Wage inequality and returns to education with capital market distortions: the case of Vietnam

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Abstract

"Shock therapy" transitions in Eastern Europe facilitated movement of skilled workers into privatized industries offering high wage premia relative to state industries. Other transitional economies (notably China and Vietnam) have been slower to relinquish control over key industries and factor markets. Some costs of this piecemeal approach are now becoming apparent. We examine the spillover of continuing capital market distortions into the market for a complementary factor, skilled labor. Using Vietnamese data we find that capital market segmentation creates a two-track market for skills, in which state sector workers earn high salaries while non-state workers face lower demand and lower compensation. Growth is reduced directly by diminished allocative efficiency and incentives to acquire education, and indirectly by higher wage inequality and rents for workers with access to state jobs.

JEL Codes: J31, P23, F16.

1. Introduction

The skill premium – the ratio of wages for skilled or relatively highly educated workers to those of workers with low skills or education – is an important and widely used indicator of progress in economic development. It provides information about the distribution of income, at least among wage earners. It also signals incentives for individuals to acquire education or skills, the accumulation of which (in the aggregate) is essential to long-run economic growth. Further, trends in the skill premium reveal, indirectly, some of the consequences of changes in production structure and employment associated with economic growth or globalization.

The idea of a single, economy-wide skill premium presumes the existence of a unified market for human capital. In some developing and transition economies, however, this assumption may not be justified. If the labor market is segmented by policies or market failures, then equilibrium skill premia can differ among workers even if they are alike in other respects such as gender and ethnicity, and both wages and returns to skills can in principle evolve independently. In this case skill premium data can yield more information than listed above. They provide circumstantial evidence of the nature and extent of imperfections in the wage labor market. This in turn makes it possible to ask new normative questions about economic efficiency, and about the distribution of income and opportunity among workers.

In this paper we explore trends in wages and returns to education in the wage labor market of a transitional developing country, Vietnam. That country's transition to "market socialism" since about 1990 has been marked both by extensive domestic policy reforms and by a huge increase in exposure to global markets. *A priori*, each process has momentous impacts in the labor market. Our data cover almost two decades of the transition, during which time average wages

rose in real terms and average returns to education also increased. Both of these trends are widely observed in the course of economic growth and the transition to a market economy, as we discuss in more detail below. But the Vietnamese data also reveal two unusual patterns.

First, the most important trends have not been linear – nor even monotonic – over the entire transition period. In particular, while average real wages rose from 1993 to 2008, most of this increase took place during the 1990s; in the 2000s there was a clear slowdown in wage growth. Likewise, skill premia rose sharply during the 1990s but leveled off and even declined somewhat in the 2000s.

Second, we find persistent differences in both levels and growth rates of wages and skill premia across some subsectors of the labor market, even after controlling for ethnicity, gender, location and other characteristics. These differences can be seen between state and non-state employers. Prior to the mid-1990s state sector wages offered no premium for education; this "wage grid" system was dismantled only after a major reform in the early 1990s. Another dimension over which we find variation is that of traded and non-traded industries. Vietnam's move from near-autarky to more integration with the global economy has been promoted by measures—notably exchange rate unification and depreciation, trade policy relaxation, and domestic commercial policy reform—which increase the domestic terms of trade between traded and non-traded industries.

If internal policy reforms, especially the relaxation of wage controls in the state sector, and external (trade and FDI policy) reforms have been so extensive, why is it that intersectoral gaps in wages and skill premium persist? We hypothesize that this is due to incomplete transition, specifically, the persistence of interventions in capital and labor markets, even as extensive

external liberalization was taking place. The government's policy of giving state firms preferential access to capital creates segmentation in the capital market, and this spills over to the market for skills because of capital-skill complementarity. Consequently, a program of economic policy reform that is both gradual and incomplete may impose substantial costs in the form of inefficient allocation of both capital and skilled labor. This in turn might give rise to persistent inequality of income and opportunity.

There is a large microeconomic literature devoted to estimating the determinants of wages and returns to education for individuals. We review a Vietnam-specific subset of these in the next section. But our work also connects to two areas of macroeconomic research, on transition economies and on globalization.

In Eastern Europe and the former Soviet Union (EE/FSU), the collapse of communism around 1990 caused deep and sustained recessions and dramatic reductions in state sector output and employment. The recovery of employment during this transition was led by private (and newly privatized) firms. Workers with skills specific to state-owned firms suffered relative wage declines (Brainerd 1998); there was positive selection of skilled and ambitious workers into private sector enterprises unconstrained by the state sector wage grid (Adamchik and Bedi 2000), and overall there was a rise in average returns to skills, led by growth of skill-intensive private sector firms (Flanagan 1995; Orazem and Vodopivec 1997; Adamchik and Bedi 2000; Munich et al. 2005). The evidence from EE/FSU transitions seems to support the contention that smaller, privately held firms are in general more open to new ideas and technologies. This is also the contention in recent work on China, another economy undergoing a slow and as yet highly incomplete transition (Lin 2011; World Bank/DRC 2012).

The global trend toward more open trade and capital market policies also dates from around 1990. It too has stimulated a lot of research, much of it evaluating the effects of trade policy reforms and globalization on wages and skill premia. Many studies of low-income economies undergoing trade liberalization have found that skill premia have risen rather than falling as predicted by the Heckscher-Ohlin/Stolper-Samuelson model. In Latin America and Asia, skill premia and wage inequality have increased along with integration into the global market (Wood 1997; Arbache et al. 2004; Knight and Song 2003). These trends may still be consistent with Heckscher-Ohlin in that the rise of China and India to global prominence has caused a sharp rise in the global endowment of unskilled labor. Other analyses, however, have identified Ricardian technology-based comparative advantage as playing a leading role, especially in the more dynamically growing developing and transitional economies (Feenstra and Hanson 1997; Zhu and Trefler 2005). If market-driven growth of skill-intensive industries is the main cause of rising wage inequality, then there is no cause for concern on welfare grounds. However, these studies' findings are for *average* skill premia. At least one more recent study finds (in the case of China) that the averages mask differential rates of skill premium growth within a segmented labor market (Li and Coxhead 2011).

Vietnam's transition is superficially similar to those in EE/FSU in that there was a great deal of new private sector activity and rising skill premia. By contrast with EE/FSU, however, economic growth in Vietnam remained positive throughout the transition. Moreover, state enterprises, while contracting in relative terms, by no means became irrelevant or marginalized. Rather, their privileged access to capital and other resources meant that they were well placed to take advantage of opportunities created by closer global integration. In this paper we explore how such differences in transition experiences might explain the observed trends in Vietnam's

wage labor market, in particular the rise in average wages and skill premium, as well as the persistence of inter-sectional wage and skill premium gaps.

The remainder of this paper is structured as follows. In section 2 we describe the data and conduct a preliminary examination of possible reasons for observed trends and puzzles. In section 3 we sketch a simple model of wage and skill premium determination in the presence of policy interventions in both capital and labor markets. Section 4 provides an econometric exploration of trends in skill premia, taking account of the key features of two simultaneous transitions--internal market and sectoral reforms and external trade and FDI liberalization--by discriminating between state and non-state sectors, and traded and non-traded industries. In section 5 we draw conclusions and consider possible implications for longer-term growth and development.

2. Wage growth and skill premia during Vietnam's twin transitions

2.1. Prior studies

The microeconomic literature on wage growth, wage inequality, and returns to education in Vietnam has become increasingly rich as data accumulate. All existing studies use data from the Vietnam Household Living Standard Surveys (VHLSS; see section 2.2 below). Most estimate variants of the well-known Mincer equation (see Table 1). Differences in methodologies and data among these studies mean that estimates of skill premia vary considerably. Nevertheless, findings regarding *trends* are consistent across studies. First, real wages increased rapidly in Vietnam during its transition. From 1998 to 2008, real earnings doubled for men in the wage labor force, and more than doubled for women (Sakellariou and Fang 2010). Second, returns to education in Vietnam are low but have increased over time, a trend that is broadly similar to the

experiences both of China and EE/FSU. However skill premia have yet to reach levels comparable with international data (see Psacharopoulos and Patrinos 2004).[1]

There is also strong evidence of persistent wage differentials in several dimensions. These include gender, ethnicity, and region (Pham and Barry 2007b; Liu 2006), but also (and somewhat more surprisingly) institutions—specifically, state vs. non-state sector employment. Imbert (2010) studied the state/non-state sector wage gap, noting the rise in average earnings of state sector workers from 1993 to 2006. He finds that the rise in the state sector wage premium cannot be explained by a change in worker selection into the sector; rather, it is due to differences in returns to characteristics or sectoral differences in wage-setting. Our work confirms and extends this result.

