Private Sector Labor Supply, Risk Aversion, and Economic Reform in China*

Diana Weinhold
Development Studies Institute
London School of Economics

AND

Paul J. Zak
School of Politics and Economics
Claremont Graduate University

February 15, 2000

*We thank Boqing Wang who stimulated our interest in this project and graciously provided us with his data, as well as to Leonard Tampubolon for research assistance. Nevertheless, the authors are solely responsible for any errors herein.
Correspondence to: Paul J. Zak, Department of Economics, Claremont Graduate University, Claremont, CA 91711–6165, paul.zak@cgu.edu

Private Sector Labor Supply, Risk Aversion and Economic Reform in China

Abstract

Economic reform in China has created a small, but fast-growing private sector that has spurred rapid productivity growth. Continued growth of the private sector is predicated upon labor moving away from state-run industries and into private firms. This paper presents a theory of labor market sectoral choice demonstrating that three factors determine private sector labor supply–the difference in expected wages between the state and private sectors, private sector wage risk, and risk aversion. Estimation of the model using survey data provides strong support for the theory. We find that the riskiness of private sector earnings has a greater effect in discouraging workers from taking jobs in private firms than the wage premium has in attracting workers. Our results show that a one standard deviation increase in earnings risk reduces the number of workers taking jobs in the private sector by 25%.

Keywords: Labor Market, China, Private Sector, Risk Aversion, Transitional Economies.

Journal of Economic Literature Classification Number: **J21** Labor Force and Employment, **J40** Labor Markets, **P23** Socialist Systems and Transitional Economies.

1 Introduction

A new wave of privatization has recently begun in China as the state cedes control of more than 10,000 firms to private ownership (Wall Street Journal, 1996). As a result, four million state sector jobs will be eliminated between 1999 and 2002 (Reuters, 1998). Though private and joint venture public-private companies account for only 5% of total employment in China, more than half of new entrants to the urban labor force take positions with non-state sector firms, as compared to 28% going to non-state sector firms in 1978 (Maurer-Fazio, 1995).[1] While reforms have introduced a great deal of uncertainty into the labor market, productivity gains from the increased competition have been spectacular. Li (1997) estimates that the marginal productivity of labor increased 54% from 1980 to 1989. China's gradual reform of the state sector and concomitant growth of the private sector can be credited with a substantial portion of the productivity gains that are fueling output growth. It is thus important to the future growth and stability of China to facilitate the transition of both new entrants and established state workers into the new but quickly growing private economy.

This paper presents a theory of sectoral labor supply choice. Using the theory, we characterize the factors that drive private sector labor supply in China. Although privatization increases the number of private firms, this may not result in large numbers of private sector workers if most employees are re-absorbed into the state sector.[2]

The theory developed here shows that it is not only the wage differential that determines the rate at which individuals move from the state sector to the private sector, but also the wage risk inherent in private sector jobs, and individuals' tolerance for risk. Using a unique survey-based data set of Chinese workers, we test the theory empirically by constructing measures of the riskiness of each worker's private sector wage and risk aversion. The empirics demonstrate that the most important factor affecting the flow of

[1] Maurer-Fazio (1995) defines the non-state sector to include collectives, public-private ventures and private firms. In 1994, 73% of employment was in the state sector, 21.6% in collectives and 5% in private firms or joint ventures.

[2] Excellent discussions of the effects of reform on the Chinese labor market can be found in Korzec (1992) and Hay *et al* (1994).

employees to the private sector is wage risk. This indicates the importance of risk-mitigating institutions such as unemployment insurance in hastening the transition of workers from the state sector to the private sector.

The model uses a variant of portfolio theory to derive an individual's sectoral employment choice as a function of the first *and* second moments of the sectoral difference in wages. This approach is related to the literatures on occupational choice (Weiss, 1972; Murphy & Topel, 1987), risky investments in human capital (Levhari & Weiss, 1974; Shaw, 1996) and the allocation of labor effort (Block & Heineke, 1972; Orminston & Scheilee, 1994), all of which have examined labor supply in stochastic environments. Our approach characterizes risk-adjusted income in the private and state sectors, with the earnings in each sector having different stochastic properties, and then permits agents to optimally choose the sector in which to work.

Section 2 of the paper provides an overview of the reforming Chinese labor market, including a discussion of the institutions through which jobs are assigned and benefits accrue. The theoretical relationship between sectoral choice and the first two moments of the wage distribution is derived in Section 3, with empirical tests of the model presented in Section 4. One of the innovations of our analysis is the estimation of expected private sector wage and wage risk for each individual in the sample–both those working in the state and private sectors–using a multistage procedure. The empirics in Section 4 substantiate the model's prediction that the expected sectoral wage differential, wage risk, and risk aversion fundamentally affect the flow of workers into the private sector. Section 5 discusses the implications of our findings, and Section 6 concludes.

2 An Overview of the Chinese Labor Market

In China, prior to the 1986 reforms, the government assigned almost all individuals to lifelong employment in state-owned firms. Health care and housing benefits were included in these assignations, with benefits increasing with seniority as part of the *baoxialai*, or "taking care of everything" system.[3] After reforms, a new type of job appeared, renewable term positions in the new private and hybrid public-private sectors. Called the "Shenzhen model," contract jobs in the private sector have grown steadily as individuals seek higher wages than those available in the state sector.[4] Private sector jobs generally do not include benefits, and entail some risk as they do not guarantee lifetime employment, and wages vary with market forces.[5] An attempt at tying state-sector wages to the performance of particular work-units was briefly experimented with in 1985, but this practice soon ceased because the "iron rice bowl" system was preferred by state-sector employees (Korzec, 1992). This indicates some self-selection by workers when choosing the sector within which to work. Such self-selection may be attributable to differences in risk tolerance.[6]

There are several risks inherent in a private sector job. First, private sector wages depend on firm profitability, as well as on the supply and demand for various types of workers. These effects add volatility to labor earnings. Second, private sector employees risk spells of unemployment when they are between contract positions or if the firm at which they work closes. Third, by working in the private sector one foregoes generating state-sector seniority upon which benefits are based.

