

**EMPLOYMENT AND WAGE DYNAMICS:
ESTIMATING THE IMPACT OF LABOUR MARKET INSTITUTIONS**

by

Terence K. H. Yuen

**A thesis submitted in conformity with the requirements
for the degree of Doctor of Philosophy
Graduate Department of Economics
University of Toronto**

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Abstract

This dissertation is comprised of two separate empirical projects that focus on the effect of changes in the institutional environment – in China, the movement to a “market economy” and in Canada, changes in the minimum wage legislation – on employment and wage dynamics.

Part I Wage and Employment Determination in Chinese State-Owned Enterprises 1980 - 1994

Labour market reforms in transitional economies are especially important to the restructuring of state-owned enterprises (SOEs) because they not only affect production efficiency, but also have potentially adverse social impacts on urban unemployment and income inequality. Using an extensive establishment-level panel data, Chapters 1 to 3 present some of the first empirical evidence on how Chinese SOEs have changed their

employment and wage setting behaviour in response to gradual decentralization. Despite the deep-rooted egalitarian culture, I show that the link between workers' pay and enterprise performance strengthened between 1980 and 1994. However, the effect of reform on employment decisions appears to have been much weaker. Employment adjustment to demand shocks did not increase over the slow rates of the early 1980s. More importantly, I find that the central planning model provides a more consistent interpretation of the observed employment patterns. These results suggest that the decentralization in Chinese labour market is heavily skewed towards wage determination. The government continues to play an important role in employment decisions at least until the mid-1990s.

Part II Minimum Wage Legislations in Canada 1988 - 1990

Previous U.S. panel estimates of minimum wages effects on youth employment have been criticized on the grounds that their identification rests on comparisons of 'low wage' and 'high wage' workers, who may differ in ways besides their pay. The institutional structure of minimum wage laws in Canada, whereby minimum wages vary across provinces, permits an evaluation of this objection. Using individual-level panel data for 1988-90, empirical results in Chapter 4 appear to vindicate the critics: the estimates based on exclusive samples of "low wage" workers are small and statistically insignificant. Low wage workers, however, are in turn a heterogeneous group. For 'transitory' workers with less than 3 quarters of low wage employment in the sample period, the minimum wage effects are virtually zero. Yet, there is a significant disemployment effect for the complementary group.

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The survey data for the period 1980-89 that I use for the analysis of Chinese state-owned enterprises, was the product of a collaboration between the Institute of Economics, Chinese Academy of Social Sciences (CASS), U.C. San Diego, University of Michigan, and Oxford University. Subsequently, CASS updated the information for the years 1990-94. I would like to thank Professor Wang Hongling from the CASS for helping make these data available to the University of Toronto, and for his feedback on this project during his visit to the University of Toronto in the summer of 1998.

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INTRODUCTION

Wage and Employment Dynamics: Estimating the Impact of Labour Market Institutions

A large number of theories have been offered to explain the determination of wages and employment. The conventional neoclassical model assumes that wages and employment are freely adjusted such that demand equals to supply in equilibrium. In reality, rigidities arise in labour markets for institutional reasons. The degree of inflexibility varies from the extreme case of centralization in socialist countries to various forms of employment and income protection programs in market economies. The interactions between the institutional factors and labour market outcomes have important implications for a wide range of research and public policies. One illustration is the recent debate on the role of institutions on the contrasting labour market experiences between the United States and Western European countries during the 1980s.¹ This study focuses on the impact of changes in two separate institutional structures: i) the transition from a planned to decentralized labour market in China; and ii) minimum wage legislations in Canada.

¹ For example, see Card, Kramarz and Lemieux (1999), Barrett, Callan and Nolan (1999), Bettio and Rosenberg (1999), Buchele and Christiansen (1999) and Simonazzi and Villa (1999).

Part I Wage and Employment Determination in Chinese State-Owned Enterprises 1980 - 1994

While the restructuring of state-owned enterprises (SOEs) in transitional economies involves a wide range of changes, wage and employment practices are especially important because they not only affect production efficiency, but also have potentially adverse social impacts on urban unemployment and income inequality. Labour policies in China's state sector have changed substantially since economic reforms began in 1978. The fundamental principle of the labour reform is to expand enterprise autonomy progressively by delegating power from higher authorities to enterprise managers. The revival of bonus payment and the introduction of contract labour are two distinct features of the labour market decentralization during the first decade of reform. These two institutional changes, in principle, improve the flexibility of workers' compensation and employment adjustment to demand shocks.

Part I presents some of the first empirical evidence on how Chinese SOEs changed their employment and wage setting behaviour in response to gradual decentralization. I use an extensive establishment-level panel data covering the early phase of reform through to the mid-1990s. The data provide in-depth information on over 750 SOEs, and allow for a thorough examination of the evolution of managers' and the government's role in labour decisions at various phases of the reform.

This part sheds light not only on Chinese economic reform, but also contributes more generally to questions regarding the pace of labour market reforms. As Blanchard (1997) observes, the "big bang" transitions in most Central and Eastern European countries led to the well-known U-shaped responses in output and employment – that is, an initial decline followed by a recovery. With the exception of the Czech Republic, unemployment

increased to more than 10 percent. In contrast, China's urban unemployment rate remained constant at approximately 3 percent throughout the 1980s and mid-1990s. Therefore, comparisons between China and post-communist Central and Eastern countries² (e.g., Basu, Estrin and Svejnar 1997) provide a more comprehensive assessment of emerging labour markets in transitional economies with different reform patterns.

Part I comprises of three chapters. After reviewing the key aspects of the state sector labour reform, Chapter 1 outlines some of the basic questions of wage and employment determination in the post-reform era. Chapter 2 focuses on the evolution of the link between workers' compensation and enterprise performance. Despite the deep-rooted egalitarian culture of China's industrial system, I find empirical evidence in support of a strong link between pay and performance that has strengthened over the reform period. This trend is also associated with rising wage inequality across enterprises. Chapter 3 develops a Nash bargaining model to examine the effect of reforms on employment dynamics. Using a dynamic factor demand model (e.g., see Card 1986), it appears that the central planning model provides a more consistent interpretation of the employment patterns between 1980 and 1994. More importantly, there is no evidence of increased flexibility of the "iron bowl" system. These results suggest that, though SOEs acquire more control over wage determination, the government has maintained a tight control on labour allocation after reforms.

² For a survey of principal econometric studies of labour market issues in the Central and Eastern countries, see Svejnar (1998).

Part II Minimum Wage Legislations in Canada 1988 - 1990

Most of the discussion on minimum wages concentrates on its potential impact on youth employment.³ Time series evidence from the 1970s is consistent with the neoclassical prediction of a negative employment effect as the minimum wage increases (e.g., see Brown 1988). On the contrary, a number of studies (e.g., see Card 1992a and 1992b, Katz and Krueger 1992, Card and Krueger 1994) suggest that the employment effect is insignificant or perhaps marginally positive. A number of attempts have been made to reconcile these divergent results. One vein of the research examines workers' employment patterns before and after an increase in the minimum wage using U.S. individual-level panel data (e.g., see Linneman 1982 and Currie and Fallick 1996). However, these panel estimates have been criticized on the grounds that their identification rests on comparisons of 'low wage' and 'high wage' workers, who may differ in ways besides their pay. Canada, arguably, provides a better environment to evaluate this objection. In contrast to the U.S., minimum wage legislation in Canada is under provincial jurisdiction. Therefore, for an increase in the minimum wage in a given province, low wage workers in other provinces can serve as the control group.

Part II consists of one chapter, Chapter 4. Using Canadian data for 1988-90, I compare estimates of the minimum wage effect based on the traditional U.S. panel methodology to those based on samples of "low wage" workers exclusively. The results appear to vindicate the critics: the estimates based on exclusive samples of "low wage" workers are small and statistically insignificant. Low wage workers, however, are in turn a heterogeneous group. For 'transitory' less attached workers, who have extremely limited

³ A couple of recent studies focus on the impact of a minimum wage decline on the rising earning dispersion, for example, DiNardo, and Lemieux (1997) and DiNardo, Fortin and Lemieux (1996).

low wage employment histories, the minimum wage effects are virtually zero. Yet, there is a significant disemployment effect for the complementary group – a very small portion of youth workers with poor economic prospects.

PART I

Wage and Employment Determination in Chinese State-Owned Enterprises 1980 - 1994

CHAPTER 1

An Overview of the Labour Market Reform in China

1.1 Introduction

A fundamental issue in transition economies is the restructuring of state-owned enterprises (SOEs). In China, even after two decades of economic reform, improvements in SOEs remained one of the top priorities in the September 1999 plenum of the Communist Party. Most of the discussion pertaining to China's state sector reform has focused on the performance of SOEs. Analysis based on financial data, such as the rate of return on assets, fiscal subsidies and preferential bank loans to the state enterprises, supports the view that profitability has deteriorated over the reform period (Lardy 1998). However, another vein of research using productivity as the performance measure presents an inconclusive picture. Despite the estimated growth rates vary from 1.6 (Jefferson, Rawski and Zheng 1996) to 4.6 percent per year (Li 1997), empirical evidence¹ suggests that total factor productivity may have improved in the 1980s. The dramatic decline in financial performance accompanied by possible improvements in productivity poses a puzzle.

Overlooked in this debate is the underlying behavioural changes in SOEs that are brought about by the gradual decentralization process. The success of this process, in particular, has strong interactions with the labour market. Changes in wage and

employment practices are central to improving enterprise efficiency. For example, increasing firms' autonomy on workers' compensation allows for stronger incentive schemes, which may increase labour productivity. Greater flexibility in recruitment and dismissal decisions improves employment adjustments to demand shocks, and consequently enterprise profitability. From a social welfare perspective, these practices will have profound implications for workers in terms of unemployment and income inequality. In addition, labour market instability may lead to social unrest that affects the sustainability of reforms. More generally, labour market reform relates to the public policy debate on maintaining a balance between efficiency and equity in transitional economies, where the social security systems are poorly developed (e.g., see Ham, Svejnar and Terrell 1998).

The main purpose of Part I is to examine the corresponding changes in underlying wage- and employment-setting behaviour of state enterprises as China's labour market has evolved from a centrally planned system to a more decentralized environment. Labour policies in the Chinese state sector have changed substantially since economic reforms began in 1978. In short, the central features of the first decade of reform include the revival of bonuses as incentive pay in workers' compensation, and the introduction of short-term contract labour in an attempt to increase mobility in the traditional "iron bowl" employment system. In the mid-1990s, the spotlight was turned to the aggressive policy of Xiagang – laying off surplus workers. Details of these institutional changes in China's labour market will be reviewed in the next section.

¹ Other examples on total factor productivity growth include Woo et al. (1994) and Gordon and Li (1995).

1.2 Summary of the Labour Reform since 1978

Prior to the reform, Chinese industry was almost completely dominated by the state sector. In 1978, it accounted for 78 percent of the total industrial output² as well as urban employment.³ SOEs had limited autonomy on issues concerning prices, outputs, inputs, and investments. In December of 1978, economic reforms in both the agricultural and industrial sectors were initiated by the Chinese Community Party (CCP) leader, Deng Xiaoping, who believed that the market could function as an important supplement to the existing planned economy in order to improve efficiency. At the outset, only a few enterprises in Sichuan were selected for experiments to increase autonomy. The dual-track pricing system⁴ introduced in 1984 was considered the cornerstone of industrial reforms in China. The central feature of this new pricing system is that enterprises were allowed to sell their products at a price “freely” adjusted to reflect the market conditions after fulfilling the quotas predetermined by their supervisory agencies. Since then, delegation to state enterprises extended to other dimensions, including labour and investment decisions. In this section, I narrow the focus on the changes in wage and employment polices between 1978 and the mid-1990s.⁵

² Industrial output refers to the total output in 3 sectors: mining and quarry, manufacturing, and electricity, gas and water supply.

³ Urban employment, which is defined as formal employees in China Labour Statistical Yearbook, refers to workers in all urban enterprises, institutions and government agencies, except those under private individual-ownership.

⁴ Details of the dual-track economic system, see Byrd 1987.

⁵ For a comprehensive picture of the Chinese industrial reform, see Naughton (1995).

1.2.1 Wages

Monetary rewards⁶ for workers in Chinese SOEs mainly consist of two components: the basic wage and a bonus. A standardized national scale for the basic wage was first formulated by the central government in 1956. In order to ensure that workers were paid according to their “effort,” wages were determined by workers’ experience and the skill level of their occupation. After adjusting price differentials in different geographic areas and various working conditions across industries, the scale was extremely complicated, with over 300 classes and 8 sub-grades within each class.⁷ However, the central government did not revise the scale frequently enough to keep up with the changes in socio-economic conditions. As is clearly evident in Figure 1.1a, annual earnings for state workers were effectively frozen for two decades. Only four minor adjustments were made between 1957 and 1977.⁸ As a result, the average real wage⁹ in 1977 was about 20 percent lower than the 1956’s level (Figure 1.1b).

