The Choice of Institutions: The Role of Risk and Risk-Aversion

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Abstract: Institutions can affect individual behavior both via their efficiency impact and via their risk reducing mechanisms. However there has been little study of the relative importance of these two channels in how individuals choose between simultaneously extant institutions. This paper presents a simple model of institutional choice in a labor market when there is a risk/reward trade-off, and tests the predictions of the theory. Using a novel empirical approach that adapts an ARCH-in-mean to cross-sectional survey data from China, we find that risk and risk aversion are strongly related to the choice of a labor market institution. Further, risk and risk aversion are quantitatively more important than the sectoral wage differential in explaining employment institution choices. Specifically, we find that wage risk has two orders of magnitude greater impact on labor market institutional choice than the wage difference, with a one standard deviation increase in earnings risk reducing the number of workers choosing jobs in the private (risky) sector by 22%.

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1. Introduction

Relative reward and risk are arguably the two most important factors in economic decision making across a broad range of human activities. Increasingly, current research also shows the importance of institutions in producing desirable long run economic outcomes (see, for example, Acemoglu et al. 2001). This paper examines the intersection of these three powerful forces in the context of labor markets to show how institutions, by affecting the risk and benefits of certain economic activities, influence people's choices. We demonstrate theoretically how these factors affect decisions between labor market institutions, and provide empirical evidence suggesting that differences in risk, even more than reward differentials, have substantial effects on sectoral labor supply choices.

The importance of institutions in reducing both actual and expected transactions costs has been recognized at least as far back as Coase (1937). Many institutions may have also (or even exclusively) evolved to mitigate risk (see for example, Bell, 1977, and Townsend, 1994). Theory would suggest that risk adverse individuals will favor institutions that facilitate high returns (i.e. lower transactions costs) and less risk, and that any such institution would come to dominate the market.

However, if there is a trade-off between institutions that yield higher mean benefits with higher benefit variance or risk, no one institution will necessarily dominate. Instead, several alternative institutions may well arise. In this case, we would expect individuals to choose institutions according to their preferences and constraints. One area in which these trade-offs can be acutely observed is in the labor market, with different compensation arrangements offering varying degrees of remuneration and risk.

A substantial body of literature has examined labor markets in which simultaneously existing institutional arrangements coexist or partially coexist (e.g. informal and formal, North and South, union and non-union etc.). Nevertheless, from many versions of the original Todaro (1969) model (i.e. Stiglitz, 1974, 1976, Cole & Sanders, 1985) to modern theories of international migration, labor economists have mostly concentrated on the expected wage differentials between segmented labor markets as the driving force behind inter-sectoral (or national) labor supply decisions. While the concept of a risk/reward trade-off in labor market institutions appears straightforward, very little empirical work has been done to explicitly examine the role of risk-

reducing labor market institutions. As Herzog (2004) comments, " … little is known of the implicit costs imposed on workers by job insecurity …" This paper characterizes the importance of the second moment effects (risk) on sectoral labor supply decisions. We directly ask if people respond more to changes in wage differentials or to risk.

In the labor market literature, risk is generally represented as the likelihood of finding employment (or the likelihood of unemployment) in a sector (see, for example, Hatton & Williamson (1998), Herzog (2000), Petrongolo & Pissarides (2001)). For example, Herzog (2004) exploits the relatively exogenous transformation of institutions within transition countries (e.g., Poland) to examine the aversion to job insecurity revealed by worker quit functions. Herzog (2004) finds that aversion to unemployment risk is "significant in magnitude."

In this paper we examine a different dimension of wage uncertainty: the spread of the expected wage. Some labor market institutions entail greater wage spread even when the likelihood of unemployment is near zero. We introduce a new measure of wage risk by defining the variance of the conditional wage distribution faced by each worker. This provides a continuous measure of wage risk that varies across institutions, and accords well with the notion of risk used by financial economists.

We begin by presenting a theoretical model of institutional choice where both risk and returns vary. The model demonstrates that both market and personal characteristics impact the choice of labor market institutions. The model's predictions are then tested empirically using a rich survey data set from China. As China decentralizes its economy, a bifurcated labor market has appeared between public sector and private sector employment, each with distinct institutions that govern employee and employer behavior. As with the studies on unemployment risk in the transition economies of Central Europe (i.e. Herzog 2000, 2004), the Chinese segmented labor market provides an excellent opportunity to study the relative importance of institutions on risk and return.