Concurrent with the commencement of the private sector labor market, the 1986 reforms also altered institutions in the state sector. Since 1986, employees in the state sector are putatively hired on contracts, though until recently, there was little risk of termination. Additional labor market reform

[3]For the most part, benefits are retained upon retirement.

[4]For expositional clarity, we will call private and joint public-private firms the "private sector" and collectively owned and state-run firms the "state sector."

[5]Private sector jobs may also be sought for the experience they provide which can be used to obtain future private-sector employment or to start one's own firm.

[6]We do not model the growth of the private sector here, for this see Brixiova & Kiyotaki (1997) and the references therein. Rather, we focus on the impediments to movements into the private sector at a particular point in time.

occurred in July, 1992, with the "Regulations on Transforming State-Owned Enterprises." This edict empowered managers of state sector firms to make hiring, wage, and termination decisions. In practice, many state sector workers are given "long vacations" rather than termination; workers stay at home and receive partial pay and benefits, though eventually the "vacation" becomes unpaid (Maurer-Fazio, 1995; Faison, 1995).[7] The certainty of lifetime employment in the state-sector is fading as China's economy liberalizes, yet as of the early 1990s, employment in the state sector had little risk.

In an effort to determine why some workers stay in the state sector and others move to the private sector, we examined worker characteristics in survey data collected in 1992 of about 7600 Chinese workers sampled from a variety of state and private firms in 19 cities.[8] Workers in private firms are typically younger, more educated and, on average, earn 22% more than workers in the state sector.[9] Standard models of sectoral labor supply show that workers move among sectors until the expected wage differential (inclusive of the value of benefits) disappears.[10] Yet, this did not appear to happen in China where state sector employment was relatively ossified at the time of the survey.

This brief overview of the Chinese labor market reveals several clues regarding the factors that lead workers to select work in the state sector versus the private sector. State sector jobs come with lower pay but generous benefits and less risk, while private sector jobs are subject to the vicissitudes of the market. There are also several institutional arrangements that lead employees towards the state sector. One, called *dingti*, permits state-sector workers who retire or die to "pass" their position to a family member so that benefits which have compounded with seniority are retained within the family. Though this practice was officially banned in 1986, there is evidence that it is still in force (Freeman; 1994; Korzec, 1992). In sum, economic and institutional factors, coupled with cultural inertia and risk aversion, have forestalled the movement of labor away from the state sector–even when

[7]The Chinese press reports that 20-30% of employees in state-owned firms are redundant (Maurer-Fazio, 1995). The process of downsizing 10,000 of China's 13,000 state sector firms involves a transition from state ownership to private ownership through the issuance of stock. It is not clear who will purchase this stock (Faison, 1995).

[8]The data are described in Section 3.

[9]The difference between wages in the state and private sectors approaches 60% when state sector benefits are excluded.

[10]Models of sectoral employment choices are surveyed in Parsons (1986).

there exists a significant wage differential.

3 The Model

Individuals, identified by $i \in \Re^+$, vary by their overall earning potential because of their education, location, gender, work experience, and ethnicity. In order to focus the analysis on sectoral labor supply, we model individuals as end-of-period wealth maximizers, disregarding consumption/savings decisions. The first stage of the sectoral labor supply decision is modeled as if workers can allocate their time across both the state and private sectors. Once optimal sectoral time allocations are determined, the second stage of the problem permits workers to choose the preferred sector for employment as the one with the highest risk-adjusted income.

Before specifying an agent's labor supply decision, we introduce some notation. Let N_i^p be the time i spends working in the private sector, with time working in the state sector being N_i^s, where total time is normalized to unity. Agent i can earn wage w_i^p in the private sector, while i's state sector wage (inclusive of the value of benefits) is w_i^s. Employment in the state sector is considered free of earnings risk as wages do not vary with market conditions. Conversely, we have argued above that private sector wages are fundamentally risky. By assumption, individuals know the distribution of wages which are (truncated) normal, with mean $\mu > 0$ and variance σ^2.[11]

In the first stage of i's utility maximization problem, the agent chooses time allocations N_i^p and N_i^s to maximize expected the end of period utility,

$$Max_{N^p, N^s} \quad EU(a_i) \tag{1}$$

s.t.

$$\begin{aligned} a_i = &\quad a_i^0 + w_i^s N_i^s + w_i^p N_i^p \\ 1 = &\quad N_i^s + N_i^p, \end{aligned}$$

where $U(\cdot)$ is a strictly increasing, continuous, and concave representation of preferences over end-of-period wealth, a_i. In problem (1), end-of-period

[11] Wages must be nonnegative, but the truncation at zero can be ignored as a practical matter if μ is sufficiently above zero and σ is not too large. We will proceed under these assumptions.

wealth, a^i, is beginning of period wealth, a_0^i, plus the sum of earnings from both sectors, $w_i^s N_i^s + w_i^p N_i^p$.

The necessary and sufficient condition for an optimum to (1) is

$$E[U'(a_i)(w_i^p - w_i^s)] = 0, \tag{2}$$

which is equivalent to

$$E[U'(a_i)]E[w_i^p - w_i^s] = -COV[U'(a_i), w_i^p], \tag{3}$$

where $COV[x, y]$ is the covariance between random variables x and y.

In order to concretize the analysis, we use a quadratic utility function, $U(a_i) = b_0 a_i - \frac{b_1}{2} a_i^2$, for constants $b_0, b_1 > 0$.[12] Using this parameterization, the marginal utility of wealth is linear in wages, and thus is normally distributed. As a result, optimality condition (3) can be written as

$$E[w_i^p - w_i^s] = \theta_i VAR[w_i^p], \tag{4}$$

where $VAR[w^p]$ is the variance of private sector wages, and

$$\theta_i = (\frac{b_0}{b_1} - E[a_i])^{-1} \tag{5}$$

is the risk aversion of worker i.