During the 1950s and early 1960s, bonuses were distributed as a certain percentage¹⁰ of the basic wages if the enterprise was able to achieve the planned targets. However, Mao Zedong, Chairman of the CCP, criticized any materialistic incentive in workers’ pay as contradictory to the Party’s political ideology. He believed that workers should be motivated by moral education. Consequently, all sorts of incentive pay,

⁶ In addition to monetary wages, workers’ compensation includes housing subsidies, medical insurance, and payments in kind, such as food and clothing.

⁷ Kao, 1991, p. 25.

⁸ Adjustments were made in 1959, 1961, 1963 and 1971.

⁹ Average real wage refers to the average nominal wage of formal employees in all state-owned units deflated by urban consumer price index.

¹⁰ Usually less than 7 percent (Shirk 1993, p.16).

including bonuses, were officially abolished at the time of the Cultural Revolution in 1966. Bonuses were then replaced by supplementary wages, which were uniformly distributed across firms. In summary, the wage system in the state sector was far removed from a market, and compensation did not reflect workers' or enterprise productivity. Egalitarianism was the main guideline in determining workers' wage in the pre-reform era.

Following the death of Mao and the downfall of the Gang of Four, Deng re-emphasized the correlation between pay and performance. Egalitarianism was no longer emphasised as the primary ideological backbone for the CCP. In accordance with the original principle for the uniform wage scale set in 1956, workers would be rewarded according to their "contribution." As a result, a bonus system very similar to that of the 1950s was revived¹¹ as one of the key elements of the industrial reforms in 1978. Enterprises achieving the plan targets were entitled to bonus payments which equal to a certain percentage of the total wage bill.¹² Beginning in 1979, a new policy was introduced that allowed the bonus to be tied to enterprise profitability. Managers from selected SOEs were given the autonomy to determine the bonus amount that was paid out of their own retained profits. In order to control the trend of rapidly increasing bonus payments, a cap on payments of less than 2 months of the basic wage was imposed in 1982. Two years later, this limit was replaced by a progressive tax paid by the enterprise. Bonuses of less than 2.5 months of the basic wages were not taxed; the tax rate for 2.5 to 4 months was 30

¹¹ Besides bonuses, piece-rate wages were also revived.

¹² The bonus was 5 percent for achieving eight plan targets: output, variety, quality, raw material inputs, energy and power consumption, labour productivity, cost, profit, and circulating capital, but it was cut down to 3 percent for four targets: output, quality, variety and profit. (Shirk 1993, pp. 198).

percent of the bonus payment; 100 percent for 4 to 6 months; and 300 percent for over 6 months.¹³

Despite all the precautionary policies, the percentage of the total wage bill paid as bonuses and piece-rate wages, shown in Figure 1.2a, increased substantially from 2.4 percent in 1978 to 23.3 percent in 1993, then declined by 6.5 percent over the next two years.¹⁴ As shown in Figure 1.2b, this implies an unbalanced growth in bonus payment relative to the basic wages. Compared to a moderate growth rate of 3.3 percent per year in the real basic wage, the mean bonus increased almost 15 fold between 1978 and 1995, or equivalent to an annual rate of 16.9 percent. In contrast to the stagnant wage pattern in the pre-reform era, Figure 1.3a presents an entirely different picture after the economic reform. Average income in the state sector doubled every five years following the acceleration in reforms in 1984. Taking into account the high inflation rates over the period, state workers experienced a real increase of 100 percent in their earnings over the two decades (Figure 1.3b). The rapid growth in bonus payment implies that enterprises were less constrained by the uniform basic wage scale over the reform period. Potentially, managers are able to strengthen workers' discipline through profit sharing. Whether bonus is distributed effectively as an incentive payment becomes an important empirical question that will be addressed in Chapter 2.

¹³ The progressive tax rate was significantly lowered in 1985 and 1987. In 1987, no tax was imposed on bonuses up to 4 months of the basic wages. Between 4 to 5 months, the tax rate was only 20 percent. The rate increased to 50 percent between 5 to 6 months, 100 percent between 6 to 7 months, and 200 percent over 7 months.

¹⁴ This is probably due to the fact that managers are able to redirect part of the bonuses into basic wages as enterprises are given more autonomy in determining basic wages. There are two advantages to this kind of manipulation. First, shifting to basic wages can reduce the amount of accounting profits, which results in lower profit tax. Second, the bonus payment is under control without exceeding the tax free limit.

1.2.2 Employment

In the pre-reform era, the labour market in China was very much under-developed in comparison to the Soviet Union (Granick 1987 and Pryor 1985). Migration from rural areas to cities was forbidden, except through tightly controlled recruitment programs. Allocation of urban industrial labour was also highly bureaucratic. Instead of firms competing for labour, workers were directly assigned to them by the government and most of the employment was lifetime. Quits or labour mobility between firms were virtually non-existent. Moreover, managers, in principle, had no autonomy to fire or promote workers. Under this restrictive “iron bowl” policy, surplus labour developed in the state sector. In my sample, 60 percent of the managers reported that more than one-fifth of their workers were redundant in 1994. This is consistent with the consensus that the redundancy rate ranges from one-fifth to one-quarter.¹⁵

In order to improve labour mobility under the “iron bowl,” various policies were implemented in the mid-1980s. First, the labour contract system¹⁶ was officially applied to all new workers entering the state sector in 1986. The duration of the contract could vary from 3 to 20 years and renewal depended on the worker’s individual performance. The proportion of contract workers in the state sector increased dramatically from 13 percent in

¹⁵ For example, Wu (1998) estimates that the redundancy rate was about 30 percent in 1994. A World Bank (1996) survey of 142 SOEs in 1994 reported that 60 percent of the enterprises had over 10 percent of excess workers, while 1/3 of them had labour redundancy exceeding 20 percent.

¹⁶ In China, contract workers are different from temporary workers. The former are employed under the state labour plan, and thus have rights comparable to those of the permanent workers, except lifetime employment. For details of the implementation of the labour contract system, see White (1987).

1990 to 40 percent in 1995.¹⁷ In addition, direct state control over labour allocation was reduced and managers were granted more autonomy in hiring and dismissal of workers.¹⁸

In spite of these reforms, the state sector's share of total urban employment¹⁹ remained roughly constant over the period. As shown in Figure 1.4, it declined only very slightly from 78.4 percent in 1978 to 73.5 percent in 1995. The Chinese government has been very cautious in reducing redundancy in the state sector, and in fact, employment increased. Since a considerably large portion of urban workers is employed in the state sector, massive layoffs would substantially increase the urban unemployment rate. This kind of economic imbalance might lead to social instability that would threaten the leadership of CCP cadres. In order to maintain a stable unemployment rate in urban areas, labour policy at the macro level is first set by the Central Labour Bureau. Employment targets are then allocated to the local labour bureaus, whose task is to implement the national policy locally. A series of negotiations among the local labour bureaus and SOE managers follow to determine employment at the enterprise level. This suggests that economic reformers and the Central Labour Bureau have competing objectives concerning the improved flexibility of the labour market. Which groups seem to be holding greater sway becomes an empirical question which will be discussed in length in Chapter 3.

Employment policies in the 1990s were characterized by the aggressive use of *Xiagang* – a policy to lay off surplus SOE workers progressively. Since the policy began in 1993, the number of annual layoffs has increased rapidly from 0.2 to 6.3 millions in

¹⁷ *China Labour Statistical Year Book 1996*.

¹⁸ More than 75% of the managers in my sample reported that they had the right to refuse to accept employees assigned by higher authorities by 1994.

¹⁹ See footnote 4.

1997.²⁰ The total number of layoffs exceeded 16 million in 1997, which is around 20 percent of the state sector employment. If the estimated redundancy rate of 30 percent²¹ is accurate, an additional 8 to 10 millions of workers need to be laid off in order to eliminate the surplus completely. This rapid increase in laid-off workers creates enormous social and political pressure in terms of hidden unemployment and financial burden to the Chinese Communist Party. There was some retrenchment in the use of Xiagang in the late 1990s as a result of the recessions in Asia following the financial crisis in 1997.

1.3 Implications

Considering the long egalitarian culture in the state sector, the natural question is that to what extent Chinese SOEs were responding to the institutional changes in labour market. In particular, what trends in wages and employment might we expect if Chinese SOEs began to behave like profit-maximizing firms in a market economy? In the post-reform era, managers were granted partial autonomy on labour issues which used to be under mandatory plans. Instead of a standardized policy, the experimental nature of the economic reform intensified the negotiations between enterprises and the government on an ad hoc basis. Details of the negotiation process are not formally documented because of this distinctive feature of "particularistic contracting."²² Reformers argue that both parties may have several bargaining objectives other than profitability of the enterprise (e.g., see Walder 1989; Gorden and Li 1997). One possible approach to conceptualize the co-determination of wages and employment is a general Nash bargaining framework with

²⁰ *China Labour Statistical Year Book*, various issues.

²¹ See footnote 15.

three objectives: enterprise profits, employment, and workers' compensation. If delegation of power from the government to managers also leads to increasing emphasis on profitability, wage- and employment-setting behaviour of SOEs will be affected in the following ways.

First, bonus will be implemented as an incentive payment in order to enhance labour productivity. Workers' pay is related to the financial prosperity of the enterprise. The link between pay and profitability is generally referred to rent-sharing between workers and employers (e.g., see Hildreth and Oswald 1997). Workers in a centrally planned economy, on the other hand, are rewarded uniformly, regardless of their individual or enterprise productivity. Whether the pay-performance link is strengthened over the reform period is an important empirical question subject to investigation. Furthermore, examining the reverse causality from profit sharing to enterprises performance is equally important. The success of the revival of bonus payment is measured by its effectiveness on improving labour productivity.

Second, in addition to the link between workers' pay and enterprise overall performance, workers will be paid according to their own productivity. Due to the uniform wage scale, wage differentials across workers were heavily compressed before the economic reform. Decentralization will increase the return to human capital which benefits high-skilled workers at the expense of the low skilled. The combined effect of rent sharing and the high skilled premium widens the wage gap across enterprises as well as individuals. This characterizes a general rise in wage inequality as reforms proceed. From a social policy perspective, it is necessary for the Chinese government to replace the traditional egalitarian wage structure with a new redistributing system, such as a progressive income

²² Details of the political strategy of "particularistic contracting" refer to Shirk (1993), Chapter 14.

tax. Analysis of trends in returns to skill and income inequality are essential to a decentralizing labour market.

Third, employment will be adjusted along a downward sloping labour demand. In other words, employment is more responsive to enterprise-specific wages. According to the neoclassical model, profits are maximized when the marginal product of labour equals the firm's specific wage rate. In contrast, a social planner or "efficient bargaining" (e.g., see Brown and Ashenfelter 1986) may equate the marginal product of labour across firms according to the outside opportunity costs; that is, employment is independent of the firm's own wage. To understand the underlying employment dynamics, it is necessary to evaluate empirically which model provides a more consistent representation of China's labour market. This comparison also sheds light on the persistent redundancy problem in the post-reform era. Another testable hypothesis is that greater flexibility of personnel decisions increases the speed of employment adjustments to demand shocks (e.g., see Hamermesh and Pfann 1996).

In view of the extensive impact on virtually all aspects of the labour market, I have to narrow down my focus and exclude some of the issues noted above. Using an enterprise-level panel data with very limited information on workers' characteristics, I am not able to address the questions related to skill premiums and wage inequality. The bulk of the existing literature gives attention to the effect of profit sharing on enterprise performance (e.g., see Groves et al. 1994 and Yao 1997). This study, therefore, attempts to bridge the remaining gap by exploring the opposite causation: the evolution of a link from performance to pay. I also examine changes in the underlying employment-setting

behaviour in response to the gradual decentralization. In particular, Chapters 2 and 3 address the following questions:

- i) Is bonus payment distributed as a group incentive? In other words, is workers' pay tied to enterprise performance? If so, how does this link evolve over the reform period and how does it differ across enterprises?
- ii) Who has the control over employment decisions? More importantly, how is employment adjusted to output, wage or price shocks?
- iii) A considerable amount of effort has been targeted on the restrictive "iron bowl" system. Is there evidence of improving labour market flexibility ?