Liberalization of the exchange rate regime, external trade and capital flows have played a major role in the transition. Oostendorp and Doan (2010) examine the labor market effects of trade liberalization and find that it lowered returns to education by 1.2-3.6%, though in their study most of this decline was due to changes in the industry distribution of employment rather than lower Mincerian returns. We explore the traded/non-traded dimension further in this paper and reach a somewhat different conclusion.

Relative to the foregoing empirical literature we make a twofold contribution. First, we use all available rounds of the VHLSS, from 1993 through 2008. This enables us to study the evolution of the Vietnamese labor market over a longer period than was previously possible. The combined data span almost two decades of extensive domestic reforms and rapid economic integration. Second, we examine skill premium trends along the two dimensions of particular importance to the transition discussed above: state or non-state firms, and traded or non-traded

industries. Because Vietnam's transition occurred in piecemeal fashion, dividing the data in this way enables us to identify the contribution of external liberalization to wage growth and rising skill premia separately from that of domestic labor market reforms, and to examine potential interactions between the two types of reform.

2.2. Data

The VHLSS[2] was carried out in 1993, 1998, and then every other year from 2002 to the present. We have access to data from 1993 to 2008. The surveys gather data on household income and expenditure and are designed to measure living conditions and poverty and inequality (Grosh and Glewwe 2000). They are intended to be representative at the national level. They include modules that generate the employment and wage data used in this paper. Early rounds of VHLSS were smaller in size (4,800 households in 1993 and 6,000 in 1998). The survey year 2002 had the largest number of households (29,533). In the most recent three rounds, the number of households surveyed has stabilized at around 9,000.

We include all individuals of working age (15-60 years) with reported wages. The hourly wage is calculated by dividing annual total wage income (salary plus cash bonuses and in-kind benefits) by the estimated number of hours worked during the year. Only the primary job is counted. Within each survey year, wages are regionally deflated to January of that year using deflators provided by the surveys. For year 2002, there are no data on experience, so we replace it with *min*{age–17, age–schooling years–17}.

To measure years of education, most other studies based on VHLSS data have used the survey's original schooling year variable, which ranges from 0 through 12 years. We adjust schooling years for highest educational level (junior college means 14 years of education, a college degree

16 years, master's degree 18 years, and Ph.D. 21 years). As a result, our calculations of average years of schooling are higher than other studies. This might also slightly lower our estimates of returns to schooling.

Finally, we also allocate workers into traded and non-traded industries.[3]

2.3. Descriptive statistics

We begin by characterizing the data and analyzing wage trends.[4] The first lines in Tables 2 and 3 show that real wages for all groups have risen over the years. However, the pace of growth has been unequal across groups, and the trends have not been linear (see Table 3). Wage growth has been higher for those with more education, so skill premia have risen. In 1993 the skill premium, as measured by the ratio of the average wage for workers with different educational levels to those for workers with no schooling, hardly existed (Figure 1). From 1993 through 2002, as the economy went through a series of domestic reforms, there was a dramatic increase in the skill premium, most especially for college-educated workers. Interestingly, however, this rise did not persist in the second reform decade. In fact, Figure 1 shows that for some levels of education, the skill premium actually declined slightly from 2002-2008.

Another interesting revelation in Table 2 is the evolution of the wage differential between state and non-state sectors. In 1993, average wages of state workers were only 90% of those in non-state. But from 1993-2002 wages grew much faster in the state sector, with growth rates of 18% in 1993-1998 and 17% in 1998-2002, as against only 9% and 4% in the non-state sector (Table 3). As a result, state sector wages quickly caught up with and then exceeded those in non-state sectors; by 2002, state sector workers' average wage was 175% that of non-state sector workers.

During 2002-2008 non-state sector wages regained some ground; the state to non-state wage ratio declined from 1.75 in 2002 to 1.57 in 2004. However, this difference has persisted.

The rise of state sector wages and their persistent premium over those in non-state sectors stands in strong contrast to trends seen in the transitions of the EE/FSU countries. Interestingly, however, these data are similar to those from a comparable period in China, where the ratio of average state to non-state sector wages rose from 0.4 in 1988 to approximate parity (0.9) in 2001, while the coefficient of variation of wages across institutions fell from 0.46 to 0.16 (Cai, Park and Zhou 2008, Table 6.4).

2.4. Wage determinants: preliminary analysis

While the descriptive analysis yields interesting results, when examining factors associated with wage differentials we need to control for covariates. We do this initially with standard OLS wage regressions (Mincer 1974):

$$log(Wage_i) = \beta_0 + \beta_E E_i + \boldsymbol{\beta_X X_i} + \beta_S S_i + \beta_T T_i + \varepsilon_i \quad (1)$$

where i indexes workers, $Wage_i$ is reported hourly wage, E_i is education measured by years of schooling,[5] S_i is state sector dummy, T_i is traded industry dummy, and $\boldsymbol{X_i}$ is a set of covariates including experience, gender, ethnicity, and regional dummies.[6] The results (Table 4) show that in 1993, the return to one additional year of schooling was statistically different from zero but very low at just 0.019, or 1.9%. By 1998, this had jumped to 4.1%, and increased in each subsequent period, reaching 5.8% in 2008. Even after these increases, however, our estimates suggest that average returns to education in Vietnam remain low by international standards (Psacharopoulos and Patrinos 2004).

The contrasts between periods are also notable. Between 1993 and 2002 returns to education rose 147%, or about 16% per year. In 2002-08 they rose by just 23%, or only 4% per year.

An important insight from these basic OLS results is that there is conspicuous instability across decades in the parameter estimates for the state sector and traded industry dummy variables. In particular, state sector employment was associated with a significantly negative wage effect in 1993 and 1998, but a positive one in 2002 and 2008. The traded industry dummy was not statistically significant in the 1990s, but became negative and significant in the 2000s. In 2002, as Vietnam adjusted to the aftermath of the Asian financial crisis and its own set of policy reforms (see section 2.5 below), the wage discount for tradable sector employment was a remarkable 10-11%. But even six years later, this discount remained a significant 3-5%. By themselves, these results provide a striking contrast with the EE/FSU experience, where state employment declined and traded industries expanded rapidly as the transition progressed. They also raise questions about the trajectory of the transition as reflected in the wage labor market. Vietnam's state-owned industries have indubitably flourished, and the wage data seem to reflect that; yet so too have its trade-oriented industries. Reflecting on the estimates just presented, it seems that there may be more processes in the data than the basic model is capable of capturing. In the remainder of this paper we explore this possibility and its implications: first by means of a brief review of Vietnam's transition, second with the help of a theoretical model, and third by fitting nonlinear wage regressions allowing for interactions among the internal and external components of the transition process.

2.5. Vietnam's transition

In contrast with the 'shock therapy' transitions of most EE/FSU economies, Vietnam's transition has extended over many years (see Table 5). In early reforms, the government liberalized product markets and trade, implemented policies to attract foreign capital, and began to "equitize" (i.e., partially privatize) some state-owned enterprises. However, high rates of import protection and other forms of preferential treatment were retained for products and services dominated by state-owned enterprises (Athukorala 2006). Private sector business enterprises were legalized from 1990, albeit under restrictive conditions. But while product markets have been liberalized over time, relaxation of state controls over factor markets has been much slower and more uneven than that in the former EE/FSU economies. As a result, access to capital through the banking system remained essentially closed to private borrowers, while state firms could obtain funds at below-market prices. By 2000, capital per worker in state firms averaged VND 147m, nearly four times greater than in the private sector (VND 40m).[7] There was a strong bias toward joint ventures with state firms in tradable industries, mainly operating at the higher end of the capital-intensity range (World Bank 1995).

In the labor market, the government introduced a number of changes that affected wages and conditions for state sector workers. These changes included a wholesale reform of state sector enterprises (resulting in the loss of an estimated 1.5 million state sector jobs), and the 1994 Labor Law, which relaxed somewhat the regulations governing state sector workers' compensation and benefits (Moock et al. 2003). These labor law reforms were thought by contemporary observers to have had little direct impact on private sector workers as "in general the private sector was not hampered by the more rigid labor remuneration regulations" to which government agencies and state-owned enterprises were subject (World Bank 1995: 63). Despite such reforms, the state

sector labor market remains tightly regulated to this day, and rationing of state-sector jobs continues to be a common practice, with non-transparent selection procedures and substantial "fees" for successful appointments widely reported.