Our empirical strategy permits both individual- and institution-specific wages and risk, and tests whether these and an individual's risk aversion measures explain institutional choice. The empirical tests necessitate a novel adaptation of an ARCH-in-mean estimation to cross-sectional data. We find that wage risk is the most important factor affecting the flow of employees to the private sector, dominating the wage differential in determining institutional choice. These findings

have significant policy implications for China, transition economies, as well as for the general design of institutions.

2. A Simple Model of Institutional Choice Under Risk

The model uses a variant of portfolio theory to derive an individual's preferred employment institution 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 & Schlee, 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.

Individuals vary in their earning potential because of their education, location, gender, work experience, and ethnicity. In order to focus the analysis on institutional choice, we model individuals as maximizing the utility of end-of-period wealth, disregarding consumption/savings decisions. Before specifying an agent's decision problem, we introduce some notation. Let N_i^P be the time individual *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, private sector wages are fundamentally risky. By assumption, individuals know the distribution of wages which are (truncated) normal[1], with mean $m>0$ and variance s^2.

In the first stage of individual *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,

$$Max_{N^P,N^S} \quad EU(a_i) \tag{1}$$

$$\text{s.t.} \qquad a_i = a_i^0 + w_i^S N_i^S + w_i^P N_i^P$$

[1] Wages must be nonnegative, but the truncation at zero can be ignored as a practical matter if m is sufficiently above zero and s^2 is not too large. We will proceed under these assumptions.

$$1 = N_i^S + N_i^P$$

where $U(\cdot)$ is a strictly increasing, continuous, and concave representation of preferences over end-of-period wealth, a_i. End-of-period wealth a_i, is beginning-of-period wealth, a_i^0, plus the sum of earnings from both sectors, $w_i^S N_i^S + w_i^P N_i^P$. Total time is normalized to unity.

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

$$E\left[U'(a_i)\left(w_i^P - w_i^S\right)\right] = 0$$

which is equivalent to

$$E[U'(a_i)]E\left[\left(w_i^P - w_i^S\right)\right] = -\text{cov}\left[U'(a_i), w_i^P\right] \qquad (2)$$

where $\text{cov}[x, y]$ is the covariance between random variables *x* and *y*. Assuming $U'(a_i)$ and w_i^P are bivariate normal, applying Stein's lemma[2] and simplifying, we can write equation (2) as

$$E\left[\left(w_i^P - w_i^S\right)\right] = -\theta_i \,\text{var}\left[w_i^P\right] \qquad (3)$$

where $\theta_i = -E[U''(a_i)] \Big/ E[U'(a_i)]$ is a measure of risk aversion and $\text{var}\left[w_i^P\right]$ is the variance of private sector wages. Denote the optima that come from equation (3) as N_i^{S*} and N_i^{P*}. These are risk-adjusted time allocations for each sector. We consider agent *i*'s preferred institution to be the private sector if $N_i^{P*} > N_i^{S*}$; otherwise *i*'s preferred institution is in the state sector.

It is straightforward to show using equation (3) that an individual is more likely to work in the private sector 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)* when the agent is less risk averse.

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[2] Stein's lemma states that for bivariate normal random variables *x* and *y* and a differentiable function *g*, $E[g(x), y] = E[g'(x)]\text{cov}(x, y)$ when *g* satisfies standard regularity conditions. See Huang & Litzenberger (1988). If $U'(a_i)$ and w_i^P are not bivariate normal Stein's lemma can be applied via an approximation using a central limit theorem.

3. Institutional Choice and the Chinese Labor Market

The Chinese labor market in the early 1990's is an attractive place to test the predictions of our model. Prior to reforms instituted in 1986, 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 then 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] Institutional rules in the private sector do not require that benefits be offered to employees, do not guarantee lifetime employment, and permit wages to vary with market forces.[5]

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 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).[6] The certainty of lifetime employment in the state-sector is fading as China's economy liberalizes, yet as of the early 1990s, the time when our data were collected, employment in the state sector had little risk.

This brief overview of the Chinese labor market reveals several clues regarding the factors that led workers to choose state sector or private sector employment institutions. State sector jobs generally came with lower pay but generous benefits and less employment risk, while private sector jobs were based on short-term contracts and were subject to the vicissitudes of the market.

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[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.