Figure 1.1 Pre-Reform Average Annual Earnings by Ownerships, 1952-77

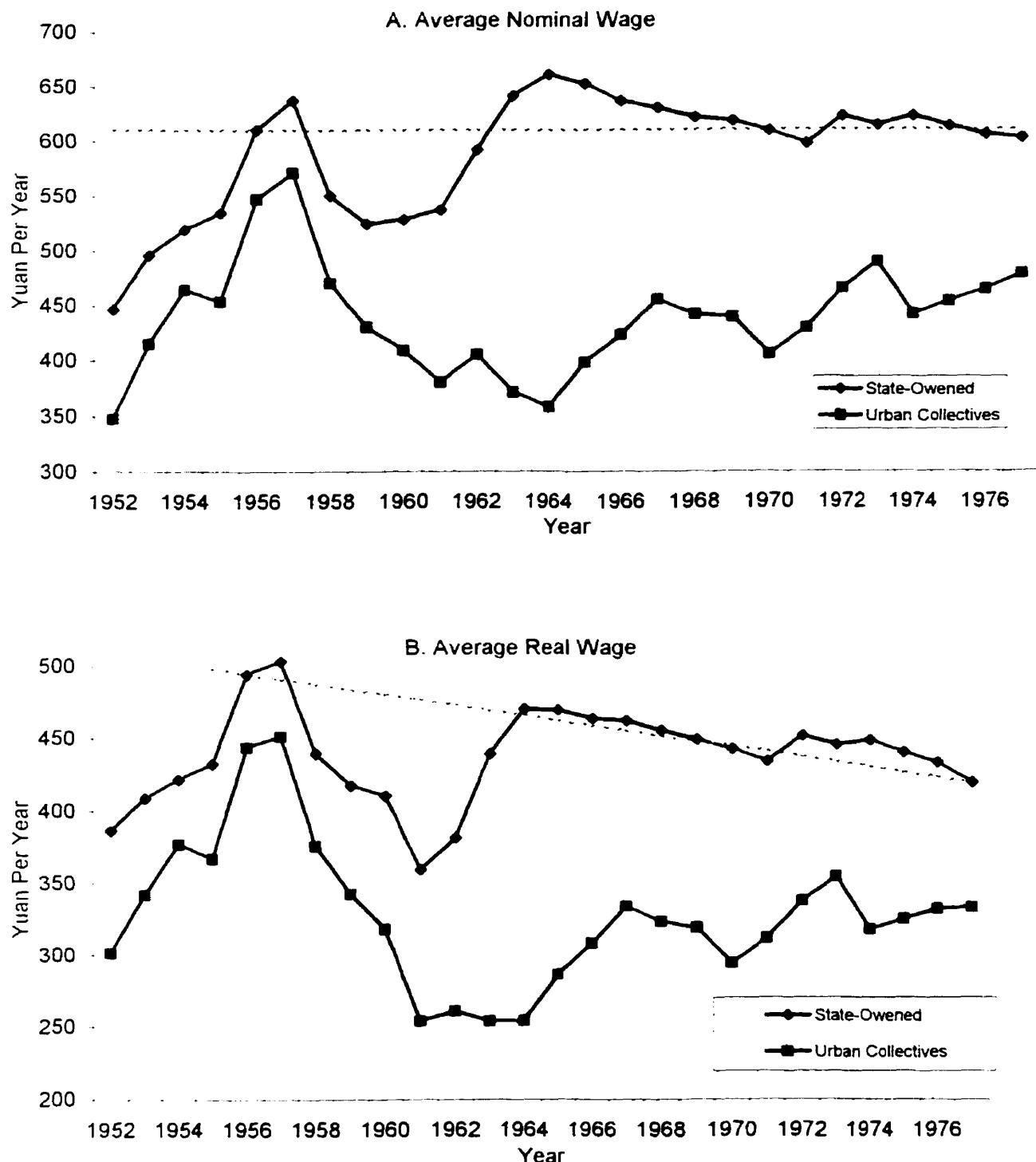


Figure 1.2 Growth of Bonus Payment, 1978-95

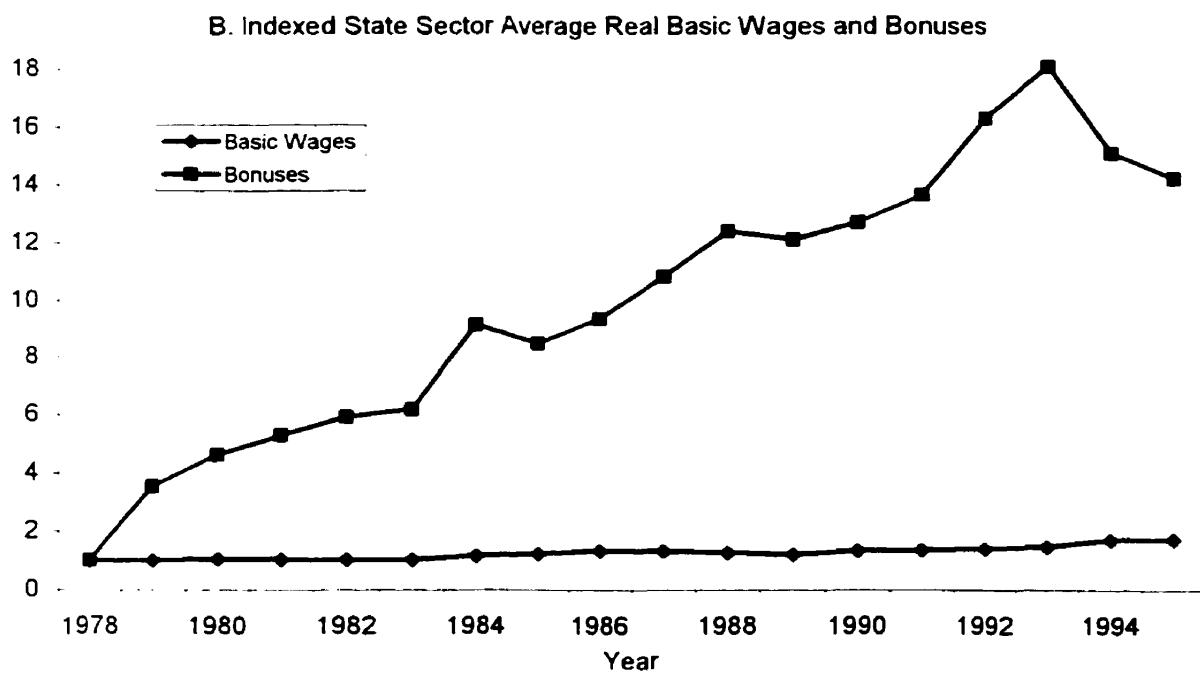
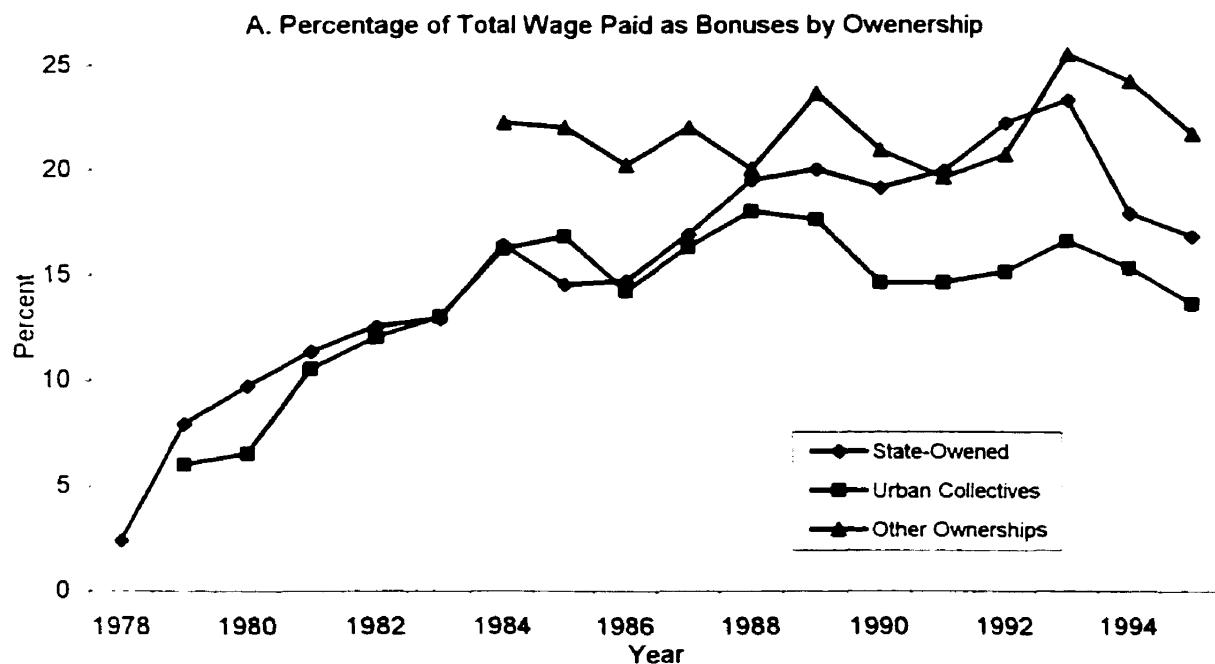


Figure 1.3 Post-Reform Average Annual Earnings by Ownerships, 1977-95

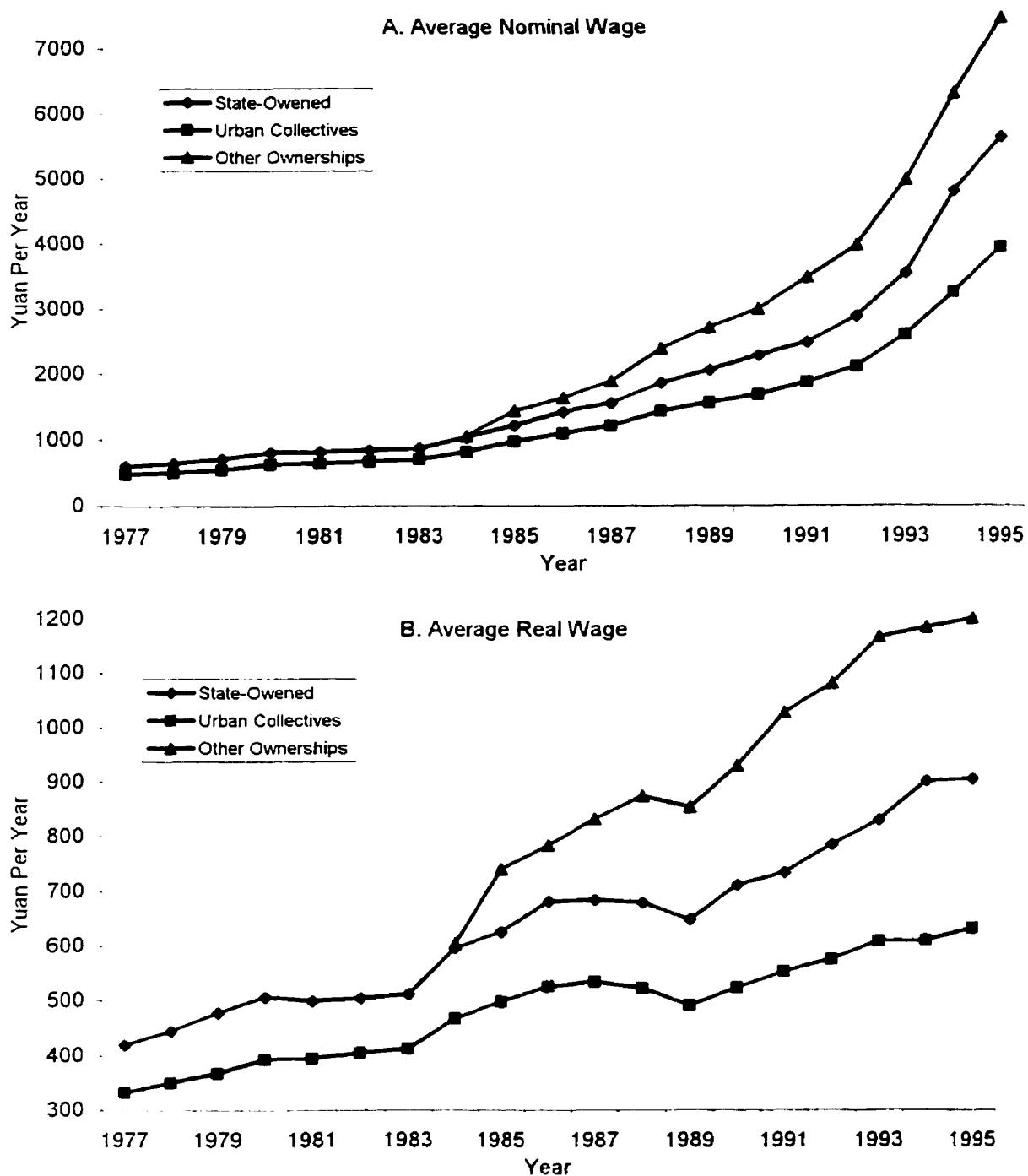
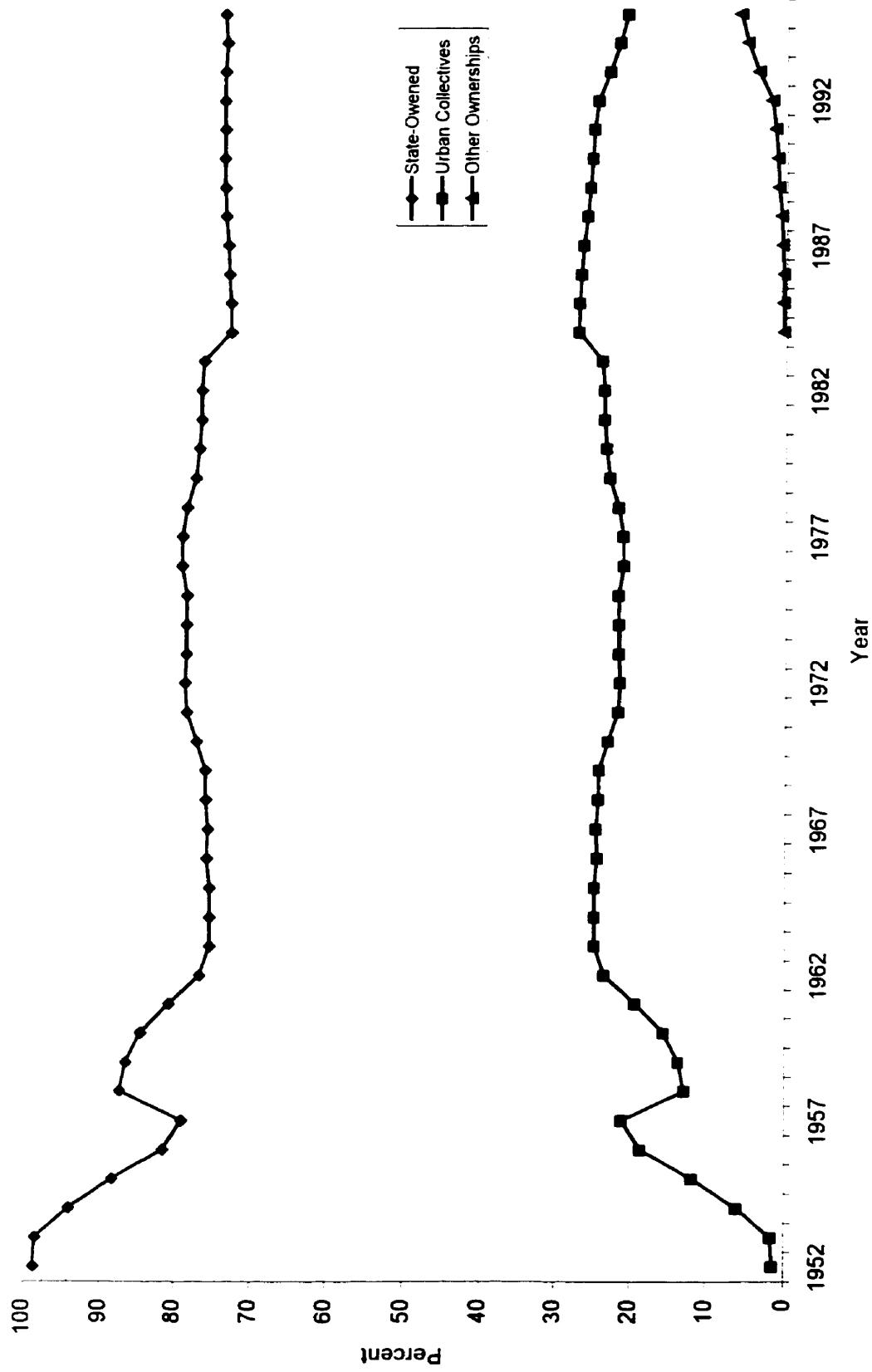


