and other income even though it only contributes about 20 percent of total income. Farm income, instead of being a substantial contributor to inequality as the uncorrected estimates make it appear, actually reduces household income inequality. The decomposition of household expenditure inequality by predominant income source also shows that predominantly wage employment households, household enterprise households, and other income households have similar levels of inequality, while farm households are substantially more equal.

VII. Projections of Future Inequality

The previous section showed that predominantly wage income households are roughly similar to predominantly household enterprise and "other" income households both in terms of inequality and income levels. Farming households, on the other hand, are quite distinct. They have much less within-sector inequality, and they have a much lower average income level.

One of clearest historical patterns of economic development is the shrinking role of agricultural sector as the economy grows, both as an employer of labor and as a share of output. Farms now make up half of all households in Vietnam. The fact that farm households are very different from other households, they are a large part of the economy, and their relative number will diminish as the economy grows means that we can predict an important part of how inequality will change in the near future. Inequality in Vietnam will rise over time as the proportion of equally-distributed farming households falls in the economy.

We can make empirical predictions of how fast inequality will change as the Vietnamese economy develops by examining the relationship between the decline of agriculture and economic development in other countries around the world. The relationship between income growth and the share of labor in agriculture, and the relationship between income growth and the ratio of agricultural income to total income are both well-established international patterns. If we estimate these relationships from historical data, and we can assume that inequality *within* the farming and non-farming sectors remains unchanged, we can predict the future course of inequality as a function of economic growth.

Statistics from the previous section confirm that farm households have more equally distributed income and lower income levels than non-farm households, and that non-farm households are similar across sectors. The Generalized Entropy indices of inequality in Table 22 are half the level for farming that they are for other income sources. Predominantly farming households have 54% of the average income of non-farming households (Table 18). The inequality indices for households whose main income sources are household enterprise, wage employment, or other income sources all have

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inequality indices within 8% of each other (Table 22) and average incomes within 30% of each other (Table 18).

To estimate the relationship between income level (as measured by GDP per person) and share of labor force in agriculture, and between income level and agricultural output relative to total output, we use cross-country time-series data.[21] Figure 2 shows the cross-country relationship between GDP per person and the share of labor force in agriculture. The data come from 111 countries with an average of 30 observations per country. The data shown for each country in Figure 2 are actually points on country-specific log linear trend lines to highlight the relationship in each country. Only 4% of countries had positive income growth and increasing share of the labor force in agriculture. Of the 15% of countries with an upward sloping country trend, 89% of them were countries with shrinking income, so the share of labor force in agriculture fell even though the economy was getting poorer. This suggests that the share of agriculture falls over time independently of income growth due to technical change.

The estimated relationship between the share of labor force and GDP per capita using cross-country data shows a strong decline in the share of agricultural labor as the income level rises (Table 23, column 1). The regression includes country-specific constants and a time trend, which shows a clear but small decline in the share of agricultural labor over time of a half a percentage point per year. The simple regression is able to explain 73% of all the cross-country variation in the labor force share in agriculture.

The ratio of agricultural income per person to average income per person is also strongly correlated with the level of income per person and time (Table 23, column 2). Agricultural incomes are lower relative to non-agricultural incomes at higher GDP per person levels, but agricultural incomes became more similar to non-agricultural incomes over time, probably due to technical change in agriculture. The net effect for a country growing at the rate of Vietnam in the 1990s is a decrease in agricultural incomes relative to non-agricultural incomes. The agriculture income share regression explains 21% of the cross-country variation.

The inequality projection is based on the assumption that the Vietnamese economy continues to grow at the rate at which it has for the previous decade: gross domestic product (GDP) per person grew 5.5% per year from 1988 to 1998. In other words, this is a projection of what would happen to income inequality if Vietnamese economic growth continued as it has in the recent past.

The inequality projections are shown in Table 24. The first column shows the actual figures for 1998, and the second and third columns show the projects for 2003 and 2008, respectively. The projection of the proportion of labor in agriculture depends on the regression estimates from Table 23, and shows a decline of 3.8% per five years. The projection of future agricultural GDP per worker depends on the second regression

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[21] The cross country data for share of labor force in agriculture and the ratio of agricultural value added to total output are from World Bank (2000b). The purchasing power parity GDP per person data are from the Penn World Tables 6.0 (2002).

estimates in Table 23, and shows that agricultural GDP per worker as a fraction of overall GDP per person declines by 3.4% per five years.

The within agriculture and within non-agriculture income inequality is assumed to stay constant at the 1998 level, and is measured by the I_0 inequality index. The total within inequality measure depends on the proportion of households in agriculture (which is taken to be equal to the proportion of labor in agriculture). As the proportion of the labor force in agriculture declines going forth to 2003 and 2008, total within inequality increases because agricultural households have lower inequality and their share of households is shrinking.

Between inequality also increases because average agricultural and non-agricultural incomes are diverging. Taking the sum of the within and between measures of inequality, total inequality increases by 4.9% from 1998 to 2003, and 4.4% from 2003 to 2008. This compares to an actual increase to I_0 of 9.6% from 1993 to 1998.