4. Empirical Methodology and Data

4a. Data and Estimation Methodology

We begin testing the model of institutional choice by examining worker characteristics in survey data collected in 1992 by the Chinese Academy of Social Sciences under supervision by a U.S. team of economists.[7] 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.[8]

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 well as the monetary equivalent of benefits, such as job position subsidies (e.g. to purchase protective clothing), and any additional in-kind income. As the summary statistics in Table 1 illustrate, the average monthly earnings of workers in the private sector exceed those in the state sector by 22%. Standard models of sectoral labor supply (Parsons, 1986) show that workers move among sectors until the expected wage differential (inclusive of the value of benefits) disappears. Yet, this did not appear to happen in China where state sector employment was relatively ossified at the time of the survey.

Importantly, 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. Although measured wages do include benefits, we cannot observe accumulated privileges that do not show up in the current value of remuneration. Thus for the primary analysis we further restrict our focus to workers less than 36 years of age, [9] leaving an effective sample size of 3723.[10]

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[6] The Chinese press reported that 20-30% of employees in state-owned firms in the early 1990s were redundant (Maurer-Fazio, 1995).

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

[8] 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.

[9] Younger workers can more easily be thought of as comparing contemporary benefits and wages (and wage risk) as the theory shows.

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 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 factors that motivate individuals to work in the private sector, and almost all adults worked in China in 1992, this should induce little or no bias in the results.

4b. Estimating Expected Wages and Wage Risk

We test the implications of the model by defining a variable z_i which takes the value 1 if an individual chooses the private-sector labor market, and 0 otherwise. Taking logs of equation (3), leads to the private sector labor supply equation

$$z_i = \ln\left(E\left[\left(w_i^P - w_i^S\right)\right]\right) - \ln\left(\text{var}\left[w_i^P\right]\right) - \ln q_i \qquad (4)$$

This labor supply equation forms the basis for our empirical analyses. The difficulty in testing equation (4) is twofold: the development of a measure of risk aversion, q_i, using individual-specific characteristics, and the proper measurement of the risk of private wages $\text{var}\left[w_i^P\right]$ for workers in both the private and state sectors. It is these issues to which we next turn.

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 are not faced by any particular 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

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[10] The main results for the full sample including older workers are presented in Table 5 and do not substantially change

of worker *i* is riskier than that of worker *j* if, given worker characteristics X_i and X_j, the expected variance of the wage for worker *i* is greater than the expected variance of the wage for worker *j*. If we denote the wage risk of workers *i* and *j* by Φ_i and Φ_j, then

$$\Phi_i > \Phi_j \; iff \; E\left[\text{var}\left(w_i^P \mid X_i\right)\right] > E\left[\text{var}\left(w_j^P \mid X_j\right)\right]$$

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. Note that wages in the institutional choice model (1) are 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. 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 for worker *i* in either the T=S state sector or the T=P private sector is estimated:

$$\begin{aligned} Wage_i^T = & \sum_k b_{T1k} City_{ki} + b_{T2} Age_i + b_{T3} Agesq_i + b_{T4} Exper_i + b_{T5} Expsq_i + b_{T6} Educ_i \\ & + b_{T7} Educsq_i + b_{T8} Sex_i + b_{T9} Marry_i + \sum_z b_{T10z} Ethnic_{iz} + e_{Ti}, \end{aligned} \qquad (5)$$

where *k*=1…K denotes cities where employees work, and z=1…Z are worker ethnicities. 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* are also included. We also control for the sex of the worker, SEX_i, and whether the worker is married or not, $MARRY_i$. In addition, we control for the ethnic classification (*z*) of the worker, $ETHNIC_z$. There are nineteen cities in the sample and

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our findings.

four primary ethnic groups - the majority 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 some 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.

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, $\hat{b}_{Tk}, \hat{b}_{T1}...\hat{b}_{T9}, \hat{b}_{T10z}$ for T=N, S; k = 1…19; and z=1…4. The expected wage differential facing worker *i*, $WDIFF_i$, is the estimated difference between state sector and private sector wages,

$$WDIFF_i = \sum_k (\hat{b}_{P1k} - \hat{b}_{S1k}) City_{ki} + \sum_q^8 \left(\hat{b}_{Pq} - \hat{b}_{Sq}\right) X_{qi} + \sum_z \left(\hat{b}_{Pz} - \hat{b}_{Sz}\right) Ethnic_{zi} \qquad (6)$$

where X_q corresponds to the q=1…8 explanatory variables from the wage regressions (5).