Figure 1.4 Percentage of Total Urban Employment by Ownership, 1952-95



CHAPTER 2

The Evolution of the Link between Workers' Pay and Enterprise Performance

2.1 Introduction

During the pre-reform era, state sector workers were paid according to a national wage scale set by the central government. Wages for the same type of work were identical and were unrelated to individual worker's or the enterprise productivity. This uniform reward system, combined with the inflexible 'iron bowl' employment policy, created the widely known problems of shirking and lack of work discipline in the state sector. In order to promote labour productivity, bonus payment was revived as one of the key components at the early phase of reform. Under the new "managerial responsibility system", managers were given the autonomy to determine the bonus which was paid out of enterprises' retained "profits".¹ If managers started distributing bonuses as group incentives, workers' average earnings would be dependent on enterprise performance.² The primary objective of this paper is to examine whether workers' compensation is tied to enterprise productivity. Utilizing a unique establishment panel data that spans the period 1980-1994, I present

¹ Details of the wage reform. see Chapter 1.

² The 'hardening' of the budget constraint might be another factor which linked bonuses to firm's ability to pay.

some of the first empirical evidence on the development of this link over time and how it differs across regions, sectors and levels of administration. The importance of analyzing a panel of firms is that cross-section estimates may be biased due to unobserved heterogeneity in wage-setting behaviour across SOEs.

The evolution of the relationship between pay and performance over the reform period is particularly important in China. Due to the long egalitarian culture in SOEs, the existence of such a link has been called into question, especially in the early 1980s. As Walder (1987) notes, even poorly performing enterprises were usually able to pay out bonuses up to the four months limit³ in 1984. He concludes that the new bonus policy simply inflated the wage bill and became the major source of wage growth. Empirical studies on other transitional economies, such as, Central and East European countries (Basu et al. 1995) suggest that the link between pay and performance would strengthen during market reforms. Yet, the existing literature provides only limited evidence for China.

Many studies have been conducted to examine the impact of bonus payment on the productivity and profitability of SOEs (e.g., Yao 1997; Zhuang and Xu 1996). However, few econometric work focuses on the extent of profit sharing in wage determination and how it changes as reform progressed.⁴ In order to evaluate the overall success of the bonus reform, it is equally important to address the causality issue from both directions: from performance to bonuses and vice versa. If bonuses are distributed uniformly across enterprises, they no longer serve the original purpose as an incentive through profit sharing.

³ In order to control the growth in bonus payment, all bonuses exceeding 4 months of basic wage are subject to a harsh progressive tax. Details refer to Chapter 1.

⁴ Using cross-section state enterprise data, ordinary least square estimates in Jefferson et al. (1998) provide some simple evidence that bonuses have been increasingly responsive to labour productivity between 1984 and 1992.

In this case, even if there is productivity enhancement associated with the revival of bonus, it may very well suggest that an increase in basic wage will lead to the same results.

A link between workers' compensation and the firm's financial performance is an old question of whether the wage structure takes in a form of rent-sharing (Slichter 1950). In contrast to the conventional competitive model prediction of a constant wage, that is no correlation between pay and profits, a number of empirical studies suggest that rent sharing behaviour exists in many market economies.⁵ Drawing on the existing models (e.g.. Hildreth and Oswald 1997), I find that more productive or profitable Chinese SOEs tend to pay higher wages even at the early stage of the reform. More importantly, wage reforms appear to be successful at least in two aspects. First, a significant rise in wage dispersion across SOEs indicates that the reward system in China's state sector is shifting from the traditional unified scale to a more decentralized environment with increasing autonomy. Second, market reform has been effective in strengthening the link between workers' pay and enterprise performance. Long-run elasticities of wages with respect to output are increasing over the years. This implies that, not only short-run volatility in profits, but also enterprise long-term performance is transmitted into movements in workers' remuneration as reform advances.

In the next section of this chapter, I describe the key aspects of the longitudinal data set and the overall wage pattern since 1980. Section 3 further examines the growing wage dispersion across SOEs. Econometric specifications and empirical results for rent-sharing in wage-setting behaviour are discussed in Section 4. Section 5 offers some conclusions.

⁵ The long-run profit-per-employee elasticity of wages available in the rent-sharing literature ranges from 0.02 to 0.05 depending on various kinds of data and countries (Hildreth and Oswald 1997).

2.2 Data

In order to study the effect of economic reform on state-owned enterprises in China, the Chinese Academy of Social Sciences (CASS) conducted two extensive surveys, in 1990 and 1995. The first covered a balanced panel of 769 SOEs from 1980 to 1989.⁶ The enterprises are located in four provinces (Jiangsu, Jilin, Shanxi, and Sichuan) covering three sectors.⁷ The same set of firms⁸ were then resurveyed, extending the series to 1994. Although different questionnaires were used in the two surveys,⁹ they contained similar questions on various aspects of enterprise activities, including output, material inputs, employment and wages, finances, investments, and assets.¹⁰ By assembling the annual data from the two surveys, it is possible to construct a 15-year panel (1980-94) for the main variables of interest: output, employment, and wages. These key variables were carefully checked and corrected for apparent coding errors, inconsistencies, and missing values. As a result, an unbalanced panel of 10131 observations on 680 enterprises remained for estimation.

Summary measures for the sampling distribution of enterprise average real wage¹¹ are presented in Table 2.1. There was a substantial growth in SOE average real wages over the sample period 1980-94. The mean wage increased from 758 yuan to 1120 yuan, or an

⁶ This panel data has been used by other published work (e.g., Groves et al. 1994, 1995 and Li 1997).

⁷ In the original survey, enterprises are classified into 40 industries. According to China Statistical Yearbook, these industries are grouped into 3 sectors: mining and quarrying, manufacturing and electricity Power, Gas and Water Production. Details are given in appendix A.

⁸ Only 681 out of 769 enterprises were updated in the second survey.

⁹ The questionnaire in the 1995 survey was revised because of the new accounting system in state enterprises.

¹⁰ Both questionnaires had a separate section, consisting mostly of qualitative questions relating to managers' behaviour and firms' autonomy.

¹¹ Average real wage of the firm is defined as the total wage bill divided by employment, using the provincial urban consumer price as the deflator.

annual increase of 2.6 percent. As shown in Figure 2.1a, real wages remained more or less constant during the early stage of the economic reform until 1983. A sharp increase of 22 percent was evident in 1984, which was the beginning of the second phase of the accelerating reform. Subsequently wages rose steadily through 1993 before declining dramatically in 1994. One point worth mentioning is that labour productivity (proxied by real output per worker) followed a trend very similar to that of the real wages, especially after 1984. It would seem that SOE wages were more closely tied to overall workers' productivity since enterprises were formally given the autonomy to determine the bonus fund paid out of their retained profits. Figure 2.1b also illustrates the tremendous increase in wage inequality across enterprises. The coefficient of variation of real wages doubled over the 15-year period.

The growing trend in the coefficient of variation presented in Figure 2.1b implies divergence in wage growth across percentiles. That means enterprises at either end of the distribution may behave very differently. Figure 2.2 graphs the tenth percentile, median, and ninetieth percentile of the average real wage for 1980-94. (For ease of comparison, the three series are indexed to 100 in 1980.) The figure clearly shows that the median wage series exhibit a pattern very similar to that of the sample mean observed in Figure 2.1. However, the tenth and ninetieth percentiles tell a rather different story. For the low paying enterprises (tenth percentile), real wages declined by 30 percent from 1987 through 1994. Nevertheless, remuneration in the ninetieth percentile enterprises rose steadily after 1983. Average real wages increase rapidly by almost 50 percent in the three years after 1990, followed by a 10 percent decrease in 1994. As a result, after 15 years, workers in the

top 10 percent of high paying firms saw their wages nearly double in real terms, while workers' wages in the bottom 10 percent remained unchanged.

2.3 Growing Wage Inequality

Figures 1 and 2 indicate overall rising wage inequality across SOEs during the reform. Simply associating this growing wage dispersion with managers' expanding autonomy on wage setting behaviour, or other within-group variations, may be misleading. It is possible that the divergence was due to increasing variations between groups, such as disproportionate wage growth in a particular province or sector. Therefore, I decompose the variance of wages into components accounted for between- and within-group difference using the following analysis of variance (ANOVA) framework:

$$w_{i,t}^r = \delta + \alpha_p + \alpha_s + \alpha_z + \alpha_o + \varepsilon_{i,t} \quad (1)$$

where $w_{i,t}^r$ is log of the average real wage for establishment i at time t . α_p , α_s , α_z , and α_o represent the four group effects: province, sector, firm size and ownership by level of government. A detailed description of each group can be found in the Appendix.

Partitioning the sum of squares of wages in equation (1) is a standard ANOVA on main-effect-only models. The model sum of squares (SSM) measures the variations between groups, whereas the residual sum of squares (SSE) is the variations within groups. The marginal contribution to SSM of each group can be identified as the reduction of SSE due to the additional main effect after all other effects have been added to the model. Thus,

changes in the R^2 before and after the inclusion of a main effect represent the portion of explanatory power associated with that group. Since the number of observations in each group is unequal, the marginal contributions of all main-effects do not add up to the SSM of the full main-effects equation (1). The difference measures the between-group variations jointly explained by the groups.¹²

The results of estimating equation (1) are reported in Table 2.2. The basic story is that the enormous increase in wage inequality is attributable to the diverging trends in both between- (SSM) and within- (SSE) group wage differentials. During the 15 year period 1980-1994, the SSM of log real wages increases from 5.13 to 41.36, whereas the SSE rises from 10.21 to 62.21. As a result, the R^2 lies within the range of 0.25 to 0.35, except in 1983, 1990 and 1991. Despite the rapid increase in overall wage dispersion, between-group differences remain a key factor in explaining about 25 to 35 percent of the total variations. As shown in Figure 2.3, the general pattern of the R^2 resembles the pace of the economic reform. Wage differentials between groups as measured by the R^2 increase with the acceleration of the reform. On the other hand, the differentials are dramatically reduced during the periods of retrenchment. For example, the R^2 drops by almost 50 percent between 1989 and 1991 when government conservatives reimposed strict controls on the economy after the Tiananmen crisis.