This projection shows with numbers that the secular decline in agriculture as the economy grows will increase inequality due to a shift in the composition of households, since Vietnamese agricultural households have much less inequality between them than non-agricultural households. The second effect captured in the projections is that the relative incomes of the average agricultural household and the average non-agricultural household will continue to diverge as the economy grows, causing the between-sector inequality to grow. This second effect actually accounts for more than half of the change in inequality in the projections as well as more than half of the actual change from 1993 to 1998.

The projections predict future inequality increases only half of the actual increase for 1993 to 1998. This is mainly because agricultural incomes have fallen behind nonagricultural incomes more rapidly from 1993 to 1998 compared to the change predicted by the cross-country evidence. The regression estimates predict that the ratio of agricultural GDP per worker to overall GDP per person will fall by 3.4% for the five year periods 1998-2003 and 2003-2008. The actual fall in expenditures per person of predominantly agricultural households relative to the average expenditures per person for all households fell by 5.3% for 1993-1998. If the 1993-1998 rate of decline in the ratio of agricultural incomes to total incomes was extended to the future periods, projected total income inequality would increase by 8.9% from 1998 to 2003 and 8.4% from 2003 to 2008, which is quite similar to the 9.6% rise in inequality for 1993-1998.

The projected rise in inequality is not inevitable if non-agricultural income distribution becomes considerably more equal in the future. During the 1993-1998 period, however, wage earning households and non-agricultural enterprise household earnings both became less equal, although predominantly "other" income household earnings became more equal (Tables 21 and 22). A sharp improvement in the equality of non-agricultural earnings would be surprising.

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If the divergence of agricultural and non-agricultural incomes is slower than predicted in Table 24, but income distribution within the agriculture and non-agriculture remain unchanged, then income distribution will worsen more slowly than predicted in Table 24.

The rising inequality that looks likely for Vietnam is a consequence of the declining role agriculture as the economy develops, and the unusually equal distribution of incomes among Vietnamese farm households. In low income countries with unequally distributed agriculture, economic development improves overall income distribution as the share of agriculture declines.

The increase in inequality due to the decline of agriculture can probably only be delayed by deliberately slowing economic growth and rising incomes in Vietnam. A way out of rising inequality (other than a sharp improvement in the equality of non-agricultural incomes) would be the rapid growth of incomes within agriculture while also preserving the equality of income distribution among agricultural households. Sustained growth in agricultural incomes on par with income growth in the rest of the economy is an historical anomaly. Vietnam escaping poverty will most likely have the unfortunate consequence of an increase in inequality, because historically, sustained development has almost always meant a shrinking role for agriculture. The inequality in the non-agricultural sector in Vietnam is not particularly high by international standards, however, and if unchanged, it provides the upper limit for the effect of the declining share of agriculture on inequality.

Conclusion

The labor market in Vietnam has seen very rapid change in the 1990s. Average real hourly wages grew by ten and a half percent per year between 1993 and 1998, faster than income per person in the economy. At the same time there was a substantial increase in hours worked, especially in rural areas, and a gradual increase in the share of the labor force in wage employment.

The rate of return to schooling is very low in Vietnam, although it increased from 2% 1993 to 4-5% in 1998. Women face substantial wage discrimination despite their schooling and work experience, but this also fell by half over the period. Even controlling for worker characteristics, workers in Hanoi and Ho Chi Minh City receive a substantial wage premium over the rest of the country, with wages over 50% higher than any of the other regions in the country. The primary city wage premium suggests that the residency permit restrictions contribute to inequality between the residents of the two biggest cities and the rest of the country.

Despite the rapid growth of the wages in the 1990s, wage inequality fell modestly. Wage employment has not been the locus of growing disparity between the haves and the have-nots in Vietnam.

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A new method for consistent decomposition of inequality by income source shows that contrary to the results of uncorrected methods, wage employment contributes a roughly similar amount to overall income inequality as other non-agricultural employment (household enterprise and remittances, mainly). Agricultural income actually reduces overall income inequality because inequality between agricultural households is much lower than inequality between non-agricultural households, and agricultural income has a lower correlation with other income sources.

The much lower inequality and income level in agriculture allows us to predict future inequality change in Vietnam, assuming that within-sector agricultural and non-agricultural household income distribution do not change. A declining share of agriculture as the economy grows in Vietnam means that income inequality will rise, assuming that within-sector inequality does not change. The rise in inequality will probably be 5% to 10% each five years for the next decade, after increasing by 9.4% from 1993 to 1998.

This rising inequality due to the shrinking share of agriculture will be difficult to avoid without giving up economic growth and rapid poverty reduction in Vietnam. Keeping a large proportion of the Vietnamese population on household farms would keep inequality from continuing to rise over time, but it would also keep the majority of Vietnamese at very low incomes because there are not good prospects for substantial rises in farm self-employment income without a major movement of labor out of farming.