The model above is a portfolio choice problem where one chooses between a risky and risk-free "asset," in this case, a riskless state sector job or risky private sector employment. Equation (4) shows that the labor supplied to the private sector depends on the difference between the expected private wage and the state wage, the variance of the private wage, and risk aversion (which depends on individual characteristics).

Once risk-adjusted sectoral time allocations are determined from the first stage problem (1), in the second stage workers choose to work in the sector that provides the highest income. Let $N_i^{s\star} = N^s(w_i^s, w_i^p, VAR[w_i^p], \theta_i)$ and $N_i^{p\star} = N^p(w_i^s, w_i^p, VAR[w_i^p], \theta_i)$ denote the optimal hours worked in the state and private sectors for agent i, respectively, that solve (1). Then, if risk-adjusted income is higher in the private sector, $N_i^{p\star} w_i^p > N_i^{s\star} w_i^s$, the agent chooses to work in the private sector; otherwise, she works in the state sector.

[12] To maintain the standard properties for utility over wealth, we restrict assets to be below the satiation point, $a_i < \frac{b_0}{b_1}$.

It is straightforward to show using equation (4) that labor supplied to the private sector increases when *(i)* the expected difference between the private-sector wage and the state wage rises; *(ii)* the variance (risk) of the private-sector wage is reduced; and *(iii)* individuals become less risk adverse.

4 Empirics

We test the implications of the model by defining a variable z_i which takes the value 1 if an individual chooses a private-sector job, and 0 otherwise. Taking logs of equation (4), leads to the private sector labor supply equation

$$z_i = \ln(E[w_i^p - w_i^s]) - \ln(VAR[w_i^p]) - \ln(\theta_i). \tag{6}$$

This labor supply equation forms the basis for our empirical analysis. The difficulty in testing equation (6) is twofold: the development of a measure of risk aversion, θ_i, using individual-specific characteristics, and the proper measurement of the risk of private wages $VAR[w_i^p]$ for workers in both the private and state sectors. It is these issues to which we next turn.

4.1 Data and Estimation Methodology

The data we use were collected in 1992 by the Chinese Academy of Social Sciences under supervision by a U.S. team of economists.[13] The team surveyed 9393 workers in 26 cities throughout China, sampling employees of state-owned, collective-owned and joint-venture (private) firms. Seven cities were omitted from the current analysis because there were no private sector workers among those sampled. There are 6106 complete observations for the remaining 19 cities.[14]

Wages are defined as average total monthly earnings (in yuan) in 1991. Total earnings include, depending on the form of remuneration, a base wage and performance incentives, including "above average piece" payments, as

[13] A description of the data can be found in Freeman (1994).

[14] Surveys were considered incomplete if it was not possible to unambiguously determine the total wage or if other relevant sections were missing. A Heckman selection bias analysis revealed no significant selection bias between complete and incomplete survey responses in the wage regressions.

well as the monetary equivalent of benefits, such as job position subsidies (e.g. to purchase protective clothing), and any additional in-kind income.

Although wages do include benefits, we cannot observe accumulated priviledges that do not show up in the current value of renumeration. Thus for the primary analysis we further restrict our analysis to workers under 36 years of age, leaving an effective sample size of 3723[15]. As discussed in section 2, by the time of the survey in 1991 the chinese labor market could be reasonably well characterized by workers having a choice between private and public sector jobs. However, many older workers could be expected to have accumulated significant benefits in the public sector in terms of housing and pension rights, and might be much more reluctant to risk losing these by changing jobs. These accumulated rights are not measured in the current total wage data collected by the survey and could significantly impact their choice behavior. Younger workers, on the other hand, could more easily be thought of as comparing contemporary benefits and wages (and riskiness, as we shall show) as they would not yet have accumulated significant seniority benefits in the public sector[16]. In table 6 we present selected probit regression results for the full sample including the older workers. While we fine a robust negative relationship between riskiness and work in the private sector, the relationship between the wage difference and choice of sector is not robust for these workers. This is consistent with the idea that older workers are taking un-measured factors into account that would tend to make contemporary wage differences much less important to their sectoral choice.

As the summary statistics for all workers in the larger sample in Table 1 illustrate, the average monthly earnings of workers in the private sector exceed those in the state sector by 22%. In addition, the variance of private sector wages is almost three times the variance across state sector jobs. Workers in private firms are, on average, about 4 years younger, and have commensurately less work experience than those in the state firms, but the differences between the two groups in education, family size and the ratio of men to women are quite small.

Before beginning the empirical analysis, it is worth pointing out several unique characteristics of this data set. First, due to the small number of private firms in China in 1992, there is little likelihood that the past education

[15]The main results for the full sample including older workers are presented in table 6

[16]We thank an anonymous referee for this observation on the characterization of the Chinese labor market as of 1991.

and training decisions of interviewees were made in order to prepare for a private sector job. For this reason, we consider education and previous training as exogenous to the labor sector decision. Second, only employees were interviewed; that is, there are no unemployed individuals in the sample. Thus, our analysis is conditioned upon the current state of employment. Since our goal is to estimate the private sector labor supply, and almost all adults worked in China in 1992, this should induce little or no bias in the results.

The theory in Section 3 demonstrates that there are three primary factors that determine whether an individual will take a job with a state or private firm, namely the difference in expected wages, the risk of private sector wages, and an individual's level of risk aversion. Empirically testing this model entails obtaining measures of each of these factors.