Furthermore, Table 2.2 quantifies the between-group variations separately into the four groups. One striking result about Table 2.2 and Figure 2.3 is that the increasing between-group variations are mainly due to growing wage differentials across provinces. Compared to the erroneous increase in SST, sum of squares associated with sectors, levels of government and firms' sizes remain pretty constant throughout the period.

¹² For details on estimating variance components in a linear model on unbalanced data, see Searle (1987).

Consequently, the relative explanatory power of these three groups as measured by the percent of the sum of squares gradually declined. In 1994, provincial effects alone can explain more than one third of the total variance, or alternatively over 90 percent of the between-group variations. Figure 2.4 addresses this issue by plotting provincial means of log real wages for 1980 - 1994. Although Jiangsu started off as the lowest pay province at the early stage of the reform, it has been paying the highest wages to its workers since 1986. In contrast to the very low or even negative wage growth in other three provinces, real wages in Jiangsu continued to grow at a faster rate after 1990. This further enlarges the wage gap between provinces to over 0.25 log points after 1992. This finding reinforces the results in Table 2.2.

In summary, there are two core messages from the ANOVA on equation (1). First, overall wage inequality across SOEs increased tremendously between 1990 and 1995. This is consistent with the fundamental principle of the wage reform: expanding enterprise autonomy and flexibility on wage decisions. The reward system in the state sector is dismantling from the traditional uniform scale. Second, this rising trend is evident in both between and within groups. Between-groups differentials are primarily due to the disproportionate wage growth in the province of Jiangsu which is commonly considered as the most liberalized provinces among the other three. Reform indicators listed in Table 2.3 confirm that Jiangsu is the pioneer province with the highest ratios in all aspects: contract workers in the state sector, non-state urban employment, total wage paid as bonus, gross non-state industrial output, gross light industrial output, and gross industrial output produced in medium and small enterprises.¹³

¹³ Definitions of urban employment and gross industrial output, see Chapter 1 footnotes 2 and 3 respectively.

2.4 Empirical Estimation and Results

At first glance, workers' compensation, especially the bonus payment, and enterprise financial performance should be closely related as bonuses are paid out of the retained profits. However, this is only true when profitability is the managers' prime concern and therefore bonus is implemented as an instrument to promote labour efficiency. If managers' primary objective lies in their workers welfare,¹⁴ they would negotiate with the government for the maximum rents, which in turn can be distributed indiscriminately as bonus. Considering the 'soft budget' constraint and no formal auditing procedures, there are less ways for managers to conceal their firms' inefficiency by manipulating the accounts. As a result, money-losing enterprises may still be able to pay the workers large amount of bonus through preferential treatments on tax and bank loans. In this case, bonus payment is simply another source of "basic wage" and is independent of the enterprise performance. Since there is no supplementary evidence that reveals managers' objective on bonus distribution, whether workers' pay is tied to firm's productivity becomes an empirical question. If market reform has been successful in shifting managers' objective towards profit maximization, we would observe a stronger link developed over time.

A number of recent studies¹⁵ have been conducted to test the existence of such a link in market economies. The underlying wage equation for estimating the extent of rent-sharing takes the general form of

¹⁴ As described in Walder (1989), big- or even medium-sized SOEs in China often employ thousands of workers. Enterprises normally provide a lot of supporting facilities, such as housing, health-care, schooling and entertainments, to their employees as well as their families. Therefore, a factory manager is also a socio-political leader of the community and is akin to a mayor of a small town.

¹⁵ Recent studies on rent-sharing include Christofides and Oswald (1992), Van Reenen (1996) and Hidreth and Oswald (1997).

$$w_{i,t}^n = \mu_i + \beta_1 w_{i,t-1}^n + \sum_{j=0} \lambda_j p_{i,t-j} + \tau' E_t + v' D_y + \varepsilon_{i,t} \quad (2)$$

The dependent variable is the log of the average nominal wage for enterprise i at time t ($w_{i,t}^n$).¹⁶ Last period wage ($w_{i,t-1}^n$) is included to explain the autoregressive properties of the series. As noted in Chapter 1, monetary rewards for state workers compose of two main types: a “fixed” basic wage set by the national scale and a “floating” bonus paid out of the enterprise retained profits. The natural approach would be investigating the effect of performance on two types of wages separately. However, data limitation makes this separation unfeasible. Definitions of basic wages and bonuses in the two surveys are not consistent and, therefore, it is not possible to obtain a continuous series. In addition, as the reform proceeds to the 1990s, managers have increasing autonomy on setting the basic wage. The distinction between the two types of wages becomes obscure.

The key variable of interest in wage equation (2) is the firm’s financial prosperity at time t ($p_{i,t}$). Following the existing rent-sharing literature, profit and output (sales) per employee are two common measures of $p_{i,t}$. However, it is not clear which performance measure is a better proxy for the amount of rents generated in the enterprise. On one hand, accounting profits in planned economies may not be reliable since investment decisions are heavily distorted by the ideological preference of the CCP. On the other hand, total output does not take into consideration of the firm’s production costs, even though it has been

¹⁶ Average nominal wage of the firm is defined as the total wage bill divided by the number of employees at the year end.

used in similar studies of other socialist countries.¹⁷ Realizing these potential problems, two performance measures are entered separately in equation (2) to test whether they provide similar results on λ_j . Surprisingly, it turns out that there is little difference in the choice of two measures, but the estimates on λ_j are sensitive to the functional forms. Entering the measures in logs give much higher estimates than those in levels. To reconcile the inconsistency in results, each performance measure is then entered both in logs and levels in equation (2). Estimates from this “combined” functional form are in agreement with the log-linear specification. This indicates that the logarithmic specification provides the more appropriate representation of the data. Since I have to omit all observations with negative profits in the preferred log-linear model, nominal output per worker is used as the proxy for SOEs’ rents or ability to pay.

The immediate output effect on workers’ wage is captured in λ_0 . For the long-term dynamics of lagged profitability and current wages, lagged output up to $t - 2$ is allowed in the specifications.¹⁸ The implied long-run wage elasticity with respect to output per worker is the sum of all output coefficients adjusted for the lagged dependent variable (i.e., $\sum \lambda_j / (1 - \beta_1)$). In addition, wages are determined by a vector of external factors (E_t), including the urban cost of living index, alternative wage rate,¹⁹ and aggregate industry output. All three

¹⁷ One example is Basu et al. (1995). They examine the relationship between wage and output per employee in the Czech Republic, Hungary, Poland, and Slovakia.

¹⁸ I have replicated the analysis with lags on output longer than $t - 2$. Estimates on the additional lags are virtually zero and the standard errors are much greater than the estimates. Also, they have no impact on the rest of the estimated coefficients.

¹⁹ Alternative wage is measured as the provincial average wage of collectively-owned units..

variables are at the provincial level²⁰ and entered in logarithmic form. Dummy variables, D_y and μ_i , are enterprise fixed effects²¹ and year effects, respectively. Details of each variable are given in Appendix A.

The importance of incorporating fixed effects in equation (2) is to control for the unobserved heterogeneity across SOEs, which can be referred to the manager's bargaining power or personal relationship with government officials. One of the unintended consequences of the economic reform is intensified negotiations for government favourable treatments to SOEs. Consequently, maintaining an amicable relationship with various government agencies becomes crucial in determining the financial performance. If enterprises with favourable treatments generally pay higher wages to their workers, results from simple OLS estimation are biased upward. This is due to the fact that estimates of λ_j would partly capture the unobserved heterogeneity in wage structure between high and low profit enterprises.

In order to control for the unobserved political relationship between SOEs and the government bureaus, I begin with a fixed effects model estimated by least squares on deviations from means.²² To ensure that there is sufficient variation in the explanatory variables, only enterprises with 3 or more continuous observations are included in the

²⁰ As mentioned in Moulton (1990), regressions of firm-level micro observations using aggregate provincial data as explanatory variables may lead to downward bias of the standard errors. The bias only affects the statistical significance for the aggregate variables, which are not the main interest of this analysis.

²¹ Since the group specific effects (province, sector, size and levels of administration) do not change over time within a firm, they are implicitly incorporated into the firm's fixed effect.

²² The standard with-in group estimation is subject to two potential econometric problems: i) simultaneity bias from wages to profitability, and ii) asymptotic bias in dynamic panel models (e.g., see Nickell 1981). These problems can be eliminated by using a generalized method of moments (GMM) estimator suggested in Arellano and Bond (1991). With-in group estimates presented in Tables 2.3 and 2.4 are taken as the benchmark results. Also, as shown in Hildreth and Oswald (1997) who estimated a wage equation similar to (2), both ordinary least squares and GMM estimation gave similar coefficients.

sample for this part of analysis.²³ Results presented in Table 2.4 show that wages depend positively on SOEs' contemporaneous performance or productivity. For the full sample period between 1982 to 1994, the overall short-run output-per-employee elasticity of wages (λ_0) from column 1 is 0.14. The implied steady-state elasticity is 0.11, which is approximately the same as the short-run elasticity. That means a 10 percent increase in average output will lead to an immediate rise in current wages of 1 percent, but there will be no subsequent impact in later periods.

Also, the lagged dependent variable has a high coefficient of 0.7.²⁴ It is consistent with the first order autoregressive process of wages. The estimated coefficient of the general price index is close to unity (0.89). This suggests that workers' wages are almost fully indexed for changes in the cost of living. The alternative wage has an expected positive coefficient of about 0.5. After controlling for alternative wages and prices, aggregate output has a small, but negative impact on wages.

The estimated wage elasticity of 0.1 is low by the standards of similar studies on transitional economies in Central and East European countries.²⁵ This could be attributed to the fact that estimates from column 1 cover a much earlier and longer period beginning in 1982, while studies of the Central and East European countries mainly focus on the "big bang" transitions after 1989. If the link between pay and performance in China grew stronger as predicted by the reformers, we would expect to find a higher estimate for the wage elasticity when reform accelerated after 1992.

²³ As a result, 2553 observations are dropped from the unbalanced sample.

²⁴ OLS estimation of the model gives an even higher estimate of 0.89, indicating the existence of firm's fixed effects.

²⁵ Wage elasticities with respect to sales per worker in CEE countries during transitions range from 0.3 to 0.4 (Svejnar 1998).

To show the evolution of the link, columns 2 to 4 in Table 2.4 break down the sample into three sub-periods. The results in column 2 provide some empirical evidence that more profitable firms tended to pay higher wages to their workers even at the early stage of the reform between 1982 and 1985. The coefficient of the current output per worker is positive (0.14) and statistically significant at the 1 percent level. The short-run elasticity increases dramatically to 0.23 for the period 1986-89, then drops sharply to 0.1 over the next four years. This cyclical pattern is also evident in the long-run elasticity. It appears that the relationship between pay and performance is related to the economic cycle. The link is much stronger at the peak (1986-89), than at the troughs. This cyclical behaviour may be due to retrenchment in reform that usually occurs during recessions, in which the government reasserts control over wage and employment decisions to stabilize the economy. It may also suggest that the soft budget constraints enable SOEs to provide some "insurance" for their workers against economic fluctuations.

I next provide separate wage elasticities depending on the aggregate performance of the state sector. The parameters of lagged dependent variable (β_1) and output-per-worker terms (λ_j) in equation (2) are specified as a linear function of constant and economic fluctuations at t (f_t).²⁶ Also, a time trend (t) is included to see if the link strengthens over the reform period. That is,

$$\theta = a_\theta + b_\theta f_t + c_\theta t, \quad \theta = \beta_1, \lambda_j \quad (3)$$

²⁶ f_t is measured as the growth rate of the provincial total industry output between t and $t - 1$. I have replicated the empirical analysis using alternative measures for f_t , such as GDP growth rate. The results (not reported) are similar to those reported in Table 2.4.

Substituting equation (3) into (2) is equivalent to interacting last period's wage and firm's output with the economic cycle and time trend.

As shown in panel A of Table 2.5, the contemporaneous link between pay and performance is related to the overall performance of the state sector. One percentage increase in aggregate output will raise the short-run elasticity of wages by 0.002. Considering the volatility of aggregate output during transition, the actual effect on wage elasticity may not be as small as it appears. For example, the growth rate of aggregate output in the state sector was 7.7 and 35.5 percent in 1990 and 1993 respectively. Therefore, economic fluctuations alone can generate a difference of 0.056 in the short-run elasticity between these two years. The coefficient of current output interacted with the time trend (c_{λ_0}) is negative and statistically significant, indicating a downward trend over the years. After controlling for the economic cycle effect, short-run elasticity decreases by 0.06 in a decade.