Appendix A: Inequality Measures

The Gini coefficient can be defined as a multiple of the covariance of individual income and the rank of individual income divided by average income (Pyatt, Chen, and Fei, 1980):

$$G = \frac{2 \operatorname{cov}(y,r)}{N \bar{y}},$$

where y_i is individual income, r_i is the rank of individual i when the population is ordered by increasing income, $\operatorname{cov}(\cdot)$ is the sample covariance, and $\bar{y}$ is average income.

The Generalized Entropy measures of inequality have the form (Sen, 1997, p.140)

$$I_\alpha = \frac{1}{\alpha(1-\alpha)} \frac{1}{N} \sum_{i=1}^{N} \left[1 - \left(\frac{y_i}{\bar{y}} \right)^\alpha \right], \alpha \neq 0, \alpha \neq 1$$

with limit cases

$$I_1 = \frac{1}{N} \sum_{i=1}^{N} \frac{y_i}{\bar{y}} \ln \left(\frac{y_i}{\bar{y}} \right)$$

and

$$I_0 = \frac{1}{N} \sum_{i=1}^{N} \ln \left(\frac{\bar{y}}{y_i} \right).$$

The I_2 index simplifies to

$$I_2 = \frac{\operatorname{var}(y)}{\bar{y}^2},$$

which is the squared coefficient of variation.

For mutually exclusive groups, the overall Generalized Entropy indices decomposes into a weighted sum of the inequality indices of the groups that make up the whole. Assume there are several groups k with population N_k, average group income $\bar{y}_k$, and within-group inequality index $I_{\alpha k}$. Then a Generalized Entropy index I_α can be written as the sum $I_\alpha = I_{\alpha W} + I_{\alpha B}$ of the total within-group inequality $I_{\alpha W}$ and between-group inequality $I_{\alpha B}$ (Shorrocks, 1984).

$$I_{\alpha W} = \sum_k \frac{N_k}{N} \left(\frac{\bar{y}_k}{\bar{y}} \right)^\alpha I_{\alpha k}$$

is a weighted sum of the within-group indices. Between-group inequality $I_{\alpha B}$ has the form of I_α with $\bar{y}_k$ substituted for y_i.

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Appendix B. Inconsistency of Inequality Shares in the Presence of Income Measurement Error

For simplicity, take the case where income only comes from two possible sources: wage employment (w) and self-employment (s). Self-employment income is observed with measurement error, while wages are observed without error (relaxed below). Total income for person i is $y_i = y_{wi} + y_{si}$, where y_{wi} is wage income, and y_{si} is income from self-employment. Observed income for person i is $y_i^* = y_{wi} + y_{si}^*$, where y_{si}^* is measured income from self-employment. $y_{si}^* = y_{si} + \theta_i$ where θ_i is the measurement error. Actual incomes have a constant mean and variance, and may be correlated across source:

$$E(y_{wi}) = \mu_w; \ E(y_{si}) = \mu_s;$$
$$\sigma^2(y_{wi}) = \sigma_w^2; \ \sigma^2(y_{si}) = \sigma_s^2;$$
$$\sigma(y_{wi} y_{si}) = \sigma_{ws}.$$

Self-employment measurement error has a zero mean, constant variance, and is uncorrelated with incomes or across time:

$$E(\theta_i) = 0; \ \sigma^2(\theta_i) = \sigma_\theta^2;$$
$$\sigma(\theta_i y_{si}) = \sigma(\theta_i y_{wi}) = 0;$$
$$\sigma(\theta_i \theta_j) = 0 \ \forall i \neq j.$$

The estimated contribution of wage employment income to inequality relative to self-employment income from Shorrock's equation (1) above is

$$\gamma^* \equiv \frac{\text{cov}(y_w, y^*)}{\text{var}(y^*)} \bigg/ \frac{\text{cov}(y_s^*, y^*)}{\text{var}(y^*)} = \frac{\text{cov}(y_w, y^*)}{\text{cov}(y_s^*, y^*)}.$$

γ^* does not provide a consistent estimate of the ratio of income source contributions to inequality, γ.

$$\text{plim}\,\gamma^* = \text{plim}\left(\frac{\text{cov}(y_w, y^*)}{\text{cov}(y_s^*, y^*)}\right) = \frac{\sigma_w^2 + \sigma_{sw}}{\sigma_s^2 + \sigma_{sw} + \sigma_\theta^2}$$
$$< \frac{\sigma_w^2 + \sigma_{sw}}{\sigma_s^2 + \sigma_{sw}} = \text{plim}\left(\frac{\text{cov}(y_w, y)}{\text{cov}(y_s, y)}\right) = \text{plim}\,\gamma. \tag{B1}$$

Wage Income Also Measured with Error
In real life, of course, wage income will also be measured with some error, though usually much less than the errors in imputed self-employment income. Wage income certainly has "errors" if we are really interested in the inequality of permanent income, so that annual income would be viewed an estimate of permanent income containing substantial error, even though annual income itself is measured perfectly accurately. We

show that as long as the variance of self-employment income is large enough relative to wage income, then the same result as in Equation B1 still holds.