As a result of continued state control in critical factor markets, the role of the state sector in the Vietnamese economy did not decline as in the EE/FSU transition economies; rather, it was strengthened in certain aspects. Early growth in tradable industries was dominated by state enterprises (some with foreign buy-in, in the form of joint ventures), largely producing import-substitutes using capital-intensive technologies. Export revenue growth in this period was dominated by agriculture (especially rice and coffee) and natural resources such as oil and coal. As the World Bank (1995) concluded, "These privileges - in particular preferential access to land and foreign trade quotas and licenses - have played a very important role in the concentration of foreign direct investment in joint ventures with state enterprises, which is transferring to them new financial, managerial and technological resources." Undoubtedly, SOEs' access to foreign capital and joint venture partnerships in the 1990s helped raise their productivity, and along with it the returns to their workers.

Only later, at the start of the 2000s, were reforms adopted that encouraged private sector engagement with the global economy and promoted a more level domestic playing field between the state and private sectors. The Enterprise Laws of 2000 and 2005, in particular, consolidated the legal basis for organized private sector activity, and legalized private sector joint ventures as well as wholly foreign-owned firms. The Enterprise Law of 2000 eliminated over one hundred business license requirements and considerably reduced the time and cost needed to register business, leading to a dramatic increase in the number of registered private enterprises (Hakkala and Kokko 2008, page 86).

However, with capital market segmentation still in place, private sector investment continued to be crowded out by state sector firms. The non-state tradable sector activities that grew fastest, as a consequence, were those employing technologies and factor proportions consistent with comparative advantage as defined by the vector of factor endowments *net* of those employed in the state sector. This is the decade during which assembly-driven light manufacturing became Vietnam's leading source of export earnings after coal and oil. Demand for higher-skilled labor has also grown, but mainly in non-tradable service-sector activities such as banking, finance, insurance and administration, all of which have remained the preserve either of the state (including provincial governments) or of state-owned companies.

This review suggests considerable, if circumstantial, evidence that there is a policy-driven form of segmentation between state and non-state sectors. Moreover, trends in wages and skill premia observed in the Vietnamese labor market in the 1990s and 2000s might be explained by shifts in both internal capital and labor market policies and external trade liberalization. We next construct a simple model to formally examine the mechanism for this potential link between policies and labor market trends. This in turn lays a foundation for empirical hypothesis tests in section 4.

3. Theory

Assume that representative firms in state and non-state sectors produce the same output, face the output price vector p, and share the same production function $f(L,T,K)$, where L is unskilled labor, T is skilled labor, and K is capital. Under the counterfactual of complete and undistorted markets, both types of firm choose factor employment to maximize profit, given by $p*f(L,T,K) - wL - qT - rK$, where w, q and r are economy-wide uniform unit prices for unskilled labor,

skilled labor, and capital respectively. Under the usual assumptions of concavity and linear homogeneity, this profit maximization yields factor demand functions $L_i^*(w,q,r,p)$, $T_i^*(w,q,r,p)$, and $K_i^*(w,q,r,p)$, where i indexes non-state (N) and state (S) sectors. Let w be unity by choice of unskilled labor units. Then relative labor demand $H_i=T_i/L_i$ is a declining function of the relative factor price q: $H_i^*(q,r,p)$.

An important feature of the model is the assumption of complementarity between capital and skills (Griliches 1969; Krusell et al. 2000; Duffy et al. 2004). Complementarity requires:

$$\partial H_S/\partial r_S < 0 \text{ and } \partial H_N/\partial r_N < 0$$

The interaction of capital-skills complementarity with policy distortions in factor markets rationalizes observed patterns of intersectoral divergence and convergence of skill premia during Vietnam's transition. Capital market interventions cause deviation from the competitive equilibrium above. The government sets the price and quantity of capital made available to the state sector at r_s^{max} and K_S^{max} respectively. This yields a new relative labor demand function for state firms, $H_s(q, p, r_s^{max}, K_S^{max})$ while that for non-state firms is still $H_N(q, r_N, p)$. Under this policy state and non-state firms no longer face the same rental rate of capital, but they still face the same relative wage. Moreover the quantity constraint on capital allocations to state firms imposes a limit on the number of skilled jobs they can create. For a given capital constraint, the maximum number of skilled workers hired in state firms is $Q(K_S^{max})$.

Figure 2 captures the main idea. We assume a fixed total supply of skilled workers and full employment. The horizontal axis measures the total skills endowment, and the vertical axes measure relative wages in state and non-state sectors. State sector demand for skills is measured from the left by the curve H_S, and non-state demand from the right, by the curve H_N.

Without policy distortions, equilibrium is at the point where the value marginal product of skills is equal across sectors, at H^*, with a common unit price q^*. If there is only a capital market distortion, then in the skilled labor market both state and non-state firms still face the same relative wage q^*. In the absence of capital-skills complementarity, cheaper (or more readily available) capital to the state sector leads to more hiring of skilled workers, which crowds out skills in the non-state sector. However, complementarity means that the capital quota also causes segmentation in the skilled labor market. It raises the equilibrium relative wage in the state sector to q_s while lowering that in the non-state sector to q_N. This conjecture is consistent with the divergence observed in the data.

Capital rationing in the state sector is the indirect cause of segmentation in the skills market, and generates divergent skill premia. A change in K_S^{max} directly affects the gap in skill premia through a corresponding change in the quota of skilled state-sector jobs (Q). Moreover, other changes that affect relative labor demands in the two sectors—such as changes in output prices due to trade liberalization, or capital injections due to policy changes or foreign direct investment—also alter the gap, by displacing the relevant skilled labor demand curves in relation to each other and the hiring constraint. For example, an increase in the government's allocation of capital to SOEs will shift that the state sector's relative labor demand curve to the right, raising wages paid to state sector skilled workers and widening the inter-sectoral gap. On the other hand, an increase in foreign direct investment into the non-state sector will increase that sector's relative labor demand (a leftward shift of that curve in Figure 2), raising wages paid to skilled workers in non-state firms, and so narrowing the gap.

This analysis accounts for equilibrium skilled wage differences across sectors, but leaves one remaining puzzle. If limits on the hiring of skilled workers by state firms lower the cost of the

same workers to non-state firms, why do these firms not adopt more skill-intensive technologies? The answer, we surmise, lies in a macroeconomic link between the otherwise disjoint sectoral capital markets. As in China (Lin 2011), Vietnam's state-owned industries have preferential access to domestic capital at low administrative prices. Their borrowings are limited only by administrative quotas, and the capital they borrow is frequently cycled back into the economy in a variety of forms of spending and speculative activity. Seeking to maintain monetary stability, and lacking adequate sanctions over state sector activity, the monetary authorities attempt to stabilize credit growth by limiting supply to the non-state sector. This pushes private firms toward less capital-intensive processes. Capital-skills complementarity then ensures that their demand for skills is also low.

This stylized model is useful in explaining what happened to skill premia in many transition economies. In the former communist countries of Eastern Europe, transition and globalization involved a sharp reduction in the capital stocks of state firms but a dramatic increase in those of private firms. This directly reduced the relative demand for skilled labor in state firms while raising it in private firms (in Figure 2, the relative labor demand curves for the state and non-state sectors both shift to the right). The net result was a relative increase in skill premia in the private sector as this sector expanded. In Vietnam, as explained earlier, transition has not been accompanied by contraction of the state sector. We take advantage of policy changes in Vietnam between two decades of reform (1990s and 2000s) to test the hypothesis that *trends in inter-sectoral skill premia gap in Vietnam were a result of incomplete transition (i.e., continued state intervention in capital and labor markets) coupled with rapid external liberalization*.

Specifically, during the 1990s, the state sector expanded because of preferential treatment in the capital market. Firms either received capital directly from the government, or had easy access to

subsidized loans from state banks or foreign investments. This capital market distortion, coupled with rationing of skilled sector jobs in state firms, led to widening of the gap in skill premia between state and private sectors (the relative labor demand curve for state sector shifts to the right in Figure 2). As will be shown empirically below, this widening of the skill premium gap was the most pronounced among state firms in the traded sectors, because trade liberalization during this period also favored state firms more.