In contrast, no cycle effect ($\sum b_{\lambda_j} \sim 0$) or trend ($\sum c_{\lambda_j} \sim 0$) is evident in the long-run elasticity. Although the sum of all output coefficients ($\sum \lambda_j$) remains pretty constant, the link between workers' pay and enterprise long-term financial performance strengthens over the period because of the upward trend in β_1 ($c_{\beta_1} = 0.0232$). The overall short-run and long-run output-per-worker elasticities are presented in Figure 2.5. The short-run effect is declining modestly over time and ranges from 0.10 in 1990 to 0.16 in 1985. The long-run elasticity of wages increases steadily from 0.05 to 0.16 for the period between 1982 and 1994.

Since housing subsidies are another major component of the workers' total compensation, it is worthwhile to investigate whether more profitable enterprises provide

better housing benefits for their workers. I replicate equation (2) by using non-productive assets per worker as the proxy for the amount of average housing subsidies. Results are presented in Panel B of Table 2.5 and Figure 2.5. Comparing with the estimates using workers' wage, the link between housing subsidies and output per worker exhibits a similar pattern: cyclical behaviour in the short run and a steady upward trend in the long run. The long-run elasticity remained basically zero until the second phase of reform in 1985 and then increased sharply to 0.45²⁷ in the following decade.

The basic message of Figure 2.5 is that, on average, workers' pay is more closely related to enterprise performance over the years. If the time effect simply reflects a positive correlation between reform advancement and the extent of rent-sharing behaviour, it is reasonable to suspect that this average pattern applies uniformly across enterprises. Considering the experimental and piecemeal nature of the economic polices in China, reform pattern varies significantly across SOEs in different provinces and industries. The hypothesis to be tested would be whether enterprises with more autonomy have a stronger pay-performance link.

To investigate this issue, one possibility is to allow the parameter λ_j in equation (2) to vary across groups – that is, interacting the firm's current and lagged output per worker with group dummies. In view of the wage growth differentials across provinces exhibited in Figure 2.4, I begin with the provincial effects. The long-run elasticities of wages are presented in Panel A of Table 2.6. SOEs in Jiangsu, which experience the fastest real wage growth over the years, have the strongest link between pay and performance followed by

²⁷ Although very similar patterns are shown in the long-run elasticities of wages and housing subsidies, we have to be aware of the two separate effects, β_1 and $\Sigma\lambda_j$, which give rise to the overall trend. As noted above, the output effect on wages is mainly due to the upward trend in β_1 . On the other hand, the effect on housing subsidies is from both β_1 and $\Sigma\lambda_j$.

Shanxi, Jilin and Sichuan.²⁸ Results in Tables 2.3 and 2.6, therefore, provide some support to the hypothesis that reforms are effective in inducing SOEs to build a stronger pay-performance link. I next replicate the analysis on sizes and ownership by levels of government. As shown in Panel B and C of Table 2.6, the long-run elasticities of wages look similar across these groups. At a 5 percent level, I cannot reject the null hypothesis that the link between pay and performance is identical across SOEs with different sizes and under various levels of subordinations.

In order to provide direct evaluation of the effects of decentralization on rent-sharing behaviour, I identify a set of variables which indicate the extent of the enterprise's autonomy on decision-making. In particular, managers reported in the first year that they were granted the autonomy on 7 different dimensions. Figure 2.6 depicts the general pattern of the decentralization process. When the dual-track system was introduced in 1984, enterprises began to experiment output autonomy, so that they could produce above the plan quotas. In 1994, more than 90 percent of the firms can decide on their own output. The delegation of decision-making is relatively slower in other areas. Even after a decade of reform in 1988, less than 10 percent of the enterprises in my sample were given the autonomy regarding employment, refusal of direct worker assignment, exports and imports, short-term investment, long-term investment and sale of assets. Since then the ratios increased substantially to above 60 percent in 1994, except the decisions on sale of assets.

I then construct a dummy variable, $\text{Aut}_{i,t}^k$, which equals to 1 if enterprise i has autonomy on area k at period t , and = 0 otherwise. Therefore, interacting $\text{Aut}_{i,t}^k$ with the

²⁸ In fact, the F statistics for the null hypothesis of $\sum \lambda_j = 0$ are 0.06 for Sichuan and 0.54 for Jilin. Therefore, we cannot reject the hypothesis of no relationship between pay and performance in the long run even at the 10 percent level of significance.

firm's current ($p_{i,t}$) and lagged output per worker ($p_{i,t-j}$) allows me to compare between enterprises with and without autonomy k . Clearly, results of Table 2.7 show that autonomy on output, employment, and refusal of direct worker assignment (columns 1 to 3) have a significant and positive effect in strengthening the pay-performance link. The implied long-run output-per-worker elasticities rise by 0.04 to 0.06 after receiving autonomy in these three areas. Although the evidence on other autonomy measures is less clear-cut (columns 4 to 7),²⁹ these results are consistent with the hypothesis that the pay-performance link is sensitive to the decentralization of decision-making. Based on the autonomy effects here, the time trend exhibited in Figure 2.5 and the provincial difference shown in Table 2.7, all these evidences suggest that the wage reform in China have been successful in inducing SOEs to improve worker discipline by tightening the pay-performance link.

2.5 Conclusion

Wage reforms in China's state sector have made a determined effort to resolve the problems of the uniform wage scale by expanding managers' autonomy on labour decisions. This chapter focuses on the changes in wage-setting behaviour in response to the gradual decentralization process during the period 1980-94.

Despite the long egalitarian culture in the centrally planned system, the revival of bonus has been successful in beginning to tie workers' remuneration to enterprise overall performance. I find empirical evidence that firms with stronger financial performance are more likely to pay higher wages to their workers even in the early stages of reform.

²⁹ Estimates in columns 4, 5 and 7 indicate that enterprises with autonomy on investments and sale of assets may even have a weaker link between pay and performance. However, at the 5 percent level of significance, F-statistics cannot reject the hypothesis that these autonomy measures have no impact on the pay-performance link ($\sum p_i \times Aut_{i,t}^k = 0$).

Although the elasticities appear to be small comparing to other Central and East European countries, both monetary compensation and non-wage benefits have been increasingly responsive to productivity over the reform period. More importantly, SOE managers appear to strengthen workers' discipline in response to their expanded autonomy. Differences in the extent of rent-sharing across provinces and autonomy measures suggest that enterprises receiving output and employment autonomy maintain a stronger link between pay and performance.

These results establish a necessary condition for the possibility of enhanced labour productivity if profit sharing is effective in motivating workers. From an equity perspective, given that wage inequality increases significantly after 1990, it appears that the "social rents" are not evenly distributed across firms. Workers in more productive firms are able to get a larger piece of the pie. What characterizes the source of rents becomes the next important question that has not yet been answered. In order to address the notion of overall economic efficiency, more work has to be done on the distribution of rents across firms.

Appendix

Description of Variables

Table 2.A1 Province, Ownership, Size and Sector Classifications

	No. of SOEs in Original Survey	
	80-89	90-94
I. Province (4)		
a. Jiangsu	212	209
b. Sichuan	157	142
c. Shanxi	196	141
d. Jilin	204	189
II. Ownership by Level of Government (4)		
a. Central	66	56
b. Province	76	64
c. City	546	497
d. Others	81	64
III. Size (3)		
a. Big	169	154
b. Medium	371	347
c. Small	229	180
IV. Sector and Industry		
a. Mining and Quarrying		
1. Coal Mining and Processing	19	14
2. Petroleum and Natural Gas Extraction	0	0
3. Ferrous Metals Mining and Processing	3	3
4. Non-ferrous Metals Mining and Processing	1	1
5. Non-metal Minerals Mining and Processing	11	9
6. Other Minerals Mining and Processing	0	0
7. Logging and transport of Timber and Bamboo	3	3

¹ Industrial enterprises are categorized as small, medium, or large depending on their sector-specific productive capacities. In general, small enterprises have less than 1000 workers.

Table 2.A1 Province, Ownership, Size and Sector Classifications (cont'd)

	No. of SOEs in Original Survey	
	80-89	90-94
IV. Sector and Industry		
b. Manufacturing		
8. Food Production	35	32
9. Beverage Production	15	14
10. Tobacco Processing	3	2
11. Textile Industry	103	94
12. Garments	2	1
13. Leather, Furs and Related Products	12	11
14. Timber Processing, Bamboo, Cane, Palm Fibre and Straw Products	4	4
15. Furniture Manufacturing	1	1
16. Paper Products	19	12
17. Printing	13	12
18. Stationary, Educational and Sports Products	5	5
19. Arts and Crafts	1	1
20. Petroleum Processing	5	4
21. Chemical Products	80	70
22. Medical and Pharmaceutical Products	27	27
23. Chemical Products	8	6
24. Rubber Products	10	10
25. Plastic Products	8	8
26. Building Materials and Non-metal Mineral Products	52	49
27. Smelting and Pressing of Ferrous Metals	27	19
28. Smelting and Pressing of Non-ferrous Metals	7	7
29. Metal Products	10	9
30. Machinery	148	138
31. Transportation Equipment Manufacturing	30	26
32. Electric Equipment		19
33. Electronics and Telecommunication	44	40
34. Instruments, Meters, Cultural and Office Machinery	16	13
35. Other Manufacturing	3	3
c. Electricity, Gas and Water Production		
36. Tap Water Production and Supply	4	4
37. Electricity, Steam and Hot Water Production	9	8
38. Gas and Coal Production	2	2

Table 2.A2. Descriptions of Variables in ANOVA and Rent-Sharing Estimations

Variables	Definitions
Aggregate output ($aout_t$)	Provincial aggregate industry output
Alternative wage ($altw_t$)	Provincial average nominal wage in collective-owned units
Average nominal wage ($w_{i,t}^n$)	Total wage bill / $n_{i,t}$
Average real wage ($w_{i,t}^r$)	$w_{i,t}^n / cpi_t$
Economic cycle (f_t)	$(aout_t - aout_{t-1}) \times 100 / aout_{t-1}$
Employment ($n_{i,t}$)	Total number of workers at the year end
Enterprise total output ($y_{i,t}$)	Gross nominal output
Performance ($p_{i,t}$)	Output per worker ($y_{i,t} / n_{i,t}$)
Provincial price index (cpi_t)	Urban provincial consumer price index (1980 = 100)

Table 2.1
Summary Measures of the Sampling Distribution
of Enterprise Average Real Wage

	1980	1983	1986	1989	1990	1994
Mean	757.62	755.60	1002.36	1041.12	1190.23	1120.44
Percentile:						
10	613.21	621.33	780.09	740.09	807.72	623.36
50	754.13	742.41	981.22	1003.17	1134.66	1050.79
90	901.83	889.10	1224.97	1374.08	1616.19	1725.25
Std. Deviation	126.02	127.42	203.84	269.92	342.89	453.27
Coefficient of Variation	0.1663	0.1686	0.2034	0.2593	0.2881	0.4045

Table 2.2
Analysis of Variance on Log Average Real Wage
(F-Statistics in parentheses)

	1980	1983	1986	1989	1992	1994						
Model Sum of Squares (SSM)	5.13	2.55	6.66	13.44	14.82	41.36						
Residual Sum of Squares (SSE)	10.21	11.28	16.27	24.48	39.34	62.21						
Total Sum of Squares (SST)	15.34	13.83	22.93	37.93	54.16	103.57						
R ²	0.334609	0.184264	0.29025	0.354473	0.273696	0.399328						
Source of Variation	SS	Percent SS	SS	Percent SS	SS	Percent SS	SS	Percent SS	SS	Percent SS	SS	Percent SS
1. Province	1.31 (21.78)	8.54 (0.94)	0.06 (0.94)	0.41 (32.63)	2.66 (32.63)	11.60 (57.69)	7.04 (57.69)	18.56 (70.71)	12.80 (70.71)	23.63 (128.29)	36.72 (128.29)	35.46 (128.29)
2. Sector	1.69 (9.35)	11.00 (5.27)	0.96 (5.27)	6.95 (7.65)	1.87 (7.65)	8.16 (5.62)	2.06 (5.62)	5.43 (1.62)	0.88 (1.62)	1.63 (0.98)	0.84 (0.98)	0.81 (0.98)
3. Government Control	0.47 (7.78)	3.05 (9.76)	0.59 (9.76)	4.29 (9.63)	0.78 (9.63)	3.42 (13.21)	1.61 (13.21)	4.25 (2.62)	0.47 (2.62)	0.88 (5.98)	1.71 (5.98)	1.65 (5.98)
4. Size	0.40 (9.98)	2.61 (7.69)	0.31 (7.69)	2.25 (12.93)	0.70 (12.93)	3.06 (21.98)	1.79 (21.98)	4.71 (2.72)	0.33 (2.72)	0.61 (5.06)	0.97 (5.06)	0.93 (5.06)
5. Joint Groups	1.27	8.25	0.63	4.52	0.64	2.78	0.95	2.50	0.34	0.63	1.12	1.08
6. Within Enterprise	10.21	66.54	11.28	81.57	16.27	70.98	24.48	64.55	39.34	72.63	62.21	60.07