Let $y_i^* = y_{wi}^* + y_{si}^*$, where y_{wi}^* is measured income from wages. $y_{wi}^* = y_{wi} + \phi_i$ where ϕ_i is the measurement error. All other variables are the same as above, and

$$E(\phi_i) = 0; \quad \sigma^2(\phi_i) = \sigma_\phi^2;$$
$$\sigma(\phi_i y_{si}) = \sigma(\phi_i y_{wi}) = 0;$$
$$\sigma(\phi_i \phi_j) = 0 \ \forall i \neq j;$$
$$\sigma(\theta_i \phi_i) = 0.$$

Then the estimated contribution of wages relative to self-employment for income inequality is biased:

$$\text{plim} \gamma^* = \text{plim}\left(\frac{\text{cov}(y_w^*, y^*)}{\text{cov}(y_s^*, y^*)}\right) = \frac{\sigma_w^2 + \sigma_{sw} + \sigma_\phi^2}{\sigma_s^2 + \sigma_{sw} + \sigma_\theta^2}$$

$$\neq \frac{\sigma_w^2 + \sigma_{sw}}{\sigma_s^2 + \sigma_{sw}} = \text{plim}\left(\frac{\text{cov}(y_w, y)}{\text{cov}(y_s, y)}\right) = \text{plim} \gamma.$$

$$\text{plim} \gamma^* < \text{plim} \gamma \Leftrightarrow \sigma_\theta^2(\sigma_s^2 + \sigma_{sw}) > \sigma_\phi^2(\sigma_w^2 + \sigma_{sw}),$$

so $\text{plim} \gamma^* < \text{plim} \gamma$ if $\sigma_\theta^2 > \sigma_\phi^2$ and $\sigma_s^2 \geq \sigma_w^2$. That is, wages will appear to make a greater contribution to income inequality than it really does when measurement error is worse for self-employment income than wage income, and actual self-employment income is more variable than wage income, both of which are likely to be true.

Consistent Estimator

If we observe a second estimate of income whose measurement error is uncorrelated with the measurement error in y_i^*, then we can estimate consistently the contribution of each income source to total inequality. That is, we can estimate $\alpha_j = \dfrac{\text{cov}(y_j, y)}{\text{var}(y)}$ consistently, and hence also the ratio of the contribution of two sources of income, γ. We use household consumption expenditure per person, e_i, as a second estimate of income. $e_i = y_i + \varepsilon_i$, where

$$E(\varepsilon_i) = 0; \quad \sigma^2(\varepsilon_i) = \sigma_\varepsilon^2;$$
$$\sigma(e_i y_i) = 0;$$
$$\sigma(\varepsilon_i \varepsilon_j) = 0 \ \forall i \neq j;$$
$$\sigma(\phi_i \varepsilon_i) = \sigma(\theta_i \varepsilon_i) = 0.$$

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Our estimator of the contribution of wage income to total inequality is

$$\hat{\alpha}_w = \frac{\text{cov}(y_w^*, e)}{\text{cov}(y^*, e)}.$$

$$\text{cov}(y_w^*, e) = \text{cov}(y_w + \phi, y + \varepsilon)$$
$$= \text{cov}(y_w, y) + \text{cov}(\phi, y) + \text{cov}(y_w, \varepsilon) + \text{cov}(\phi, \varepsilon)$$
$$\text{cov}(y^*, e) = \text{cov}(y + \phi + \theta, y + \varepsilon)$$
$$= \text{var}(y) + \text{cov}(\phi, y) + \text{cov}(\theta, y) + \text{cov}(y, \varepsilon).$$

Since ϕ, θ, and ϵ are uncorrelated with y and y_w, and ϕ and ϵ are uncorrelated with each other,

$$\text{plim}[\text{cov}(\phi, y)] = \sigma(\phi, y) = 0$$
$$\text{plim}[\text{cov}(y_w, \varepsilon)] = \sigma(y_w, \varepsilon) = 0$$
$$\text{plim}[\text{cov}(\phi, \varepsilon)] = \sigma(\phi, \varepsilon) = 0$$
$$\text{plim}[\text{cov}(\theta, y)] = \sigma(\theta, y) = 0$$
$$\text{plim}[\text{cov}(y, \varepsilon)] = \sigma(y, \varepsilon) = 0,$$

so,

$$\text{plim}\,\hat{\alpha}_w = \frac{\text{plim}[\text{cov}(y_w, y)]}{\text{plim}[\text{var}(y)]} = \frac{\sigma_w^2 + \sigma_{sw}}{\sigma_w^2 + \sigma_s^2 + 2\sigma_{sw}} = \text{plim}\,\alpha_w.$$

For $\hat{\gamma} = \dfrac{\hat{\alpha}_w}{\hat{\alpha}_s}$, it follows that

$$\text{plim}\,\hat{\gamma} = \frac{\sigma_w^2 + \sigma_{sw}}{\sigma_s^2 + \sigma_{sw}} = \text{plim}\,\gamma.$$

So combining income shares from the poorly measured income data with total household expenditure allows us to obtain consistent estimates of the relative contribution of different income sources to total inequality.