In the 2000s, there was a gradual leveling of the playing field between state and private sectors. Private firms started to receive more capital investments, especially in the form of foreign direct investments. This increased the private sector's relative labor demand (shifting it to the left in Figure 2), reducing the gap in skill premia.

In the next section, we examine the empirical evidence for this hypothesis.

4. Explaining skill premia – the role of domestic and international reforms

4.1. Empirical strategy

The foregoing theoretical discussion hypothesizes that wage trend and inter-sectoral wage gap in Vietnam are a result of shifts in both domestic policies on labor and capital markets and in external liberalization of trade and FDI. To measure the impacts of these simultaneous internal and external policies, simply including state sector and traded industry dummies (as in section 2.4) is likely inadequate. These policies are likely to influence wages not only through intercept shifts, but also through changes in returns to education and in returns to other workers' characteristics. Furthermore, there could be interactions between the two sets of policies.

To account for the impacts of these two coterminous sets of policies and their potential interactions, we sort wage-earners into four groups: state and traded (ST), non-state and traded (NST), state and non-traded (SNT), and non-state and non-traded (NSNT). Our empirical strategy is to test for statistical differences in estimated returns to education across groups and years. We achieve this with "stacked regressions." That is, we interact the four group dummies with year dummies and with all explanatory variables including the constant term. We pool data for pairs of years (1993-1998, 1998-2002, and 2002-2008)[8] and calculate the change in returns to education for each group in each period. For example, for the period 1993-1998, the estimated equation is:

$$\begin{aligned}\log(Wage_i) = {} & \boldsymbol{\alpha_{ST}^{98}} * ST * Yr1998 * \boldsymbol{X_i} + \boldsymbol{\alpha_{ST}^{93}} * ST * Yr1993 * \boldsymbol{X_i} \\ & + \boldsymbol{\alpha_{SNT}^{98}} * SNT * Yr1998 * \boldsymbol{X_i} + \boldsymbol{\alpha_{SNT}^{93}} * SNT * Yr1993 * \boldsymbol{X_i} \\ & + \boldsymbol{\alpha_{NST}^{98}} * NST * Yr1998 * \boldsymbol{X_i} + \boldsymbol{\alpha_{NST}^{93}} * NST * Yr1993 * \boldsymbol{X_i} \\ & + \boldsymbol{\alpha_{NSNT}^{98}} * NSNT * Yr1998 * \boldsymbol{X_i} + \boldsymbol{\alpha_{NSNT}^{93}} * NSNT * Yr1993 * \boldsymbol{X_i} + \epsilon_i\end{aligned} \quad (2)$$

where *i* indexes workers and $\boldsymbol{X_i}$ includes the constant term, education, and all other covariates. *Yr1998* and *Yr1993* are dummy variables for 1993 and 1998 respectively. When interacted with education, $\Delta_j^{93\text{-}98} = \alpha_j^{98} - \alpha_j^{93}$ is the change in returns to education between year 1993 and year 1998 for workers in group *j* in {ST, SNT, NST, NSNT}. In effect, (2) is a triple difference-in-difference model in which there are two policy treatments: (i) internal labor and capital market policies, which directly and extensively affect state firms and their workers first and foremost, and (ii) external trade policies which affect traded industries more directly. As a result, there are four comparison groups (the non-state and non-traded group, NSNT, is the control group). Our

difference-in-difference model is general in that we allow *all* coefficients, not just the intercept or the returns-to-education coefficient, to vary across groups and years.

By using a difference-in-difference model, we focus on explaining the differential changes in returns to education for each group in each period, *not* the level of returns to education for each group in each survey year. The former is explained by group-specific characteristics, while the latter is explained by group-specific trends over the relevant time periods, which are a result of differential policy treatments. For instance, the change in returns to education for group *j* ($\Delta_j^{93\text{-}98}$) might be different from that for group *j'* ($\Delta_{j'}^{93\text{-}98}$) because during 1993-1998, policies impact workers group *j* and group *j'* differently.

One more empirical issue can contaminate the link between policy changes and skill premium trends: there might be *unobserved* worker characteristics causing workers to self-select into each group. If these unobserved characteristics correlate with the determination of wages, OLS estimates will be biased. We are especially concerned with endogenous selection into the state sector[9] because state sector skilled jobs are frequently asserted to be *not* subject to a competitive hiring process; rather non-competitive market forces such as family connections determine this selection process. We examine selection issues quantitatively in section 4.3. It turns out, however, that although we cannot reject the hypothesis of endogenous selection, there are no major differences in parameter estimates relative to OLS. Thus we feel comfortable that self-selection into state sector jobs does not contaminate the link from policy changes to wage trends already found in the OLS results.

4.2. Results

The regression results for equation (2) for the three periods (1993-1998, 1998-2002, and 2002-2008) are shown in Tables A1, A2, and A3 in Appendix A. Nearly all estimates differ from zero at conventional significance levels. To focus on our main story, we discuss only those results that relate to returns to education in each of the groups and time periods. These are presented in summary form in Table 6. Panel (a) of the table reports returns to education by year for each group, which are also presented in Figure 3. The figure shows that in 1993, only workers in state firms and non-traded industries had a positive return to education; those in state firms but traded industries actually had a negative return to education. In fact, in 1993, workers in state firms and non-traded industries were the only ones with any measurable skill premium. The gap in returns to education between this group and other workers persisted and even widened through time; by 2008, the return to an additional year of schooling for workers in state non-traded industries (8.7%) was significantly higher than the next highest figure (5%, for workers in state traded industries). Despite increased integration with the global economy, returns to education in non-state traded industries were the slowest to rise, and by 2008 reached only 2.7%, half the rate for state workers in equivalent industries.

As already noted, skill premium differences between state and non-state traded industries diminished in the 2000s. This is consistent with progress (albeit at a slow rate) in domestic policy reforms that removed impediments to private sector engagement in commercial activity in general, and international trade and FDI in particular.

Trends between years can be seen in Table 6, panel (b), or in Figure 4. During the early reform period, 1993-98, there were significant rises in returns to education for all groups, but especially

so for workers in state firms and traded industries. These workers began with a significantly negative skill premium, so the rising premium reflects the relaxation of the command economy wage grid. But it also suggests a positive interaction between institutions and globalization. The average worker in a state firm experienced a rapid increase in returns to his/her education in the 1990s, but this increase was even higher if this worker was also in a traded industry. Thanks to the ability of state firms to attract large quantities of new investment both from the domestic economy and from abroad, state workers in traded and joint-venture industries captured a dividend from the decade of state-led globalization.

The middle period, 1998-2002, was one of slower growth as the Vietnamese economy experienced aftershocks from the Asian economic crisis. These took the form of a slowing of export demand and FDI inflows. For private sector workers, skill premium growth stalled during these years. State sector workers, however, suffered no such penalty, again indicating the advantages enjoyed by these industries even well into the economic transition. The tables only began to turn during the second phase of transition, from 2002-08. In these years, non-state traded sector skill premia began to catch up, because no other group during this period experienced any significant rise in returns to education other than workers in non-state traded industries. These data signal the start of a convergence in skill premia. Despite this catch-up, however, non-state traded sector workers still had substantially lower returns to education compared with workers in other groups in 2008, as already seen in Table 6 panel (a) or Figure 3.

This changing trend is consistent with the nature of policy shifts, as discussed earlier. By the 2000s, the country had deepened its external reforms, signing a bilateral trade agreement with the USA (2001) and preparing for WTO accession (2007). Moreover, domestic reforms now began to level the playing field between state and private firms. The former began to face more

competition in domestic markets from private firms and private-sector joint ventures, and of course from foreign firms both in world markets and (increasingly) in the Vietnam home market itself. The Enterprise Laws of 2000 and 2005 facilitated FDI inflows to private sector firms. All these measures stimulated the expansion of non-state, labor-intensive traded industries, which over the past decade have become the engines of export and employment growth in Vietnam. At the same time, we see that the state traded sectors also began to converge on factor proportions more consistent with the comparative advantage of the Vietnamese economy. Between 2002 and 2008, returns to education in state traded industries ceased to increase – and in fact, even fell slightly. Deepening of both external and domestic policy reforms in the 2000s explains the beginning of skill premium convergence, with catch-up by workers in traded industries and private firms.[10]

In summary, the empirical evidence supports our hypothesis that changes in skill premium gap between state and non-state sectors were a result of both internal and external policy changes in between the two decades of reforms (1990s and 2000s). Our findings extend and to some extent unify those of prior contributions to this literature. As in Imbert (2010), we find evidence that the gap in skill premium between workers in state and private sectors increased over time. We show further that this gap is entirely due to changes occurring in the 1990s, and ceased to increase in the 2000s following adoption of a more complete program of domestic reforms. This is revealed only by examining the interaction between institutional and trade factors. Our analysis has also shown the net impact of trade liberalization on wage premia might be masked by interactions between institutions and trade. In this respect it complements other findings that trade liberalization reduces returns to education (Oostendorp and Doan 2010).