Table 2.3
Reform Indicators by Province, 1995

	<u>National</u>	<u>Jiangsu</u>	<u>Sichuan</u>	<u>Shanxi</u>	<u>Jilin</u>
Percentage of contract workers in state sector	34.9	45.1	40.3	39.9	33.6
Percentage urban employment in non-state sector	26.4	37.2	25.6	20.0	25.5
Percentage of total wage paid as bonus in state sector	16.8	16.4	14.6	17.7	14.0
Percentage of gross industrial output in non-state sector	66.0	88.9	59.7	54.1	37.7
Percentage of gross industrial output in light industry	44.0	37.7	50.1	18.1	29.1
Percentage of gross industrial output in medium and large enterprises	61.8	76.9	62.4	51.9	42.8

Table 2.4
Link between Wage and Performance:
Fixed Effects Estimates
 (standard error in parentheses)

	82-94	82-85	86-89	90-93
$w_{it-1} (\beta_1)$	0.7034 (0.0097)	-0.0825 (0.0266)	0.1665 (0.0251)	0.2554 (0.0189)
$p_{it} (\gamma_0)$	0.1361 (0.0069)	0.1366 (0.0116)	0.2295 (0.0123)	0.0990 (0.0124)
$p_{it-1} (\gamma_1)$	-0.1031 (0.0083)	-0.0305 (0.0123)	-0.0319 (0.0139)	-0.0096 (0.0134)
$p_{it-2} (\gamma_2)$	-0.0002 (0.0059)	-0.0129 (0.0096)	0.0120 (0.0114)	0.0073 (0.0105)
cpi _t	0.8884 (0.1214)	-1.5244 (0.2324)	0.7194 (0.3239)	2.9360 (0.3140)
gdp _t	-0.0695 (0.0299)	-0.3837 (0.1017)	0.1105 (0.0609)	1.0152 (0.0687)
altw _t	0.3932 (0.0443)	0.8006 (0.0732)	0.3553 (0.1478)	-0.3854 (0.1220)
SR Elasticity	0.1361	0.1366	0.2295	0.0990
LR Elasticity	0.1104	0.0859	0.2515	0.1300

Table 2.5
Link between Compensation and Performance:
Fixed Effects Estimates with Economic Cycle and Trend, 1982-94
 (standard error in parentheses)

A. Dependent Variable = Wage

	$w_{i,t-1} (\theta=\beta_1)$	$p_{i,t} (\theta=\lambda_0)$	$p_{i,t-1} (\theta=\lambda_1)$	$p_{i,t-2} (\theta=\lambda_2)$
$\times \text{cons } (a_e)$	0.4892 (0.0220)	0.1376 (0.0167)	-0.1247 (0.0198)	0.0121 (0.0133)
$\times f_t \ (b_e)$	-0.00003 (0.0002)	0.0020 (0.0006)	-0.0008 (0.0008)	-0.0011 (0.0005)
$\times t \ (c_e)$	0.0232 (0.0021)	-0.0064 (0.0019)	0.0062 (0.0023)	0.0005 (0.0015)

B. Dependent Variable = Housing Subsidies

	$h_{i,t-1} (\theta=\beta_1)$	$p_{i,t} (\theta=\lambda_0)$	$p_{i,t-1} (\theta=\lambda_1)$	$p_{i,t-2} (\theta=\lambda_2)$
$\times \text{cons } (a_e)$	0.5226 (0.0177)	-0.0014 (0.0672)	-0.0099 (0.0790)	0.0111 (0.0527)
$\times f_t \ (b_e)$	0.0029 (0.0006)	0.0053 (0.0024)	-0.0031 (0.0033)	-0.0041 (0.0022)
$\times t \ (c_e)$	0.0074 (0.0019)	0.0002 (0.0077)	0.0072 (0.0093)	0.0071 (0.0060)

Table 2.6
Link between Wage and Performance:
Fixed Effects Estimates by Groups, 1982-94

A. Province				
	Jiangsu	Sichuan	Shanxi	Jilin
$\rho_{1,t} (\hat{\nu}_{-0})$	0.1963	0.1448	0.1387	0.0746
$\rho_{1,t-1} (\hat{\nu}_{-1})$	-0.1389	-0.1139	-0.0675	-0.0818
$\rho_{1,t-2} (\hat{\nu}_{-2})$	0.0074	-0.0220	-0.0151	0.0202
F-test ($H_0: \sum \lambda_j = 0$)	61.84	1.63	42.52	3.26
LR Elasticity	0.2082	0.0289	0.1805	0.0416
B. Size				
	Big	Medium	Small	
$\rho_{1,t} (\hat{\nu}_{-0})$	0.1437	0.1315	0.1380	
$\rho_{1,t-1} (\hat{\nu}_{-1})$	-0.1092	-0.0936	-0.1153	
$\rho_{1,t-2} (\hat{\nu}_{-2})$	-0.0056	0.0004	0.0019	
F-test ($H_0: \sum \lambda_j = 0$)	17.35	44.30	11.74	
LR Elasticity	0.0972	0.1290	0.0827	
C. Ownership by Level of Ownership				
	Central	Provincial	City	Others
$\rho_{1,t} (\hat{\nu}_{-0})$	0.1354	0.1433	0.1373	0.1236
$\rho_{1,t-1} (\hat{\nu}_{-1})$	-0.0663	-0.0855	-0.1104	-0.0948
$\rho_{1,t-2} (\hat{\nu}_{-2})$	-0.0298	-0.0183	0.0053	-0.0056
F-test ($H_0: \sum \lambda_j = 0$)	15.02	18.31	34.76	4.73
LR Elasticity	0.1327	0.1334	0.1089	0.0783

Table 2.7
Link between Wage and Performance:
Fixed Effects Estimates by Autonomy, 1982-94
 (standard error in parentheses)

	(1) Output	(2) Employment	(3) Refuse Worker Assigned	(4) Exports and Imports	(5) Short-Term Investment	(6) Long-Term Investment	(7) Sale of Assets
$w_{i,t-1}$	0.7029 (0.0097)	0.7019 (0.0097)	0.7036 (0.0097)	0.7025 (0.0097)	0.7027 (0.0097)	0.7030 (0.0097)	0.7033 (0.0097)
$p_{i,t} \times Aut_{i,t}^k$	0.0363 (0.0138)	0.0091 (0.0171)	0.0574 (0.0199)	0.0108 (0.0080)	0.0291 (0.0206)	0.0249 (0.0283)	0.0402 (0.0286)
$p_{i,t-1} \times Aut_{i,t}^k$	-0.0397 (0.0172)	-0.0036 (0.0215)	-0.0857 (0.0241)	-0.0192 (0.0171)	-0.0451 (0.0263)	0.0099 (0.0348)	-0.0011 (0.0368)
$p_{i,t-2} \times Aut_{i,t}^k$	0.0161 (0.0116)	0.0134 (0.0147)	0.0445 (0.0154)	-0.0004 (0.0172)	0.0011 (0.0173)	-0.0224 (0.0229)	-0.0537 (0.0250)
F-test ($H_0: \sum p_i \times Aut_{i,t}^k = 0$)	4.61	6.38	3.46	0.76	3.47	1.26	2.29
Difference in LR Elasticity with Autonomy k	0.0426	0.0634	0.0545	-0.0295	-0.0502	0.0418	-0.0493

Figure 2.1
Indexed Mean and Coefficient of Variation of Average Real Wage, 1980-94