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Figure1. Economic Growth in Vietnam (GNP per capita in 1995 US $)
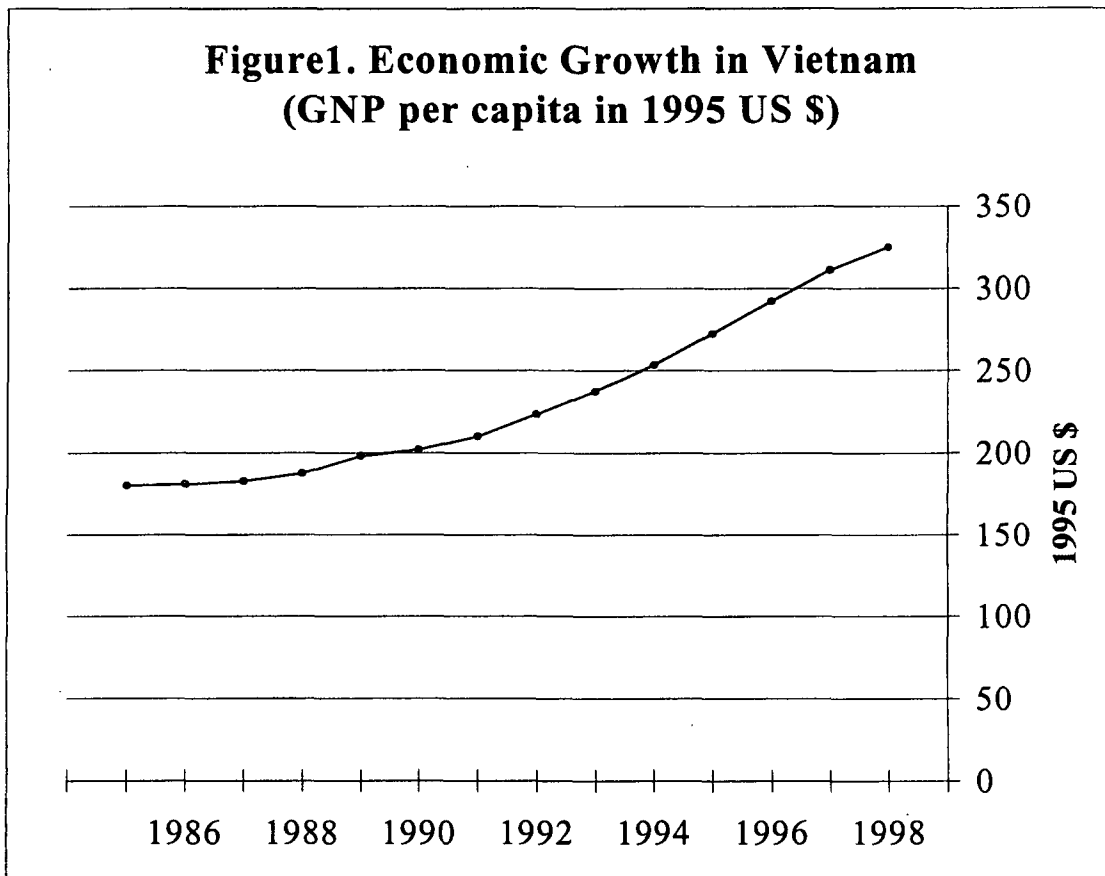
Source: World Bank, 2000.

Figure 2. Agricultural Labor Force Declines with Income Level
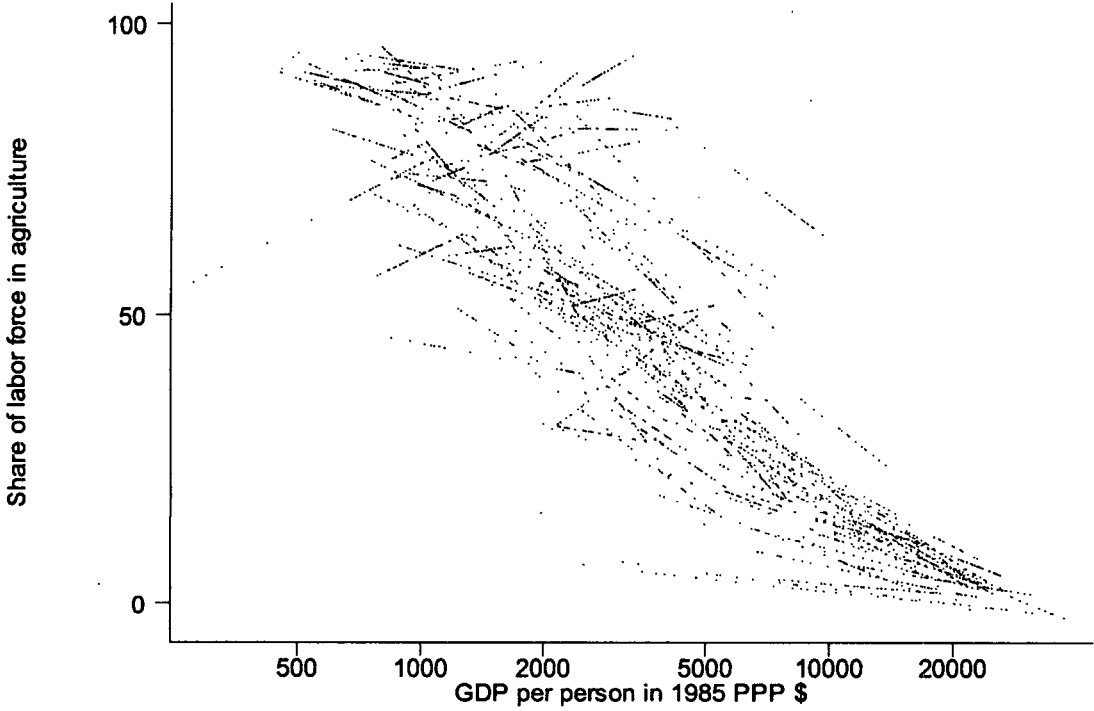
Data points are country-specific least squares trend lines for 114 countries between 1960 and 1990.
Source: World Bank, 2000b.