Despite increases over time, and with the exception of the state non-traded workforce, after two decades of reform and liberalization returns to skills in Vietnam remain low by international standards. Our estimates, based on a generalization of the Mincer model, yield rates of return to education considerably lower than those in prior studies using earlier rounds of VHLSS data and/or more restrictive estimation strategies.

4.3. Robustness checks for selection issues

As noted, OLS estimation raises potential selection bias problems arising from workers' decisions to enter the wage labor market or to choose state employment. To correct for selection into wage labor, we use the Heckman model. The second-stage wage equation (the primary equation of interest) is equation (1) above, and the first-stage selection equation is:

$$P_i = \gamma_0 + \boldsymbol{\gamma_z Z_i} + e_i \qquad (3)$$

P_i is a dummy variable which equals 1 if the worker participates in the wage labor market and has a reported wage. $\boldsymbol{Z_i}$ is a vector of identification variables including the dependency ratio, a household head dummy variable, and non-wage income (non-wage income variables are not available for survey years 1993 and 1998). Also included in $\boldsymbol{Z_i}$ are education and a subset of covariates in $\boldsymbol{X_i}$ (gender, ethnicity, urban dummy, and age). The results (Table 7) show that the null hypothesis of no selectivity into wage labor is rejected. However, there are no major qualitative differences between OLS and Heckman estimates to alter our story.

To correct for endogenous selection into state sector jobs, we use a treatment model.[11] The primary equation of interest is still equation (1). The endogeneity of the impact of having a state sector job stems from an unobservable latent variable:

$$S_i^* = \delta_0 + \boldsymbol{\delta W_i} + u_i \quad (4)$$

Here, $\boldsymbol{W_i}$ includes covariates such as education, gender, ethnicity, and urban dummy, but also an identification variable (called "network") which equals 1 if a worker's household has at least one other member with a state sector job. The decision or ability to obtain a state sector job is made according to the rule: $S_i = 1$ if $S_i^* > 0$, and $S_i = 0$ otherwise. If ε_i in equation (1) is correlated with u_i in equation (4), then OLS estimates will be biased.

Comparing the treatment regression estimates in Table 8 with OLS estimates in Table 4, we see that OLS estimates of returns to education tend to be biased upward. However, there are again no qualitative changes in the story being told. All coefficients still have the same signs and statistical significance, and their values are of similar magnitude and follow the same trends as in the OLS regressions.

5. Conclusions

In this paper we identify the separate wage and skill premium effects of globalization and domestic policy reforms, and of their interactions, in a transition economy, Vietnam. We do so with the aid of a data set spanning a period much longer than in most existing studies of transition economies. We test the hypothesis that broad trends in the timing and sequencing of reforms strongly influence trends in wages and inter-sectoral differences in skill premia. Specifically, the combined effects of trade and FDI liberalization with continued high levels of intervention in capital and labor markets explain the widening wage and skill premia gaps between state and non-state sector workers in the 1990s and their persistence into the 2000s.

In a low-income country where both capital and skills are scarce, our results point to significant development implications of the transition strategy. In such a country, there is a potentially large growth dividend associated with further relaxation of special treatment for state-owned enterprises. As a group, these industries absorb a large share of Vietnam's investment capital and its skilled labor, yet they are highly inefficient and their activities contribute a far smaller share of overall income growth and job creation. In the presence of persistent capital market segmentation, state sector activity has *both* depressed returns to skills in non-state sectors *and* crowded out more skill-intensive forms of private sector growth. Vietnam's transition "from plan to market" has been less disruptive than in Eastern Europe, yet our results suggest that even faster growth would have been possible had domestic reforms extended sooner and more deeply into factor markets.

The incomplete transition also has negative consequences for equality of income and opportunity. We have found that the return to education is substantially higher for workers with coveted state-sector jobs.[12] We find also that family connections are very strong predictors of employment in state firms (see Table 8); thus, such connections indirectly raise returns to education. The rationing of state sector jobs on non-meritocratic criteria—an inevitable consequence of capital market segmentation—is undoubtedly a contributing factor both to inequality of opportunity and to corruption, both of which have corrosive effects on economic development. A promising area for further research is to investigate in greater detail the dynamics of selection into state-sector employment and the effects of this wage inequality on household income distribution and on the household distribution of incentives to invest in education.

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Appendix A: Determinants of log(wage): generalized model

[Tables A1-A3 here]

Notes

[1] The exception is a study by Doan and Gibson (2010). Using OLS and Heckman estimators, they find that the rate of return to one additional year of schooling in Vietnam rose from about 3% in 1993 to about 10% in 2008, a level comparable to returns to schooling in other developing countries.

[2] In earlier years, the surveys were called Vietnam Living Standard Survey, or VLSS.

[3] Details on how industries are categorized are available from the authors upon request.

[4] In the very first years of the transition the VHLSS data show an appreciable increase in the share of the labor force in wage employment, from 26% in 1993 to 40.9% in 1998. Subsequently, however, the ratio remained very stable at around 41%, with the exception of a brief dip to 36% in 2002, following the Asian crisis.

[5] We also ran regressions in which education was measured by highest degree attained instead of years of schooling. Detailed results are available upon request.

[6] In this and all subsequent regressions, we examine robustness with respect to industry. The results are not substantively altered by inclusion of industry fixed effects among the covariates. Detailed results are available upon request.

[7] Authors' calculations from the Enterprise Survey.

[8] Use of this subset of survey years sharpens the focus on 'early' versus 'late' reform periods. However, the results are not sensitive to the use of data form intervening surveys (2004, 2006).

[9] We feel less concerned about endogenous selection into traded vs. non-traded industries, because this sorting can be explained by many of the *observed* worker characteristics such as gender, ethnicity, education, regional/urban dummies. The bias issue arises only if there are *unobserved* worker characteristics that determine workers' selection into traded industries and also correlate with wage determinant. As of now, we do not have any potential suspect for such unobserved worker characteristics.

[10] While the current analysis indicates that the rise in returns to education for workers in traded non-state sector was due to globalization and further domestic reforms, it cannot tell us the underlying mechanism for this change. More specifically, we cannot test the impact of globalization under the Heckscher-Ohlin model vs. models of trade in intermediate goods (Feenstra and Hanson 1997); the former would predict a decrease in skill premia while the latter would predict a rise. To carry out this test, we would need to disaggregate the industrial

classification further into import-competing vs. export-oriented and more, which our current data would not allow. This is clearly an interesting area for future research if data become available.

[11] We use the command *treatreg* in Stata to implement the treatment model. For details of this model, please see Maddala 1983 (117-122).

[12] From the regression results in Table 8, we can calculate the total effect of education on wages taking into account the treatment effect of education (treatment here refers to the fact that education increases a worker's chance of obtaining a state-sector job, which gives him/her a wage premium). That is, $\partial W/\partial E = \beta_E + \delta_E * \beta_S$, where W = wages, E = years of schooling, so $\partial W/\partial E$ = the marginal effect of education on wages, β_E = the education coefficient in the main wage equation (1), δ_E = education coefficient in the treatment equation (4), and γ = the coefficient on state-sector dummy in the main wage equation (1). Inclusion of the treatment effect can increase the returns to education by more than 100% for the year 2002 and 50% for the year 2008.