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 two wage regressions (for P and S) described in (5) are recovered. The error is the portion of the wage that is not explained by the set of first-order characteristics. This error term is squared, producing e_{Pi}^2 and e_{Si}^2.

We then estimate two equations, one for the private sector and one for the state sector, in which the squared error terms are explained by all the q=8 regressors from equation (5) plus the q* cross products of *EXPER, AGE and EDUC* that we denote XX_{q*}.

$$e_{Ti}^2 = \sum_k f_{T1k} City_{ki} + \sum_q^8 f_{Tq} X_{qi} + \sum_{q^*} f_{Tq^*} XX_{q^*i} + \sum_z f_{Tz} Ethnic_{zi} + h_{Ti} \qquad (7)$$

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 the equations described by (7) to generate a predicted $\hat{e}_{Pi}^2$ and $\hat{e}_{Si}^2$ 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,

$$RISK_i = \sum_k (\hat{f}_{P1k} - \hat{f}_{S1k}) City_{ki} + \sum_q^8 \left(\hat{f}_{Pq} - \hat{f}_{Sq}\right) X_{qi} + \sum_{q^*} (\hat{f}_{Pq^*} - \hat{f}_{Sq^*}) XX_{q^*i} + \sum_z \left(\hat{f}_{Pz} - \hat{f}_{Sz}\right) Ethnic_{zi} \quad (8)$$

Equation (8) 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 (8) gives the variance in wages that this worker would expect to face.

By including individual specific expected risk differentials into the institutional choice model, we are essentially adapting an ARCH-in-Mean model from time series into a cross-sectional analysis in order to test for second moment effects in the levels of variables. Our model differs from an ARCH-in-Mean in two 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, but derived from the wage equations. Nevertheless the intuition of the statistical approach, that second moments of some variables may affect the levels of other variables, is common in the time series econometrics literature.

4c. Estimating Risk Aversion

Although each individual's true level of risk aversion, q_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-financed training involves making a current sacrifice for an uncertain future payback, we expect *TRAIN* to be negatively correlated with risk aversion. Marital status, *MARRY,* is another 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.

4d. Additional Control Variables

Because worker-specific factors might explain some aspects of institutional 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[11].

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

4e. Bootstrapping

A concern is that the multi-step procedure described above could produce biased standard errors in the final probit model. This is because some of the explanatory variables are constructed (*WDIFF* and *RISK*) although a statistical program will consider them fixed, thus not taking into account the variation from the first stages of the estimation process when calculating the standard errors. In order to address this issue we bootstrap an approximate asymptotic covariance matrix of the coefficients to produce corrected standard errors. The bootstrapping is done by taking repeated samples (with replacement) of size N (in this case N=3723) and re-doing the entire estimation process through all stages. This is repeated 500 times and the resulting probit coefficient estimates are used to construct the bootstrapped standard errors. Because the bootstrapping procedure is extremely computer-intensive, the bootstrapped standard errors are reported for the final two specifications (regressions 5 and 6) only. As expected, the bootstrapped t-statistics are lower than the conventionally calculated figures. In some cases (such as for the effects of *AGE* and *SEX*) the corrected t-statistics are low enough that the estimated coefficients lose statistical significance. However, the corrected t-statistics for several of the risk aversion proxies (*TRAIN* and *MOVED*) and our primary variables of interest, *WDIFF* and *RISK*, remain statistically significant, albeit at somewhat lower levels of significance (5% rather than 1% for the latter two).

5. Main Results

Table 3 presents the results of six probit regressions estimating the augmented private sector institutional choice equation (4). The means and standard deviations of the included variables are reported in Table 1. The dependent variable of the probit regressions is z_i which takes the value 1 if a worker is 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 primary interest, *WDIFF* and *RISK*. The risk-aversion variable is not statistically significant but both *WDIFF* and *RISK* are highly significant and of the expected sign. The larger the difference between the

expected private sector wage and the expected public sector wage, the more likely an individual will choose to work the private sector. On the other hand, when private sector wage risk increases, an individual is less likely to work in the private sector, even when controlling for the difference in wages. However, care must be taken in interpreting the statistical significance of these results as the standard errors are uncorrected.