4.2 Estimating Expected Wages and Wage Risk

In this section, we describe the construction of a measure of individual wage risk. Our theoretical model defines risk as the *variance* of the wages faced by a prospective employee. Indeed, Table 1 shows that on average private wages have a larger variance than state wages. However, these are *unconditional* statistics estimated over the entire sample and do not necessarily apply to any one individual. Much of the dispersion of wages is simply a reflection of the heterogeneity of workers' skills and not "risk." The theory shows that once a worker ascertains his or her expected private sector wage and its variance, then a move into this sector is undertaken if the difference in wages sufficiently compensates the worker for wage risk. The private sector wage of worker A is riskier than that of worker B if, given worker characteristics I_A and I_B, the expected variance of the wage for worker A is greater than the expected variance of the wage for worker B. If we denote the wage risk of workers A and B by φ_A and φ_B, then

$$\varphi_A > \varphi_B \quad \Longleftrightarrow \quad E\left[VAR(w^p)|I_A\right] \; > \; E\left[VAR(w^p)|I_B\right]$$

That is, the risk of a particular worker's wages is positively related to the unexplained heterogeneity of wages once a worker's characteristics have been controlled for. Analogously, the wage in the sectoral choice model is not the average wage of the sector, but the *conditional* expected wage that is specific to the individual worker given his or her characteristics.

The estimate of an individual's expected wage and its risk are conditioned on factors that are traditionally included in wage regressions, such as education, age, work experience, gender, and geographic location. While other attributes, such as personality, appearance etc. may be important in determining wages as in Hammermesh & Biddle (1994), these are likely to be second-order effects, and are data unavailable to us. As long as the unexplained wage variation, after conditioning on a worker's characteristics, is correlated with the "true" unobserved variation faced by a worker, the estimated risk will correctly reflect the risk a worker faces.

The following four-stage procedure estimates worker-specific expected wage and wage risk. In the first stage, a basic wage regression is estimated separately for state and private firm workers,

$$WAGE_s = \alpha_j CITY_{js} + \beta_1 AGE_s + \beta 2 AGESQ_s + \beta_3 EXPER_s + \beta_4 EXPSQ_s + \beta_5 EDUC_s + \beta_6 EDUCSQ_s + \beta_7 SEX_s + \beta_8 MARRY_s + \beta_{9k} ETHNIC_{ks} + \epsilon_s \quad (7)$$

$$WAGE_p = \omega_j CITY_{jp} + \gamma_1 AGE_p + \gamma 2 AGESQ_p + \gamma_3 EXPER_p + \gamma 4 EXPSQ_p + \gamma_5 EDUC_p + \gamma_6 EDUCSQ_p + \gamma_7 SEX_p + \gamma_8 MARRY_p + \gamma_{9k} ETHNIC_{kp} + \epsilon_p \quad (8)$$

where $s = 1 \ldots N_{state}$ are state workers in the sample and $p = 1 \ldots N_{private}$ are private firm workers. The variables $WAGE_i$, AGE_i, $EXPER_i$, $EDUC_i$ are the logs of total labor income, age, years of work experience, and years of education, respectively, for each worker. The squares of AGE, $EXPER$ and $EDUC$ are denoted $AGESQ$, $EXPSQ$, and $EDUCSQ$, respectively. We also control for the city j where the employee works, $CITY_j$, the sex of the worker, SEX, and whether the worker is married or not, $MARRY$. In addition, we control for the ethnic classification of the worker, $ETHNIC_j$. There are four primary ethnic groups in China–the majority of the country is Han (the control group), with the primary minority groups being Mongols, Hui (Muslims) and Tibetans.

Results from the first-stage regressions are presented in columns 1 and 2 of Table 2. As would be expected in a system in which benefits increase with tenure, experience is by far the most significant explanatory factor of the variation in public sector wages. In addition, there is slight evidence of lower wages for ethnic Mongols in the public sector. For private sector jobs, on the other hand, city (not shown in the table) and experience are the primary

explanatory factors, with unexplained wage heterogeneity exceeding that in the state sector.

In the second stage, we construct the expected wage for each worker in both sectors, given his or her characteristics and location, using the estimated parameters from the wage regressions, $\hat{\alpha_j}$, $\hat{\beta}_i$, $\hat{\omega_j}$, and $\hat{\gamma}_i$, for $i = 1, ...9$; $j = 1, ...19$. The expected wage differential facing worker i is the estimated difference between state sector and private sector wages,

$$WDIFF_i = (\hat{\omega_j} - \hat{\alpha_j})CITY_{ji} + \sum_{k=1}^{9}(\hat{\gamma_k} - \hat{\beta_k})\Gamma_k \tag{9}$$

where Γ_k corresponds to the explanatory variables from the wage regressions (7) and (8) and $i = 1 \ldots N_{total} = N_{state} + N_{private}$.

The third stage of this procedure estimates the conditional unexplained variation of the wages faced by each individual in both sectors. First, the individual-specific error term from the wage regressions (7) and (8) is recovered and squared. The error is the portion of the wage that is not explained by the set of first-order characteristics. Squaring this error term, we then estimate two equations, one for the private sector and one for the state sector, in which the squared error terms are predicted by the city dummy variables, the set of explanatory variables from the wage equations, denote Γ, as well as the cross products of $EXPER$, AGE and $EDUC$, which we denote as Π.

$$\hat{\epsilon^2}_s = \sum^{19} \phi_j CITY_{ji} + \Gamma'\rho_1 + \Pi'\rho_2 + \nu_s \tag{10}$$

$$\hat{\epsilon^2}_p = \sum^{19} \chi_j CITY_{ji} + \Gamma'\delta_1 + \Pi'\delta_2 + \nu_p \tag{11}$$

The estimation results of this stage are presented in the third and fourth columns of Table 2.

The fourth stage calculates the individual-specific measure of wage risk as the conditional heterogeneity of the unexplained component of wages. In an analogous fashion to step two, this stage uses the estimated regression coefficients from equations (10) and (11) to generate a predicted $\hat{\epsilon}^2$ for both the private sector and the state sector for each worker. The difference in riskiness between the private and state sector wages, denoted $RISK$, is calculated for each worker as,

$$RISK_i = (\hat{\chi_j} - \hat{\phi_j})CITY_{ji} + \sum_{k=1}^{9}(\hat{\delta_{1k}} - \hat{\rho_{1k}})\Gamma_k + \sum_{k=1}^{3}(\hat{\delta_{2k}} - \hat{\rho_{2k}})\Pi_k \qquad (12)$$

Equation (12) shows that the private sector wage risk is the difference between the variance of the unexplained component of wages in the state and private sectors, holding a worker's characteristics constant. More simply, if worker i moves from the state sector to the private sector, equation (12) is the variance in wages that this worker would expect to face.