Table 1: Studies on wage distribution and estimates of returns to schooling in Vietnam

Paper	VHLSS years used	Methodology	Results
Gallup 2002	1993, 1998	OLS Mincerian	Returns to one year of schooling: 1.9% in 1993, 3.5% in 1998
Liu 2005	1993, 1998	OLS Mincerian; estimate separately for male and female, and for workers in government, SOE, or private sector; decomposing gender wage gap into within- and between-sector differences	Returns to one year of schooling range from 3.3% to 7.5%; lower for females and in private sector; gender wage gap has decreased from 1993 to 1998
Doan & Gibson 2010	1998 through 2008	Heckman method to correct for selection into wage employment	Returns to one year of schooling: 3.8% in 1998, increasing to 10% in 2008
Liu 2006	1993, 1998	Hay's two-stage method (generalization of Heckman) to correct for selection into wage employment; Katz and Murphy (1992) framework to identify supply and demand factors.	Returns to one additional year of schooling ranges from 3% to 6%; shift in demand in favor of more educated workers drives changes in wage structure
Pham & Reilly 2007a	1993, 1998, 2002	Mean and quantile regression separately for male and female; Oaxaca decomposition of gender wage gap into treatment and endowment effects at mean and at quantiles of conditional wage distribution	Gender wage gap halved between 1993 and 2002
Pham & Reilly 2007b	2002	Oaxaca decomposition of ethnic wage gap into treatment and endowment effects at mean and at quantiles of conditional wage distribution	Ethnic wage gap is largely attributable to differentials in returns to endowments

Oostendorp & Doan 2010	1998, 2002, 2004, 2006	Endogenous employment choice for sample selection; workers divided into three groups: non-traded, import-substituting, and export-oriented industries; diff-in-diff to study impact of trade liberalization on returns to education.	Returns to education: 3-5% at 6 years of education; 6-12% at 12 years; 7-17% at 15 years; trade liberalization reduces returns to education by 1.2 - 3.6%.
Sakellariou and Fang 2010	1998 through 2008	Oaxaca-Blinder decomposition of contribution of changes in education and other explanatory variables to changes in wages at quantiles of the unconditional wage distribution, for men and women separately	For men: wage growth underpinned by both increases in endowment of productive characteristics and changes in wage structure; for women: it was mostly the latter
Imbert 2010	1993 through 2006	Exploit the panel data (1993-1998 and 2002-2006) and modify the Oaxaca decomposition method to decompose public-private sector wage gap into: constant earnings diff. between public and private workers, diff. in returns to productive skills, selection into public sector	Public-private sector wage gap did not decline but increased over time; changes in the returns to skills are the driving factor

Table 2: Mean hourly wages (thousand VND)

	1993	1998	2002	2004	2006	2008
All workers	1.83	2.9	3.83	4.54	4.56	7.34
Gini coefficient	0.38	0.35	0.42	0.36	0.35	0.39
State	1.71	3.23	5.49	5.64	5.61	9.34
Non-state	1.89	2.73	3.14	3.6	3.65	5.84
State/non-state ratio	0.9	1.18	1.75	1.57	1.54	1.6
t-stat for state - non-state difference	2.08	5.95	25.24	21.7	21.75	20.28
No schooling	1.76	2.53	2.54	3.07	3.13	4.8
Primary school	1.99	2.68	3.03	3.5	3.53	5.39
Middle school	1.74	2.68	3.72	3.92	3.89	5.6
High school	1.75	3.2	4.7	5.42	4.99	7.82
College degree and higher	2.03	5.36	7.37	8.08	8.42	14.74
t-stat for primary against others	2.32	4.57	10.59	12.37	12.16	10.64
t-stat for middle school against others	1.34	3.48	3.24	7.24	8.02	9.89
t-stat for high school against others	0.88	2.54	8.82	9.32	5.97	3.74
t-stat for college against others	1.25	17.7	28	27.74	32.6	32.18

NOTE: all wages deflated to January 1998 prices.

Source: Authors' calculation using VLSS and VHLSS data

Table 3: Average annual growth in real wages (% change)

	1993-1998	1998-2002	2002-2008	1993-2008
All workers	12	8	15	20
State	18	17	12	30
Non-state	9	4	14	14
No degree	9	0	15	12
Primary school degree	7	3	13	11
Middle school degree	11	10	8	15
High school degree	17	12	11	23
College degree and higher	33	9	17	42

Source: author's calculation using VLSS and VHLSS data

Table 4: Determinants of Wage (OLS), using years of education

	1993		1998		2002		2008	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Years of education	**0.019**	0.004	**0.041**	0.004	**0.047**	0.002	**0.058**	0.003
Years of experience	**0.017**	0.005	**0.023**	0.003	**0.022**	0.002	**0.037**	0.003
Experience squared	**0**	0	**0**	0	**0**	0	**-0.001**	0
Ethnic minority dummy	-0.036	0.058	-0.004	0.046	**-0.13**	0.029	**-0.084**	0.034
Male dummy	**0.31**	0.027	**0.183**	0.02	**0.185**	0.009	**0.202**	0.014
Red River Delta	**-0.283**	0.043	**-0.444**	0.047	**-0.361**	0.019	**-0.294**	0.023
North East	**-0.306**	0.065	**-0.347**	0.058	**-0.428**	0.029	**-0.159**	0.037
North West	0.181	0.167	**-0.198**	0.06	**-0.636**	0.122	**-0.256**	0.074
North Central Coast	**-0.252**	0.06	**-0.424**	0.057	**-0.338**	0.027	**-0.362**	0.039
South Central Coast	**-0.182**	0.051	**-0.12**	0.04	**-0.147**	0.022	**-0.115**	0.033
Central Highland	-0.014	0.087	*-0.15*	0.086	**-0.921**	0.047	**0.137**	0.066
South East	**0.19**	0.047	0.045	0.038	-0.028	0.021	**0.081**	0.03
Mekong River Delta	**0.133**	0.04	**-0.078**	0.034	-0.028	0.019	-0.04	0.025
Tradable industry dummy	0.015	0.033	-0.025	0.027	**-0.11**	0.012	**-0.051**	0.016
State sector dummy	**-0.164**	0.039	**-0.134**	0.031	**0.216**	0.015	**0.116**	0.02
Constant	-0.003	0.054	**0.428**	0.045	**0.584**	0.025	**1.218**	0.033
N	2608		3590		21451		7019	
Adjusted R-squared	0.1		0.17		0.31		0.32	

Notes: Dependent variable = log(hourly wage); Bold means statistically significant at 5% or 1%; Italic means statistically significant at 10%; OLS regressions with robust and clustering-adjusted standard errors

Table 5: Major reform measures

Year	Domestic market liberalization	Trade and international integration
1986	Doi moi – "renovation" of the command economy: introduction of markets	
1988-89		Introduction of import tariffs, unified exchange rate
1990-91	Recognition of private enterprises (constitutional amendment); Law on Private Enterprises, Law on Companies	1991 Law on Import & Export Duties (preferential tariffs)
1994	Law on Promotion of Domestic Investment (rules on approval process); Labor Code (relaxation of wage grid)	US diplomatic recognition
1995	Law on State Enterprises (regulation and reform)	join ASEAN, apply to join WTO
2000	Enterprise Law (significant domestic market liberalization)	2000 US bilateral trade agreement ("WTO lite" – implemented 2002); mid-2000s – various bilateral/multilateral PTAs/FTS; 29 new Trade Laws
2006	Unified Investment Law – further domestic liberalization and more relaxation of foreign investment controls	WTO accession agreed
2007		WTO accession

Table 6: Returns to one additional year of schooling by institution, traded industry, and year

(a) Annual values	1993	1998	2002	2008
State*Trade	**-0.028**	**0.017**	**0.056**	**0.050**
Non-state*Trade	-0.006	**0.014**	**0.013**	**0.027**
State*Non-trade	**0.032**	**0.065**	**0.079**	**0.087**
Non-state*Non-trade	-0.003	**0.035**	**0.036**	**0.041**

(b) Changes between years	1993-1998	1998-2002	2002-2008
State*Traded	**0.046**	**0.039**	-0.006
Non-state*Traded	**0.020**	-0.001	**0.014**
State*Non-traded	**0.033**	**0.014**	0.008
Non-state*Non-traded	**0.038**	0.001	0.005

Source: summarized from estimates shown in full in Appendix A. Dependent variable is log of hourly wage. Figures in bold are statistically significant at $p \leq 0.05$.