Table 6. Wages Levels and Growth by Region

	1993 wage	1998 wage	Annual change 1993-1998 (%)	% of 1998 HCMC Wage
Ho Chi Minh City	2.60	4.70	11.9	100.0
Hanoi	1.94	4.91	18.6	104.5
Medium Urban	1.64	3.10	12.8	66.0
Small Urban	1.81	2.91	9.5	61.9
Rural North	1.54	2.39	8.8	50.9
Rural Central	1.50	2.41	9.5	51.2
Rural South	1.93	2.65	6.4	56.4
Total	1.85	3.13	10.5	66.6

Wages are mean hourly compensation in thousand 1998 Dong

Table 7. Skilled Private Non-agricultural Wage by Region

	1993 wage	1998 wage	Annual change 1993-1998 (%)	% of 1998 HCMC Wage
Ho Chi Minh City	2.34	5.57	17.3	100.0
Hanoi	1.50	5.75	26.8	103.1
Medium Urban	1.53	3.16	14.5	56.7
Small Urban	1.82	2.95	9.7	53.0
Rural North	1.90	2.58	6.2	46.4
Rural Central	2.57	3.02	3.2	54.2
Rural South	2.23	3.62	9.7	65.1
Total	2.01	3.78	12.6	67.9

Wages are mean hourly compensation in thousand 1998 Dong

Table 8: Average Annual Hours Worked in Wage-Employment

Region	1993	1998	Change 1993-1998 (%)
Ho Chi Minh City	2,176	2,365	8.7
Hanoi	2,022	2,113	4.5
Medium Urban	2,027	2,184	7.7
Small Urban	1,816	2,169	19.4
Rural North	1,113	1,460	31.2
Rural Central	1,321	1,576	19.3
Rural South	1,276	1,628	27.6
Total	1,572	1,862	18.4

Source: Author's calculations from 1993 and 1998 VLSS data.

Table 9: Wage Regressions, 1993 and 1998

	(1) 1993	(2) 1998	(3) Difference 1998-1993
Schooling (years)	0.029 (6.29)**	0.050 (14.61)**	0.021 (3.84)**
Experience (years)	0.033 (5.42)**	0.025 (4.80)**	-0.008 (0.93)
Experience squared	-0.001 (5.37)**	-0.001 (4.52)**	0.000 (0.66)
Constant	7.269 (91.40)**	7.757 (128.23)**	0.488 (4.76)**
Observations	2,007	3,033	
R^2	0.04	0.08	

Absolute value of t statistics in parentheses

* significant at 5%; ** significant at 1%

Table 10: Wage Regressions, 1993 and 1998

	(1) 1993	(2) 1998	(3) Difference 1998-1993
Schooling (years)	0.019 (3.27)**	0.035 (8.01)**	0.016 (2.19)*
Experience (years)	0.027 (4.72)**	0.028 (6.04)**	0.001 (0.15)
Experience squared	-0.001 (4.71)**	-0.001 (5.55)**	-0.000 (0.29)
Female	-0.370 (10.69)**	-0.182 (6.83)**	0.188 (4.27)**
Minority	0.030 (0.39)	-0.107 (2.05)*	-0.137 (1.58)
Chinese	0.224 (2.66)**	0.005 (0.07)	-0.220 (2.17)*
Non-agricultural employment	0.126 (2.79)**	0.289 (6.42)**	0.163 (2.45)*
Private employer	0.001 (0.01)	0.082 (2.38)*	0.081 (1.37)
Ho Chi Minh City	0.609 (11.19)**	0.589 (16.24)**	-0.020 (0.32)
Hanoi	0.296 (4.15)**	0.384 (6.58)**	0.088 (1.06)
Constant	7.353 (71.91)**	7.530 (91.24)**	0.177 (1.24)
Observations	2,007	3,033	
R^2	0.18	0.22	