By including individual specific expected risk differentials into the sectoral choice model, we are essentially adapting an ARCH-in-mean type of model from time series into a cross-section analysis in order to test for second moment effects in the levels of variables (in this case sectoral choice). Our model differs from an ARCH-in-mean model in several significant ways, however. First, most obviously, there is no autoregressive component to the model. Second, the variable whose (conditional) second moment we are including in the (levels) choice model is not the dependent variable of our primary analysis at all, but derived from the wage equations. Nevertheless the intuition of the model, that second moments of some variables may effect the levels of other variables, is straightforward and relatively common in the time series econometric literature.

4.3 Estimating Risk Aversion

Although each individual's true level of risk aversion, θ_i, is unobserved, we can proxy this variable with measures that are correlated with a worker's risk tolerance.

The first of these proxy variables is $MOVED$ which takes the value 1 if a worker has moved into the city from elsewhere, and 0 otherwise. Highly risk-averse individuals are less likely to move away from a familiar environment than others who are less risk-averse. A second proxy for risk-aversion is $TRAIN$, which takes the value 1 if a worker has engaged in self-financed technical training, and 0 otherwise. Since self-financing training involves making a current sacrifice for an uncertain future payback, we expect $TRAIN$ to be negatively correlated with risk aversion. Finally, marital status, $MARRY$, is possible proxy for risk aversion. Married individuals may be more risk-averse because they have more than just themselves to provide for. A related proxy

variable for risk aversion is family size, $FAMSIZE$. The average survey respondent in our data set lives in a household with three adults. Having several working household members may influence risk aversion by affecting the ability to diversify consumption risk across household members.

These proxy variables are likely to be correlated with an individual's level of risk aversion. At the same time, it is unlikely that a worker's current employer caused the worker to obtain previous training or to move from a previous home city, so that endogeneity should be minimal. Nevertheless, we check the robustness of the overall results by excluding these variables in some of the specifications just to be sure.

4.4 Additional Control Variables

Because worker-specific factors might explain some aspects of sectoral choice, individual characteristics are included to minimize the possibility that explanatory power from our variables of interest is an artifact of omitted variable bias. One of these factors is geographic location, $CITY$. If there are more private firms in a city, then a worker from that city might be more likely to choose a private sector job simply because they are more readily available. The $CITY$ dummy variable will also capture general city-specific characteristics of the labor market (such as particularly high labor demand). We also allow for the possibility that such elements as age, work experience, education, marriage, gender, and ethnicity may influence sectoral choice via channels outside the theory. Since many of these variables were also used to estimate the wage difference and risk variables, we present a number of alternative specifications in which subsets of these explanatory variables are included in the probit regression analysis in order to facilitate identification and ensure that the results are robust.[17]

4.5 Empirical Findings

Table 3 presents the results of seven probit regressions estimating the augmented private labor supply equation (6). The means and standard deviations of the included variables are reported in Table 6. The dependent variable of the probit regressions is z_i, which takes the value 1 if a worker is

[17]If we were to include all explanatory variables together in the probit regression analysis we would have to depend soley on nonlinearities for identification.

employed by a private-sector firm and 0 otherwise. In all seven regressions we have included among the regressors a full set of city dummies (suppressed in the table to save space but available upon request), to control for city-specific effects, and vary the set of explanatory variables to determine the robustness of the estimates. Following the theory, all of the regressions include the constructed variables $WDIFF$ and $RISK$, and have at least one proxy variable for the worker's level of risk aversion.

Regression (1) includes only family size ($FAMSIZE$) and the variables of interest, $WDIFF$ and $RISK$. Thee risk-aversion variable is not statistically significant but both $WDIFF$ and $RISK$ are highly significant and of the expected sign: the bigger the difference between the expected private sector wage and the expected public sector wage, the more likely a worker will choose the private sector. On the other hand, the riskier is the private sector choice, the less likely is the worker to make that choice, even while controlling for the difference in level wages.

In regression (2) we additionally control for a worker's ethnicity. We find that workers Hui ethnicity (and to a lesser extent Mongol ethnicity in later specifications) are statistically significantly less likely to take private sector jobs.[18] In regression (3) we add $MARRY$, a risk-aversion proxy variable as well. $MARRY$ takes the expected negative sign (if married people are more risk averse) and is statistically significant. Both $WDIFF$ and $RISK$ remain statistically significant with the correct signs.

In regression (4) we add the remaining risk-averseness proxy variables, $TRAIN$ and $MOVED$. They are both statistically significant and carry the expected positive sign: those workers who have displayed activity consistent with relatively low levels of risk aversion are more likely to choose a private sector job.

In regressions (5), (6) and (7) we include control variables for sex and find that men are statistically significantly more likely to choose a private sector job. In addition in these specifications we include control variables for education, experience and age[19]. As our sample is restricted to young people

[18]The negative sign on the Hui does not have a clear interpretation as Hui are historically traders and might therefore be better suited to work in the private sector. According to Harrell (1995), the Hui have had long-standing conflicts with the other ethnic groups in China so that they may choose not to work with the majority Han in private-sector firms or may be discriminated against in hiring.

[19]As noted earlier, we do not include all variables in one specification due to multi-collinearity and the difficulty of identification of our variables of interest $WDIFF$ and

and these variables and their squared values (and cross products in the case of $RISK$) were used to construct our $WDIFF$ and $RISK$ variables, we do not have strong priors on their expected signs or levels of significance. We find that they are statistically significant and all carry negative signs. This is perhaps reflective of the observation that senior, older workers (even among those under 35) may have more to lose from leaving a public job and accumulated benefits not reflected in current wage estimates. However we hesitate to over-interpret these results.