Table 7: Determinants of Wages - Heckman Estimation Results

	1993		1998		2002		2008	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Wage equation								
Dependent variable = log of hourly wage								
Years of education	0.011	0.007	**0.039**	0.005	**0.037**	0.002	**0.057**	0.003
Years of experience	**0.016**	0.005	**0.023**	0.003	**0.023**	0.002	**0.037**	0.003
Years of experience squared	**0.000**	0.000	**0.000**	0.000	**-0.001**	0.000	**-0.001**	0.000
Male dummy	**0.390**	0.070	**0.314**	0.026	**0.219**	0.012	**0.244**	0.021
Ethnicity minority dummy	-0.114	0.081	**-0.137**	0.055	**-0.387**	0.036	**-0.146**	0.040
Urban dummy	**0.226**	0.107	**0.403**	0.038	**0.292**	0.017	**0.194**	0.035
Public sector dummy	**-0.121**	0.039	**-0.100**	0.031	**0.243**	0.015	**0.138**	0.019
Tradable industry dummy	0.027	0.033	-0.007	0.027	**-0.106**	0.012	**-0.033**	0.018
Constant	-0.606	0.441	**-0.608**	0.105	**0.254**	0.046	**0.815**	0.090
Selection equation								
Dependent variable = wage job dummy								
Years of education	**0.027**	0.004	**0.025**	0.005	**0.028**	0.002	**0.050**	0.005
Male dummy	**0.327**	0.028	**0.345**	0.023	**0.384**	0.011	**0.372**	0.021
Ethnic minority dummy	**-0.278**	0.046	**-0.302**	0.069	**-0.364**	0.028	**-0.574**	0.047
Urban dummy	**0.539**	0.029	**0.578**	0.036	**0.457**	0.017	**0.369**	0.041
Dependency ratio	-0.033	0.019	**0.049**	0.020	**0.091**	0.011	**0.139**	0.019
Log (non-wage income)	-		-		**-0.173**	0.000	**-0.126**	0.000
Dummy for head of household	0.042	0.033	**0.067**	0.028	**0.053**	0.014	0.038	0.024
Age	**-0.004**	0.001	**-0.003**	0.001	**-0.001**	0.001	0.000	0.001
Constant	**-1.176**	0.058	**-1.268**	0.064	**-0.974**	0.034	**-1.249**	0.075
N	12985		16689		81462		25530	
Rho	0.508	0.277	0.729	0.044	0.206	0.037	0.327	0.088
Sigma	0.747	0.101	0.744	0.032	0.679	0.008	0.597	0.012
Lamda	0.379	0.258	0.542	0.055	0.140	0.026	0.195	0.051
Chi2 for Wald test that rho=0	2.25		95.62		29.18		3.03	

Notes: Bold means statistically significant at 5% or less; Italic means statistically significant at 10%; All regressions have robust and clustering adjusted standard errors

Table 8: Determinants of Wages - Treatment Estimation Results

	1993		1998		2002		2008	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
Wage equation (dependent variable = log of hourly wage)								
Years of education	0.002	0.004	**0.027**	0.003	**0.031**	0.002	**0.048**	0.002
Years of experience	**0.017**	0.004	**0.023**	0.003	**0.022**	0.001	**0.036**	0.003
Years of experience squared	**0.000**	0.000	**0.000**	0.000	**-0.001**	0.000	**-0.001**	0.000
Male dummy	**0.298**	0.027	**0.175**	0.020	**0.186**	0.010	**0.194**	0.014
Ethnicity minority dummy	-0.032	0.056	-0.013	0.043	**-0.363**	0.016	**-0.072**	0.027
Urban dummy	**0.069**	0.029	**0.182**	0.021	**0.242**	0.011	**0.142**	0.015
Traded industry dummy	0.026	0.031	-0.012	0.021	**-0.107**	0.010	**-0.031**	0.015
State sector dummy	**-0.091**	0.046	-0.022	0.032	**0.325**	0.015	**0.191**	0.022
Constant	0.053	0.050	**0.335**	0.035	**0.373**	0.018	**0.657**	0.027
Treatment equation (dependent variable = state sector dummy)								
Years of education	**0.141**	0.012	**0.135**	0.010	**0.138**	0.005	**0.130**	0.007
Male dummy	**-0.244**	0.077	-0.061	0.069	**-0.116**	0.031	0.043	0.049
Ethnic minority dummy	**0.399**	0.176	**0.328**	0.146	**0.514**	0.056	**0.616**	0.096
Urban dummy	-0.122	0.080	**-0.405**	0.073	**-0.216**	0.033	**-0.143**	0.051
Network dummy	**1.537**	0.054	**1.756**	0.052	**1.854**	0.024	**1.762**	0.038
Constant	**-0.996**	0.120	**-0.856**	0.109	**-1.105**	0.053	**-1.153**	0.085
N	2608		3590		21451		7019	
Rho	-0.051		-0.189		-0.165		-0.112	
Sigma	0.670		0.580		0.670		0.575	
Lambda	-0.034		**-0.109**		**-0.110**		**-0.064**	

Notes: Bold means statistically significant at 5% or less; Italic means statistically significant at 10%; Network dummy: value = 1 if the household has at least one other member working for the state

Table A-1: OLS regression with full interaction, 1993 and 1998

	Coeff.	SE	t-statistic	p-value
State*trade*1998	0.430	0.084	5.14	0.00
State*trade*1993	0.311	0.140	2.21	0.03
Nonstate*trade*1998	0.461	0.040	11.39	0.00
Nonstate*trade*1993	0.116	0.053	2.19	0.03
State*nontrade*1998	-0.197	0.100	-1.97	0.05
State*nontrade*1993	-0.250	0.133	-1.88	0.06
Nonstate*nontrade*1998	0.261	0.072	3.61	0.00
Nonstate*nontrade*1993	-0.103	0.122	-0.84	0.40
State*trade*1998*educ_yrs	0.017	0.010	1.76	0.08
State*trade*1993*educ_yrs	-0.028	0.014	-2.09	0.04
Nonstate*trade*1998*educ_yrs	0.014	0.005	2.76	0.01
Nonstate*trade*1993*educ_yrs	-0.006	0.006	-1.05	0.29
State*nontrade*1998*educ_yrs	0.065	0.007	9.76	0.00
State*nontrade*1993*educ_yrs	0.032	0.009	3.75	0.00
Nonstate*nontrade*1998*educ_yrs	0.035	0.008	4.6	0.00
Nonstate*nontrade*1993*educ_yrs	-0.003	0.010	-0.3	0.76
N	6198			
Adjusted R^2	0.6			

i) Dependent variable = log(hourly wage)

ii) Other covariates (gender, ethnicity, urban dummy, industry dummies, and experience) included but not reported; constant term suppressed

Table A-2: OLS regression with full interaction, 1998 and 2002

	Coeff.	SE	t-statistic	p-value
State*trade*2002	0.304	0.059	5.12	0.00
State*trade*1998	0.430	0.092	4.66	0.00
Nonstate*trade*2002	0.445	0.028	15.68	0.00
Nonstate*trade*1998	0.461	0.048	9.59	0.00
State*nontrade*2002	-0.097	0.058	-1.65	0.10
State*nontrade*1998	-0.197	0.099	-1.99	0.05
Nonstate*nontrade*2002	0.316	0.033	9.49	0.00
Nonstate*nontrade*1998	0.261	0.078	3.33	0.00
State*trade*2002*educ_yrs	0.056	0.005	11.34	0.00
State*trade*1998*educ_yrs	0.017	0.010	1.71	0.09
Nonstate*trade*2002*educ_yrs	0.013	0.003	4.59	0.00
Nonstate*trade*1998*educ_yrs	0.014	0.006	2.36	0.02
State*nontrade*2002*educ_yrs	0.079	0.004	19.67	0.00
State*nontrade*1998*educ_yrs	0.065	0.007	9.49	0.00
Nonstate*nontrade*2002*educ_yrs	0.036	0.003	10.47	0.00
Nonstate*nontrade*1998*educ_yrs	0.035	0.008	4.22	0.00
N	25041			
Adjusted R^2	0.73			

i) Dependent variable = log(hourly wage)

ii) Other explanatory variables (gender, ethnicity, urban dummy, industry dummies, and experience) included but not reported; constant term suppressed