In regression (2), we additionally control for a worker's ethnicity while in regression (3) we add a dummy variable for marital status, *MARRY*, which proxies risk aversion. *MARRY* takes the expected negative sign (married people appear to be more risk averse) and is generally statistically significant, although the bootstrapped t-statistics indicate that it is not significant in the last specification. Both *WDIFF* and *RISK* remain statistically significant (uncorrected) with the correct signs in both equations.

In regression (4) we add the remaining risk-aversion proxy variables, *TRAIN* and *MOVED*. They are both statistically significant and carry the expected positive sign: workers who have engaged in these activities, which indicate low risk aversion, are more likely to choose a private sector job.

In regressions (5) and (6), besides control variables for ethnicity, family size, marital status, prior training and having moved, we also include additional controls for sex, education, and age. Further, we bootstrap the standard errors for these two estimations to take into account the variation introduced by the multi-stage estimation process. The conventionally calculated t-statistics would suggest that men and younger people are statistically significantly more likely to choose a private sector job. However, the corrected standard errors show that these variables are not statistically significant. Nevertheless, the variables of primary interests, *WDIFF* and *RISK* remain statistically significant at the 5% level with the correct signs. This demonstrates substantial support for the impact of wage risk on labor market institution choice.

In Table 4 we calculate the marginal effect associated with the variables included in specification (6). This calculation shows that one standard deviation increase in the difference in the expected wage increases the probability of choosing a private sector job by 0.21%. Conspicuously, however, the risk of private sector wages has 100 times greater effect on institutional choice than the wage difference. A one standard deviation increase in wage risk

reduces the probability of taking a private sector job by over 22%. With the exception of being in the Mongol ethnic group, the marginal effect of wage risk dominates all other variables.[12]

In Table 5 we summarize the main results for the complete sample of 6106 workers, including those over the age of 35. In regressions (7)-(9), although the *RISK* variable is robust and negatively related to sectoral choice, the coefficient estimate of *WDIFF* is not robust in this sample. In addition, as these results are not based on bootstrapped standard errors, we would expect the true t-statistics to be somewhat lower. These results suggest that unobservables (especially accrued benefits) play a substantial role in the labor supply decisions of older workers.

6. Conclusions and Policy Implications

The theory and empirical analysis in this paper demonstrate the important roles of risk and risk aversion on institutional choice. Our results are broadly consistent with assertions of many New Institutional Economics scholars that institutions are risk-mitigating mechanisms (Williamson, 1987; North 2005), and that institutional design affects economic choices. Furthermore, this paper provides novel empirical evidence suggesting that reductions in risk, even more than increases in wages, have driven sectoral labor supply choices in our data. In particular, our analysis suggests that the lack of risk-reducing institutions for private sector employment was a primary reason why state-sector employment in China was relatively stable in the early 1990s even while private sector wages significantly exceeded state wages.

While the case under study here was that of China the policy implications are widespread, especially among transition economies. For example, our results suggest that privatization could be accelerated by supplementary institutions to reduce individual risks such as modern employment offices. Freeman (1994), using the same data set analyzed here, finds that only 27% of the labor force obtained jobs through modern methods (e.g. through employment agencies). Potentially large benefits from the provision of unemployment insurance are another implication of this analysis. If (public or private) unemployment insurance were available, our findings suggests that labor flows to the private sector would increase. Risk-reducing institutions are particularly important in light of the empirical evidence in Dunn (1996) showing that U.S. workers appear to exhibit loss aversion,

[12] Harrell (1995) suggests a reason for the large marginal effect of being a Mongol on private sector employment. He documents pervasive ethnic discrimination in China and suggests that Mongols and other minority groups lack the

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.

Another implication of our analysis is that variations in risk aversion will cause some workers to choose state-sector employment with stagnant wages even as private sector wages climb. As the private sector grows, this is likely to produce a widening of the distribution of income. Zak (2002) shows that greater income inequality increases socio-political instability (i.e. demonstrations, strikes, and the destruction of property). Socio-political instability (SPI) itself requires institutional responses to limit its negative impact on economic growth. Ghate, Le & Zak (2003) show that even optimal policy responses are unable to mitigate all the negative growth effects of SPI. Thus, institutional reform is required throughout the development process to reduce current risks as well as manage new risks.

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opportunity to work for many Han-managed businesses.

Tables

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

	Sate 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

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

Note: 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 (for workers under 35 years old)
Dependent Variable: 1 if private-sector job, 0 otherwise.