Notably, in all regression specifications (1) through (7) $WDIFF$ and $RISK$ remain statistically significant and carry the signs predicted by the theory. Among the specifications that include most of the control variables, specification (6) produces the some of the lowest coefficient estimates for these two variables, and is also one of the most successful specifications in terms of predictive performance. We thus use specification (6) to calculate in the most conservative fashion possible the marginal effects of these variables. As shown in Table 6, the positive impact of a one standard deviation increase in the difference in expected wage levels between the private sector and the public sector increases the probability of choosing a private sector job by only 0.15%. However, a one standard deviation increase in the expected relative riskiness of a private sector job will lower the probability of taking a private sector job by over 25%.

Table 5 indicates the performance of the estimation by reporting the log-likelihood and predictive power of each regression. The table reports that there are 2541 workers in state jobs (68.3% of the sample) and 1182 workers in private firms (31.7% of the sample) in the data set. Of those workers who are employed in state jobs, regression (6) correctly predicts that 2273 will work for state firms, and incorrectly predicts that 268 of them will take private jobs. The model is less accurate at predicting the behavior of workers who have taken private sector jobs. Of those individuals who are employed in private firms, regression (6) incorrectly predicts that 601 of them will be employed in the state sector (or 51% of the private workers) and correctly predicts that 581 (49% of private workers) of them will work in the private sector. This suggests that there are some important characteristics that motivate labor supply to private firms that are not captured in the model.

In table 6 we summarize the main results for the probit regression for the whole sample of 6106 workers, including those over the age of 35. In

$RISK$.

regressions (8)-(11), although the $RISK$ variable is robust and negatively related to sectoral choice, the coefficient estimate of $WDIFF$ is not robust in this sample[20] In fact, if we fail to control for AGE, the sign of the coefficient on $WDIFF$ is negative. These results are consistent with the idea that unobservables (perhaps interacted with some included variables) are playing a more significant role in the decisions of older workers.

[20]In other specifications the coefficient on $WDIFF$ for the older sample was statistically insignificant.

5 Discussion

The theory, with strong support in the empirics, shows that an important impediment to the movement of labor from the state sector to the private sector is the risk inherent in private sector employment.

There are several policy lessons to be drawn from this analysis. The first is that labor flows to the private sector could be hastened by risk-reducing institutions such as unemployment insurance or modern employment offices. Freeman (1994), using the same data set, finds that only 27% of the labor force obtain jobs through modern methods (e.g. through employment agencies). Risk reduction institutions are particularly important in light of the empirical evidence in Dunn (1996) showing that U.S. workers appear to exhibit the phenomenon of loss aversion, as described by Kahneman & Tversky (1979), where, for equivalently sized income losses and gains, losses induce a larger reduction of utility than utility increases from gains. If this were true in China, the least risk averse agents (or risk lovers) will enter the private sector first, followed by less risk averse agents. Some portion of state-sector employees are unlikely to move to the private sector because of a strong aversion to wage risk and possibly loss aversion. If the size of the state sector in China is to be reduced through market incentives, state employees will have to be induced to move to the private sector. Institutions that reduce private sector wage risk are an important policy tool that can accelerate the reform of the state sector.

A second implication shown by the empirics is that intra-family insurance of individual consumption is imperfect in China. If it were possible to perfectly insure one's consumption, the estimated coefficient on the wage risk variable would be zero. Rather, the estimated coefficient on risk ranges in value from -.44 to -1.04 in regressions (1) to (7), and is highly statistically significant, dominating almost every other variable. Using U.S. data, Hayashi, Altonji & Kotlikoff (1996) also find imperfect intra-family risk-sharing by examining consumption data. The results here are also consistent Rosensweig (1988), who finds that spatially distributed rural families in India provide only partial insurance against consumption risks.

A third implication of our analysis is that variations in risk aversion will lead some individuals into the higher wage private sector while others remain in the lower wage state sector. As the private sector grows, this will produce a Kuznet's inverted U in the distribution of income. Zak (1999a,b) shows that a widening of the distribution of income increases socio-political instability (i.e.

demonstrations, strikes, and the destruction of property). Risk aversion, and the gradual pace of privatization in China, may be reasons that movements of employees to the private sector have had fewer socio-political impacts than in other reforming countries, such as Russia.

6 Conclusion

This paper has presented a model of labor supply to private sector in China. We have shown that the supply of individuals working in private firms depends not only on the expected wage differential between the private sector and the state sector, but on the risk of private sector wages and an individual's level of risk aversion. The rationale behind this result is that individuals seek to maximize their wealth by choosing the sector that provides the highest *risk adjusted* income. An innovation of the theory is that we derive the relationship between labor supply and both the first and second moments of the sectoral wage differential.

The hypotheses gleaned from the model were tested using a rich survey data set of over 3700 workers under the age of 36 in 19 cities throughout China. After constructing individual specific measures of the expected private-state wage differential and the wage risk via a multi-stage procedure, we quantify the impact of earnings risk and the level of individual risk aversion on private-sector labor supply. We find that among young people, agents who are less risk averse (as demonstrated via proxy variables), face less wage risk, and are not members of the Hui (and to a lesser extent Mongol) ethnic group are more likely to work in the private sector. Interestingly, we find that the riskiness of private sector earnings has a larger effect in discouraging workers from taking jobs in private firms than the wage premium has in attracting workers. Our results show that a one standard deviation increase in earnings risk reduces the number of workers taking jobs in the private sector by 25%. In fact, we find that although the sectoral wage difference has a statistically significant impact on labor supply choices, the marginal impact of this variable is quite small. This suggests that institutions that reduce wage risk will facilitate the flow of workers to the private sector. The lack of risk-reducing institutions may be one reason why the pace of reform of the state sector in China is slow, even when private sector wages exceed state wages.