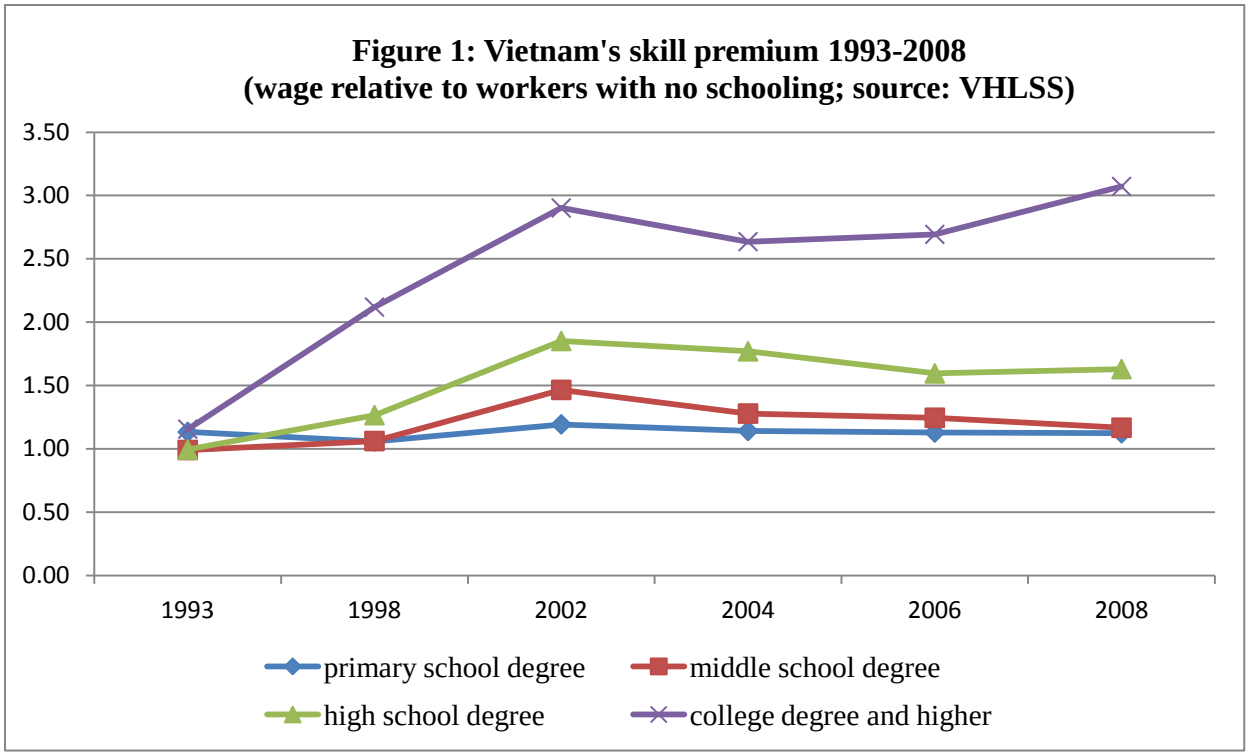
Table A-3: OLS regression with full interaction, 2002 and 2008

	Coeff.	SE	t-statistic	p-value
State*trade*2008	0.651	0.073	8.89	0.00
State*trade*2002	0.304	0.059	5.13	0.00
Nonstate*trade*2008	0.818	0.047	17.56	0.00
Nonstate*trade*2002	0.445	0.028	15.68	0.00
State*nontrade*2008	0.323	0.069	4.69	0.00
State*nontrade*2002	-0.097	0.058	-1.65	0.10
Nonstate*nontrade*2008	0.757	0.054	14.05	0.00
Nonstate*nontrade*2002	0.316	0.033	9.49	0.00
State*trade*2008*educ_yrs	0.050	0.006	7.78	0.00
State*trade*2002*educ_yrs	0.056	0.005	11.34	0.00
Nonstate*trade*2008*educ_yrs	0.027	0.004	6.33	0.00
Nonstate*trade*2002*educ_yrs	0.013	0.003	4.59	0.00
State*nontrade*2008*educ_yrs	0.087	0.005	18.66	0.00
State*nontrade*2002*educ_yrs	0.079	0.004	19.68	0.00
Nonstate*nontrade*2008*educ_yrs	0.041	0.005	7.99	0.00
Nonstate*nontrade*2002*educ_yrs	0.036	0.003	10.47	0.00
N	28470			
Adjusted R^2	0.79			

i) Dependent variable = log(hourly wage)

ii) Other explanatory variables (gender, ethnicity, urban dummy, industry dummies, and experience) included but not reported; constant term suppressed

5 Figure



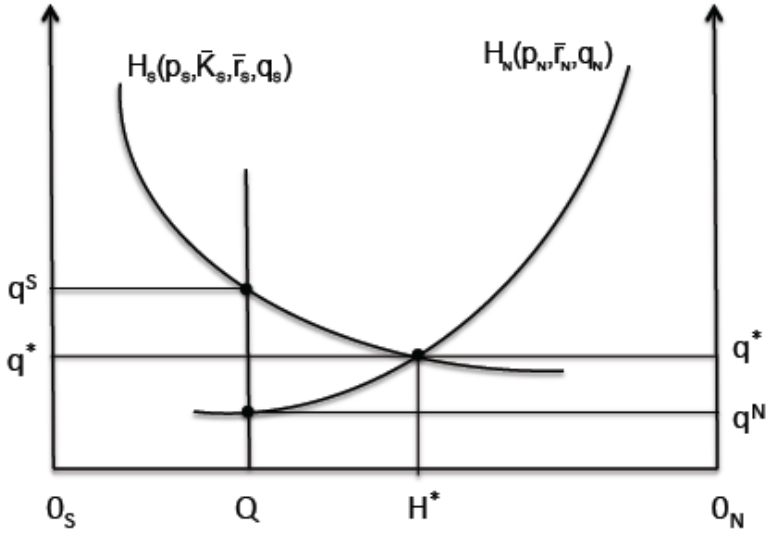


Figure 2: The intersectoral market for skilled labor

Figure 3: Estimated average returns to schooling by industry, state and non-state workers

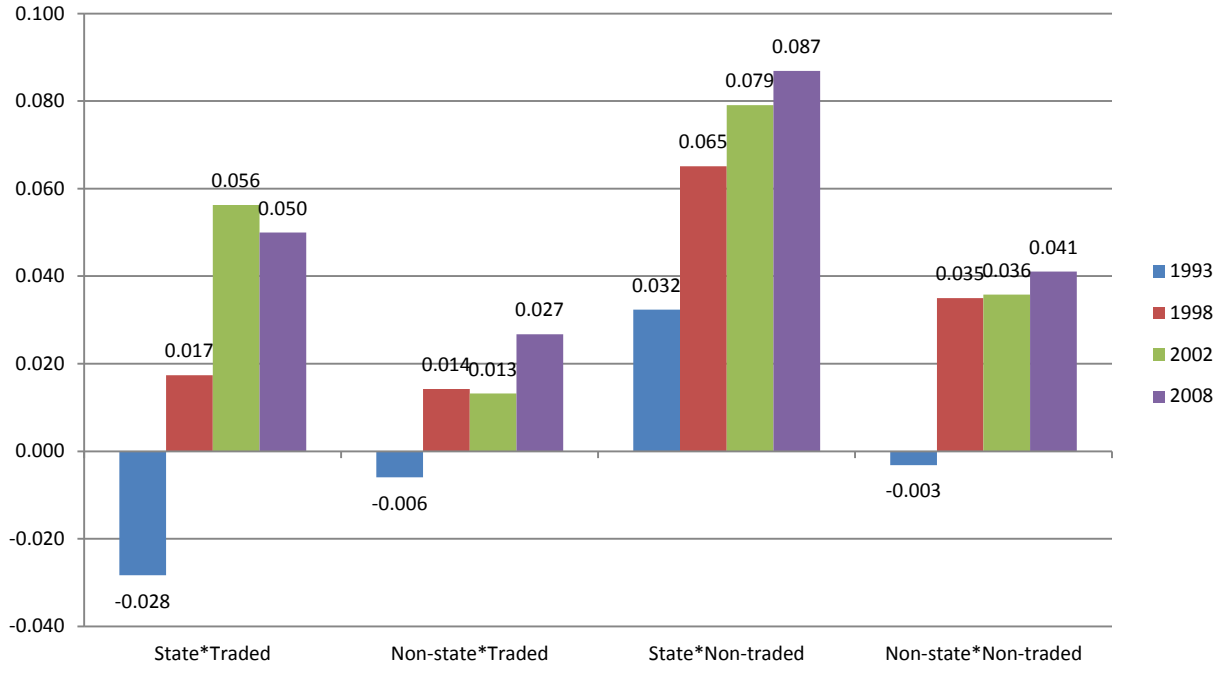


Figure 4: Changes in returns to education by industry, state vs. nonstate workers