	(1)	(2)	(3)	(4)	(5)	(6)
EDUC						-.0140 (-1.3) (-.70)
AGE						-.0224 (-2.6***) (-1.3)
SEX					0.1643 (2.74***) (1.21)	0.1564 (2.52**) (1.33)
MARRY			-.3250 (-6.6***)	-.3164 (-6.4***)	-.3205 (-6.5***) (-3.1***)	-.1742 (-2.3**) (-1.2)
HAN		0.1361 (0.57)	0.1116 (0.46)	0.1255 (0.52)	0.1044 (0.43) (0.38)	0.1005 (0.41) (0.26)
MONGOL		-1.148 (-2.0**)	-1.122 (-1.9*)	-1.106 (-1.9*)	-1.179 (-2.0**) (-.68)	-1.020 (-1.7*) (-.60)
WEI		-.3365 (-.67)	-.4761 (-.92)	-.4261 (-.82)	-.5617 (-1.1) (-.29)	-.5423 (-1.0) (-.28)
FAMSIZE	0.0092 (0.59)	0.0088 (0.57)	0.0031 (0.20)	0.0030 (0.19)	-.0001 (-.01) (-.01)	-.0007 (-.05) (-.04)
MOVED				0.2325 (4.32***)	0.2288 (4.25***) (4.21***)	0.2351 (4.36***) (4.35***)
TRAIN				0.3388 (1.80*)	0.3531 (1.88*) (1.67)	0.3465 (1.83*) (1.73*)
WDIFF	0.0071 (6.56***)	0.0077 (6.39***)	0.0073 (6.77***)	0.0076 (6.63***)	0.0073 (6.34***) (2.31**)	0.0064 (5.35***) (2.20**)
RISK	-.5126 (-4.9***)	-.5622 (-5.6***)	-.6040 (-5.2***)	-.6010 (-5.5***)	-.8080 (-6.1***) (-2.2**)	-.6705 (-4.5***) (-2.0**)
Log-Likelihood	-1846.78	-1843.08	-1821.07	-1810.33	-1806.57	-1802.23

Note: Coefficient estimates are presented with their corresponding robust *t*-statistics in parentheses. Bootstrapped *t*-statistics are also presented below the conventional *t*-statistics for specifications (5) and (6). Coefficient estimates for *CITY* variables are not shown to conserve space.

Table 4: Regression Variables' Marginal Effects, Means, and Standard Deviations
(from Table 3, regression (6))

Variable	Marginal Effect	Mean	Std Dev
AGE	-0.00467	27.1598174	4.5973823
EDUC	-0.00743	6.9508461	2.2396700
SEX	0.05197	0.5063121	0.5000273
MARRY	-0.05786	0.5799087	0.4936396
HAN	0.03336	0.9852270	0.1206594
MONGOL	-0.33881	0.0018802	0.0433264
WEI	-0.18016	0.0029546	0.0542832
FAMSIZE	-0.00024	3.9435939	1.5545045
MOVED	0.07808	0.3080849	0.4617639
TRAIN	0.11512	0.0153102	0.1228002
WDIFF	0.00212	10.9692620	51.9237395
RISK	-0.22273	0.2157091	0.4825450

Table 5: Probit regression results including workers over 35 years
Dependent Variable: 1 if private-sector job, 0 otherwise.

	(7)	(8)	(9)
AGE			-.0216 (-7.9***)
EDUC			-.0100 (-1.2)
SEX		0.0694 (1.56)	0.1213 (2.68***)
MARRY	-.4596 (-10***)	-.4726 (-10***)	-.2387 (-4.3***)
HAN	0.1855 (0.86)	0.1803 (0.84)	0.2113 (0.98)
MONGOL	-.1960 (-.45)	-.2638 (-.60)	-.4282 (-.95)
WEI	-.1305 (-.37)	-.1958 (-.54)	0.0376 (0.10)
FAMSIZE	0.0094 (0.78)	0.0084 (0.70)	0.0092 (0.75)
MOVED	0.1385 (3.20***)	0.1363 (3.15***)	0.1520 (3.49***)
TRAIN	0.3204 (2.04**)	0.3277 (2.08**)	0.3003 (1.90*)
WDIFF	0.0014 (1.28)	0.0016 (1.43)	0.0041 (3.35***)
RISK	-.3924 (-3.6***)	-.4891 (-3.9***)	-.4126 (-3.1***)

Note: Coefficient estimates for the constant term and the *CITY* dummy variables are not shown to conserve space.

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