Absolute value of t statistics in parentheses

* significant at 5%; ** significant at 1%

Table 11: Wage Regressions by Region, 1998

	(1) Ho Chi Minh City	(2) Hanoi	(3) Medium Urban	(4) Small Urban	(5) Rural North	(6) Rural Central	(7) Rural South
Schooling (years)	0.054	0.085	0.045	0.032	0.069	0.027	0.015
	(6.11)**	(4.20)**	(3.86)**	(2.44)*	(4.63)**	(2.54)*	(1.59)
Experience (years)	0.019	0.029	0.022	0.047	0.026	0.020	0.035
	(1.76)	(1.58)	(1.79)	(3.15)**	(2.28)*	(1.63)	(3.54)**
Experience squared	-0.000	-0.001	-0.000	-0.001	-0.001	-0.000	-0.001
	(1.25)	(1.43)	(1.06)	(2.72)**	(2.44)*	(1.43)	(3.90)**
Female	-0.241	-0.284	-0.204	-0.196	-0.134	-0.066	-0.249
	(3.99)**	(2.40)*	(3.19)**	(2.84)**	(1.54)	(1.02)	(4.47)**
Minority	-0.345	1.561	0.116	-0.301	0.138	-0.067	-0.202
	(3.36)**	(15.18)**	(0.51)	(1.16)	(1.17)	(0.71)	(2.25)*
Non-agricultural employment	0.245	1.218	0.235	0.502	0.896	0.300	0.352
	(0.87)	(5.50)**	(1.74)	(3.02)**	(4.70)**	(3.48)**	(5.12)**
Private employer	0.012	0.014	-0.154	-0.052	0.260	0.406	0.057
	(0.15)	(0.11)	(1.98)*	(0.46)	(2.65)**	(5.07)**	(0.78)
Constant	8.093	6.480	7.774	7.205	6.312	7.384	7.727
	(24.73)**	(12.30)**	(32.66)**	(25.19)**	(22.52)**	(36.55)**	(51.21)**
Observations	556	215	499	402	270	433	658
R^2	0.13	0.19	0.13	0.12	0.23	0.15	0.16

Robust t statistics in parentheses

* significant at 5%; ** significant at 1%

Table 12. Wages of poorest 20% grew fastest

	1993 wage	1998 wage	Annual percent change
Poorest 20%	0.59	1.18	13.8
Middle 60%	1.60	2.58	9.6
Richest 20%	3.94	7.01	11.5
Total	1.87	3.13	10.3

Wages are mean hourly wages in thousand 1998 Dong

Source: Author's calculations from 1993 and 1998 VLSS data.

Table 13. Wages of poor in 1993 grew faster 1993-1998, rich grew slowei

	1993 wage	1998 wage	Annual percent change
Poorest 20% in 1993	0.61	2.07	24.4
Middle 60% in 1993	1.60	3.03	12.8
Richest 20% in 1993	3.82	4.80	4.6

Wages are mean hourly wages in thousand 1998 Dong

Source: Author's calculations from 1993 and 1998 VLSS data.

Table 14. Wages of poor in 1998 fell 1993-1998, rich grew fastest

	1993 wage	1998 wage	Annual percent change
Poorest 20% in 1998	1.25	1.20	-0.7
Middle 60% in 1998	1.78	2.66	8.1
Richest 20% in 1998	2.81	6.40	16.4

Wages are mean hourly wages in thousand 1998 Dong

Source: Author's calculations from 1993 and 1998 VLSS data.

Table 15. Inequality Measures of 1993 Annual Wages by Region

	I_0	I_1	I_2	Gini
Ho Chi Minh City	0.204	0.178	0.221	0.312
Hanoi	0.188	0.182	0.210	0.332
Medium Urban	0.239	0.236	0.318	0.365
Small Urban	0.351	0.306	0.388	0.420
Rural North	0.310	0.261	0.301	0.393
Rural Central	0.242	0.231	0.276	0.372
Rural South	0.322	0.263	0.303	0.394
Total Within Group	0.280	0.238	0.304	
Between Group	0.036	0.039	0.044	
Overall	0.316	0.277	0.348	0.403

Source: Author's calculations from 1993 VLSS data.

Table 16. Inequality Measures of 1998 Annual Wages by Region

	I_0	I_1	I_2	Gini
Ho Chi Minh City	0.264	0.259	0.359	0.378
Hanoi	0.243	0.232	0.311	0.355
Medium Urban	0.223	0.216	0.281	0.351
Small Urban	0.241	0.243	0.356	0.362
Rural North	0.190	0.163	0.170	0.314
Rural Central	0.158	0.144	0.162	0.290
Rural South	0.235	0.211	0.250	0.351
Total Within Group	0.222	0.218	0.329	
Between Group	0.039	0.042	0.046	
Overall	0.261	0.260	0.375	0.377

Source: Author's calculations from 1998 VLSS data.