Tables

Table 1: Summary Statistics for Workers in State and Private Firms

	State Firms		Private Firms	
Variable	Mean	Std Dev	Mean	Std Dev
Wage (Yuan)	233.29	369.41	283.72	631.42
Education	6.62	2.37	6.72	2.41
Experience	15.82	9.76	12.00	9.42
Age	34.63	9.54	30.88	9.31
% Men	0.55	0.49	0.54	0.50
Family size	3.91	1.49	3.98	1.69

Table 2: Regressions to Construct Expected Wage and Wage Risk

Model:	Private Log(wage)	State Log(wage)	Private RISK	State RISK
F-value	9.966 ***	18.868 ***	4.272 ***	3.131 ***
R-square	0.188	0.167	0.100	0.035
Variable	Parameter Estimate	Paramter Estimate	Parameter Estimate	Parameter Estimate
EXPER	0.8832	0.6437	0.5332	0.1898
	(8.34***)	(11.1***)	(0.59)	(0.37)
EXPSQ	-.1567	-.0813	-.1293	-.0495
	(-5.4***)	(-5.6***)	(-2.9***)	(-2.0**)
EDUC	-.1294	-.2776	-.7203	0.2927
	(-.20)	(-.75)	(-.26)	(0.18)
EDUSQ	0.0624	0.0997	-.0616	-.1671
	(0.35)	(1.00)	(-.22)	(-1.0)
AGE	5.9395	2.5221	13.006	1.7247
	(0.92)	(0.81)	(1.29)	(0.33)
AGESQ	-.9372	-.3722	-2.084	-.3526
	(-.95)	(-.78)	(-1.3)	(-.44)
MAN	0.0528	0.0100	0.0967	-.1346
	(0.85)	(0.35)	(1.03)	(-2.8***)
MARRY	0.0949	0.0253	-.1639	0.0531
	(1.08)	(0.62)	(-1.2)	(0.77)
MONGOL	0.1885	-.6746	-.6069	-.1804
	(0.31)	(-1.8*)	(-.66)	(-.29)
HUI	0.1566	0.3974	0.0061	1.7095
	(0.26)	(1.73*)	(0.01)	(4.44***)
TIBET	0.0000	0.3150	0.0000	-.2680
		(0.38)		(-.20)
EXPER*AGE			0.0834	0.0032
			(0.30)	(0.02)
EXPER*EDUC			-.1041	0.0006
			(-.82)	(0.01)
EDUC*AGE			0.3116	0.0938
			(0.37)	(0.21)

Coefficient estimates are presented with their corresponding t-statistics in parentheses. Three stars indicates significance at 1%, two at 5% and one star indicates statistical significance at 10%. Coefficient estimates for the constant term and the $CITY$ dummy variables are not shown to conserve space.

Table 3: Probit Regression Results

Dependent Variable: 1 if private-sector job, 0 otherwise.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AGE							-0.0174
							(-1.9*)
EDUC						-.0245	-0.0319
						(-2.1**)	(-2.8***)
EXPER						-.0134	
						(-4.1***)	
MAN					0.2162	0.1834	0.2367
					(3.52***)	(2.79***)	(3.68***)
MARRY			-.3692	-.3628	-.3706	-.3284	-0.2562
			(-7.5***)	(-7.4***)	(-7.5***)	(-6.4***)	(-3.2***)
HAN		0.1803	0.1486	0.1643	0.1383	0.1014	0.1249
		(0.75)	(0.61)	(0.67)	(0.57)	(0.42)	(0.51)
MONGOL		-.7242	-.8703	-.8605	-.9876	-.6578	-0.9455
		(-1.2)	(-1.5)	(-1.5)	(-1.7*)	(-1.1)	(-1.6)
WEI		-1.190	-1.441	-1.387	-1.958	-1.598	-1.9003
		(-2.2**)	(-2.6***)	(-2.5**)	(-3.4***)	(-2.7***)	(-3.2***)
FAMSIZE	0.0132	0.0119	0.0057	0.0058	0.0015	-.0045	-0.0019
	(0.85)	(0.77)	(0.36)	(0.37)	(0.10)	(-.28)	(-.12)
MOVED				0.2305	0.2256	0.2424	0.2357
				(4.29***)	(4.19***)	(4.47***)	(4.37***)
TRAIN				0.3407	0.3627	0.3460	0.34177
				(1.81*)	(1.92*)	(1.83*)	(1.80*)
WDIFF	0.0054	0.0059	0.0068	0.0073	0.0071	0.0043	0.0063
	(3.99***)	(4.14***)	(4.75***)	(5.05***)	(4.94***)	(2.57**)	(3.93***)
RISK	-.4475	-.6268	-.7244	-.7256	-1.041	-.7794	-0.9931
	(-4.3***)	(-5.3***)	(-6.0***)	(-6.0***)	(-6.9***)	(-4.3***)	(-5.6***)

Coefficient estimates are presented with their corresponding t-statistics in parentheses. Three stars indicates significance at 1%, two at 5% and one star indicates statistical significance at 10%. Coefficient estimates for $CITY$ variables are not shown to conserve space.

Table 4: Regression Variables' Marginal Effects, Means, and Standard Deviations (from regression (6))

Variable	Marginal Effect	Mean	Stdev
EDUC	-0.0081	6.9508	2.2397
EXPER	-0.0045	13.576	9.5894
MAN	0.0609	0.5063	0.5000
MARRY	-0.1090	0.5799	0.4936
HAN	0.0337	0.9852	0.1207
MONGOL	-0.2183	0.0019	0.0433
WEI	-0.5304	0.0029	0.0543
FAMSIZE	-0.0015	3.9436	1.5545
MOVED	0.0804	0.3081	0.4618
TRAIN	0.1148	0.0153	0.1228
WDIFF	0.0014	29.222	47.551
RISK	-0.2587	0.2731	0.5480

Table 5: Summary statistics for probit regressions (1)-(7)

Notation: 1 if private-sector job, 0 if state-sector job.