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Table 17: Inequality of household expenditure per person

	I_0	I_1	I_2	Gini
1993	0.188	0.211	0.308	0.339
1998	0.207	0.235	0.347	0.357

Source: Author's calculations from 1998 VLSS data.

Table 18. Household Expenditure per Capita Broken Down by Main Income Source, 1998

	Population share	Mean	Fraction of Household Expenditure p.c.	Income share
Farming	0.541	2,157	0.722	0.391
Household Enterprise	0.176	4,019	1.345	0.237
Wage Employment	0.179	3,570	1.195	0.214
Other Income Sources	0.103	4,574	1.531	0.158

Source: Author's calculations from 1998 VLSS data.

Table 19. Decomposition of Household Income and Household Expenditure Inequality by Source, 1993

	No Correction Share of Inequality (%)	Consistent Estimates Share of Inequality (%)	Share of Income (%)
Farming	4.0	-5.2	36.3
Household Enterprise	40.2	40.4	25.0
Wage Employment	15.1	17.0	22.9
Other Income	40.6	47.9	15.8

Source: Author's calculations from 1993 VLSS data.

Table 20. Decomposition of Household Income and Household Expenditure Inequality by Source, 1998

	No Correction Share of Inequality (%)	Consistent Estimates Share of Inequality (%)	Share of Income (%)
Farming	15.6	-3.4	39.0
Household Enterprise	39.3	38.9	24.1
Wage Employment	17	29.3	19.3
Other Income	28.1	35.2	17.6

Source: Author's calculations from 1998 VLSS data.

Table 21. Inequality Measures of Household Expenditure per Capita
Broken Down by Main Income Source, 1993

	I_0	I_1	I_2	Gini
Farming	0.115	0.124	0.161	0.263
Household Enterprise	0.186	0.199	0.267	0.336
Wage Employment	0.185	0.192	0.236	0.337
Other Income Sources	0.269	0.284	0.401	0.401
Within Group	0.154	0.176	0.271	
Between Group	0.033	0.035	0.037	
Total	0.188	0.211	0.308	0.339

Source: Author's calculations from 1998 VLSS data.

Table 22. Inequality Measures of Household Expenditure per Capita
Broken Down by Main Income Source, 1998

	I_0	I_1	I_2	Gini
Farming	0.103	0.106	0.125	0.251
Household Enterprise	0.198	0.213	0.286	0.349
Wage Employment	0.250	0.267	0.375	0.390
Other Income Sources	0.220	0.234	0.308	0.367
Within Group	0.158	0.186	0.297	
Between Group	0.048	0.048	0.049	
Total	0.207	0.235	0.347	0.357

Source: Author's calculations from 1998 VLSS data.

Table 23: Agriculture in relation to income across countries

	(1) Ag. labor share[1]	(2) Ag. output p.c. ratio[2]
GDP per person (log of 1996 PPP USD)	-0.056 (20.65)**	-0.200 (26.33)**
Time (year 1960 = 1)	-0.0045 (57.59)**	0.0042 (20.48)**
Constant	9.87 (69.67)**	-6.18 (16.41)**
Observations	3,399	2,926
Number of Countries	114	106
R^2	0.73	0.21

Absolute value of t statistics in parentheses
significant at 5%; ** significant at 1%
Both regressions includes country-specific constants.
1) Ag. labor share is the fraction of agricultural workers in the total labor force.
2) Ag. output p.c. ratio is the ratio of agricultural value added per worker to GDP per capita.

Table 24: Inequality Projections 2003 and 2008.

	1998 (Actual)	2003 (Projected)	2008 (Projected)
GDP per person[a]	325	428	563
GDP p.c. growth[b]	5.5%	5.5%	5.5%
Proportion of labor in agriculture[c]	54.1%	50.3%	46.5%
Agricultural GDP per worker[d]	235	224	214
Non-agricultural GDP per worker[d]	431	429	425
Inequality of agricultural income (I_0)[e]	0.103	0.103	0.103
Inequality of non-agricultural income (I_0)[e]	0.223	0.223	0.223
Total within inequality (I_0)	0.158	0.163	0.167
Inequality between ag/non-ag (I_0)	0.046	0.052	0.057
Total income inequality (I_0)	0.204	0.215	0.224
Change in inequality (since 5 years before)	9.6%	4.9%	4.4%

[a] For 1998, this is the purchasing power parity GNP per capita estimate for Vietnam (World Bank, 2000b). The 1998 level of GNP per capita is not used in the projections.

[b] 5.5% real growth of GDP per capita is the rate for Vietnam for 1988-1998 (World Bank, 2000b).

[c] 1998 value estimated by proportion of working age individuals in predominantly agricultural households in the 1998 VLSS (Table 18).

[d] 1998 value estimated from the ratio of average expenditures per person of predominantly agricultural and non-agricultural households (Table 18).

[e] All values set to the 1998 value estimated from the VLSS (Table 22).

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