								Predicted						
Actual	Total	(1)		(2)		(3)		(4)		(5)		(6)		
		0	1	0	1	0	1	0	1	0	1	0	1	
0	2541	2281	260	2285	256	2274	267	2289	252	2290	251	2273	268	2
1	1182	679	503	661	521	635	547	620	562	611	571	601	581	(
Total		2960	763	2946	777	2909	814	2909	814	2901	822	2874	849	2
Log-Likelihood		-1864.496		-1858.654		-1830.375		-1819.770		-1813.566		-1800.268		-

Table 6: Probit regression results including workers over 35 years

Dependent Variable: 1 if private-sector job, 0 otherwise.

Variable	(8)	(9)	(10)	(11)
AGE				-.0216
				(-7.9***)
EDUC			-.0082	-.0100
			(-.97)	(-1.2)
EXPER			-.0236	
			(-11***)	( )
MAN		0.0694	0.0740	0.1213
		(1.56)	(1.64)	(2.68***)
MARRY	-.4596	-.4726	-.3464	-.2387
	(-10***)	(-10***)	(-7.2***)	(-4.3***)
HAN	0.1855	0.1803	0.1253	0.2113
	(0.86)	(0.84)	(0.58)	(0.98)
MONGOL	-.1960	-.2638	0.0783	-.4282
	(-.45)	(-.60)	(0.17)	(-.95)
WEI	-.1305	-.1958	-.3480	0.0376
	(-.37)	(-.54)	(-.96)	(0.10)
FAMSIZE	0.0094	0.0084	0.0006	0.0092
	(0.78)	(0.70)	(0.05)	(0.75)
MOVED	0.1385	0.1363	0.1673	0.1520
	(3.20***)	(3.15***)	(3.81***)	(3.49***)
TRAIN	0.3204	0.3277	0.3472	0.3003
	(2.04**)	(2.08**)	(2.19**)	(1.90*)
WDIFF	0.0014	0.0016	-.0027	0.0041
	(1.28)	(1.43)	(-2.3**)	(3.35***)
RISK	-.3924	-.4891	-.4402	-.4126
	(-3.6***)	(-3.9***)	(-3.4***)	(-3.1***)

References

Block, M.K., Heineke, J.M., 1972, The Allocation of Effort Under Certainty: The Case of Risk-Averse Behavior, *Journal of Political Economy*, 81:376-385.

Brixiova, Zuzana, and Kiyotaki, Nobuhiro, 1997, Private Sector Development in Transition Economies, *Carnegie-Rochester Conference Series on Public Policy*, 46:241-279.

Dunn, L.F., (1996), Loss Aversion and Adaptation in the Labor Market: Empirical Indifference Functions and the Labor Supply, *Review of Economics and Statistics*, 78:441-450.

Faison, Seth, 1995, Major Shift for Communist China: Big State Industries Will Be Sold, *New York Times*, June 18.

Freeman, Richard B., (1994), How Far Has China Reformed its Labor Market?, *Harvard University Working Paper.*

Hay, Donald, Morris, Derek, Liu, Guy and Yao, Shujie, 1994, *Economic Reform and State-Owned Enterprises in China, 1979-1987*, Clarendon Press.

Hammermesh, Daniel S. and Biddle, Jeff E., 1994, Beauty and the Labor Market, *American Economic Review*, 84(5): 1174-94.

Harrell, Stevan, 1995, Introduction: Civilizing Projects and the Reaction to Them, in *Cultural Encounters on China's Ethnic Frontiers*, Stevan Harrell, ed., University of Washington Press.

Hayashi, Fumio, Altonji, Joseph and Kotlikoff, Laurence, (1996), Risk-Sharing Between and Within Families, *Econometrica*, 64(2):261-294.

Kahneman, Daniel and Tversky, Amos, (1979), Prospect Theory: An Analysis of Decision under Risk, *Econometrica*, 47:263-291.

Korzec, Michael, 1992, *Labour and the Failure of Reform in China*, St. Martin's Press.

Levhari, David, Weiss, Yoram, 1974, The Effect of Risk on the Investment in Human Capital, *American Economic Review*, 61:950-963.

Li, Wei, (1997), The Impact of Economic Reform on the Performance of Chinese State Enterprises, 1980-1989, *Journal of Political Economy*, 105(5):1080-1106.

Maurer-Fazio, Margaret, (1995), Labor Reform in China: Crossing the River by Feeling the Stones, *Comparative Economic Studies*, 37(4):111-123.

Murphy, Kevin M., and Topel, Robert, 1987, Unemployment Risk and Earnings: Testing for Equalizing Wage Differences in the Labor Market, in *Unemployment and the Structure of Labour Markets*, Kevin Lang and Jonathan Leonard, eds., Blackwell.

Orminston, Michael, B., and Scheilee, Edward E., 1994, Wage Uncertainty and Competitive Equilibrium in Labour Markets, *Economica*, 61:137-145.

Parsons, Donald O., 1986, The Employment Relationship: Job Attachment, Work Effort, and the Nature of Contracts, in *Handbook of Labor Economics, Vol. II*, Orley Ashenfelter and Richard Layard, eds., North Holland.

Reuters, March 8, 1998.

Rosensweig, Mark R., (1988), Risk, Implicit Contracts and the Family in Rural Areas of Low-Income Countries, *The Economic Journal*, 98:1148-1170.

Shaw, Kathryn L., 1996, An Empirical Analysis of Risk Aversion and Income Growth, *Journal of Labor Economics*, 14(4):626-653.

Wall Street Journal, 1996, China Plans Shareholder Firms, *World Wire*, September 3, pA16.

Weiss, Yoram, 1972, The Risk Element in Occupational and Educational

Choices, *Journal of Political Economy*, 80:1203-1213.

Zak, Paul J., (1999a), Institutions, Property Rights and Growth, *Advances in International Macroeconomics*, v1, forthcoming.

Zak, Paul J., (1999b), Socio-Political Instability and the Problem of Development, in *Governing for Prosperity*, Bruce Bueno de Mesquita and Hilton Root, eds., Yale University Press.