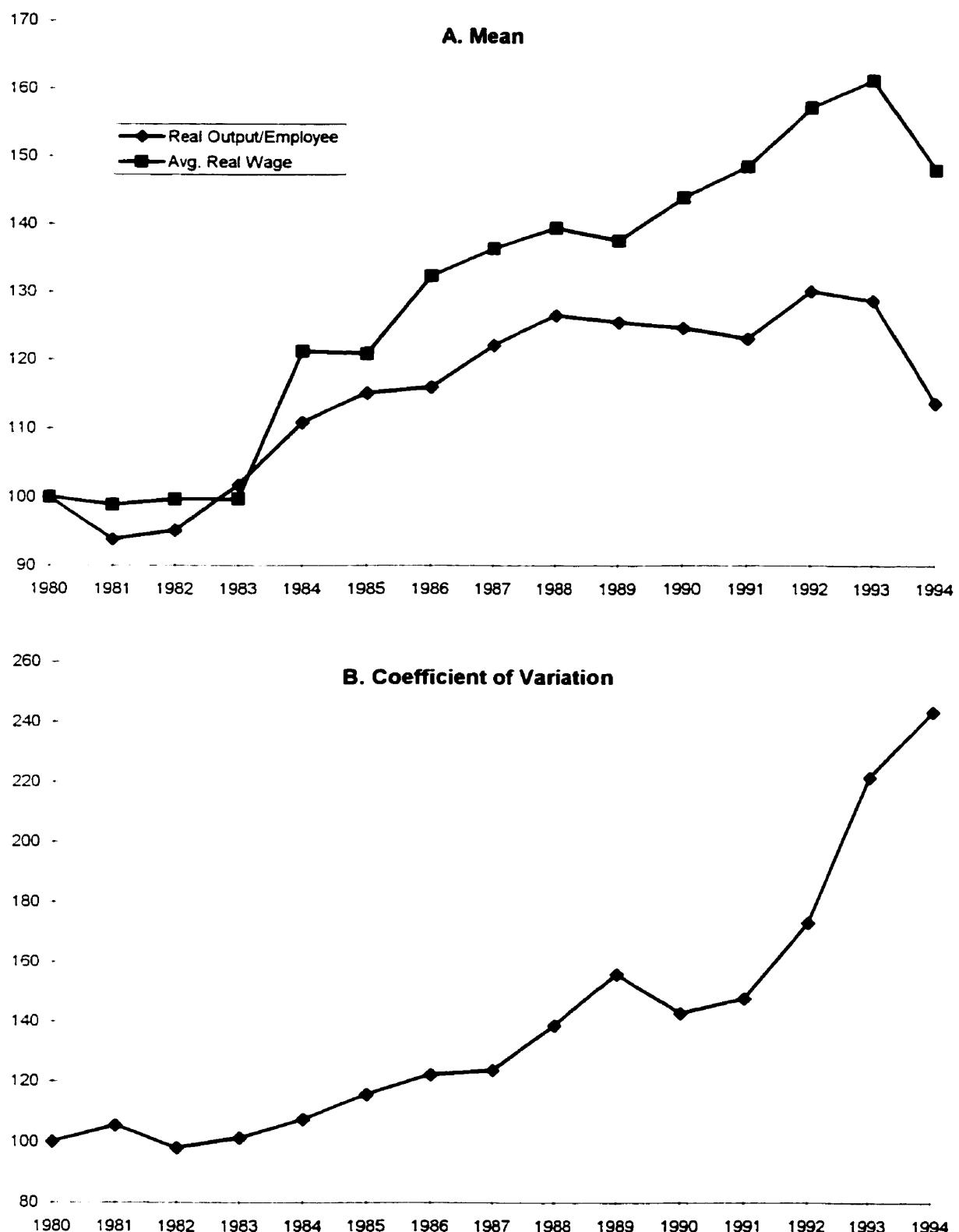


Figure 2.2
Indexed Enterprise Average Real Wage by Percentile, 1980-94

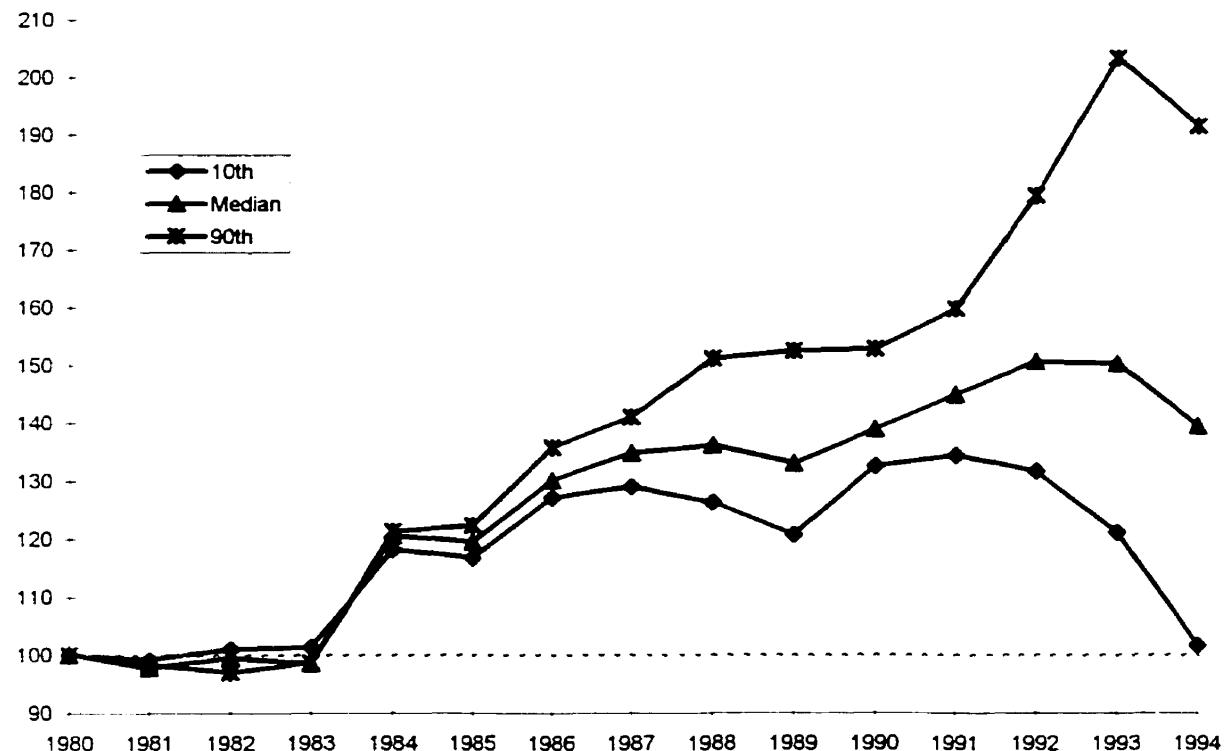


Figure 2.3
Sources of Log Average Real Wage Variations, 1980-94

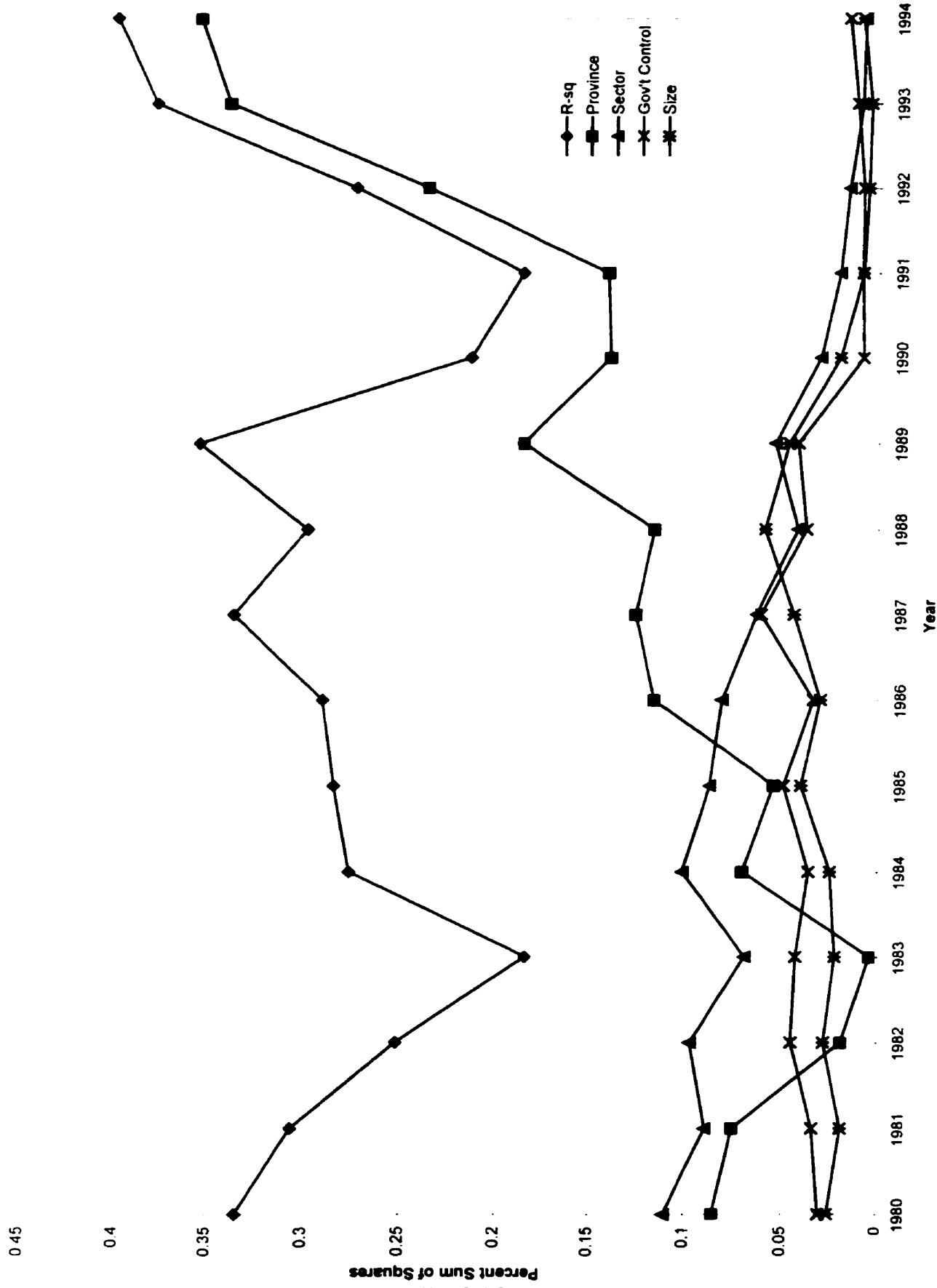


Figure 2.4
Provincial Means of Log Average Real Wage, 1980-94

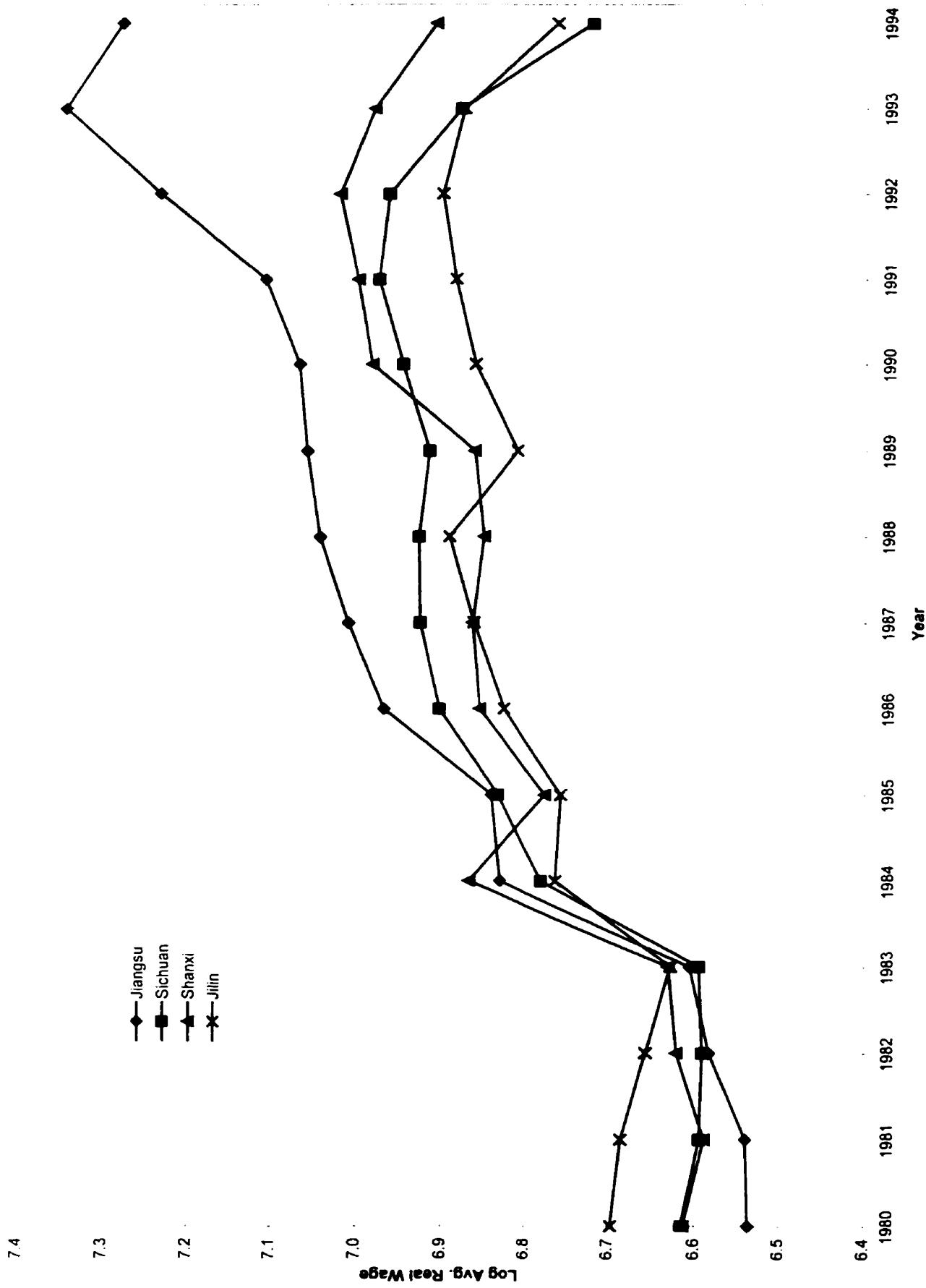


Figure 2.5
Output-per-worker Elasticities, 1982-94

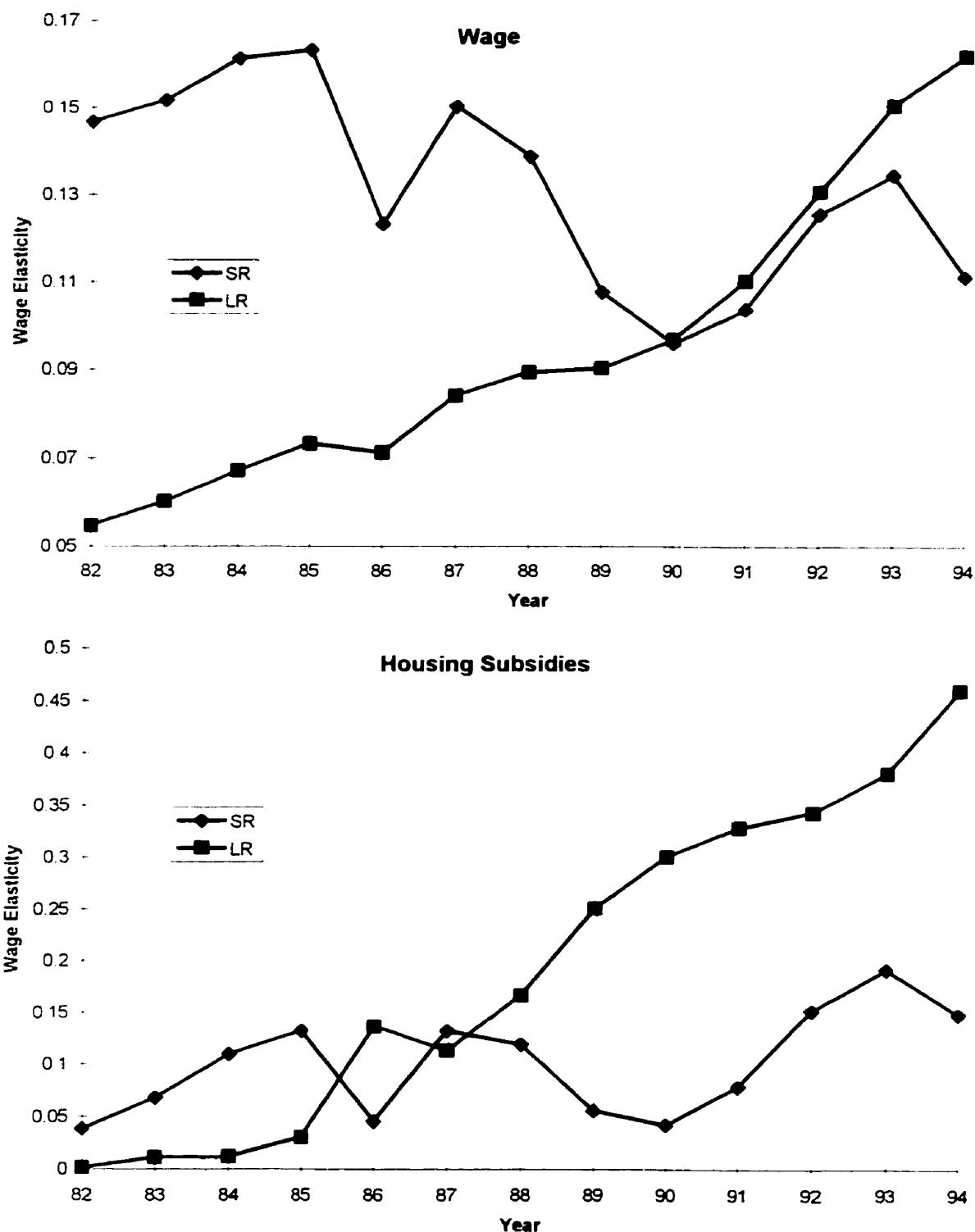
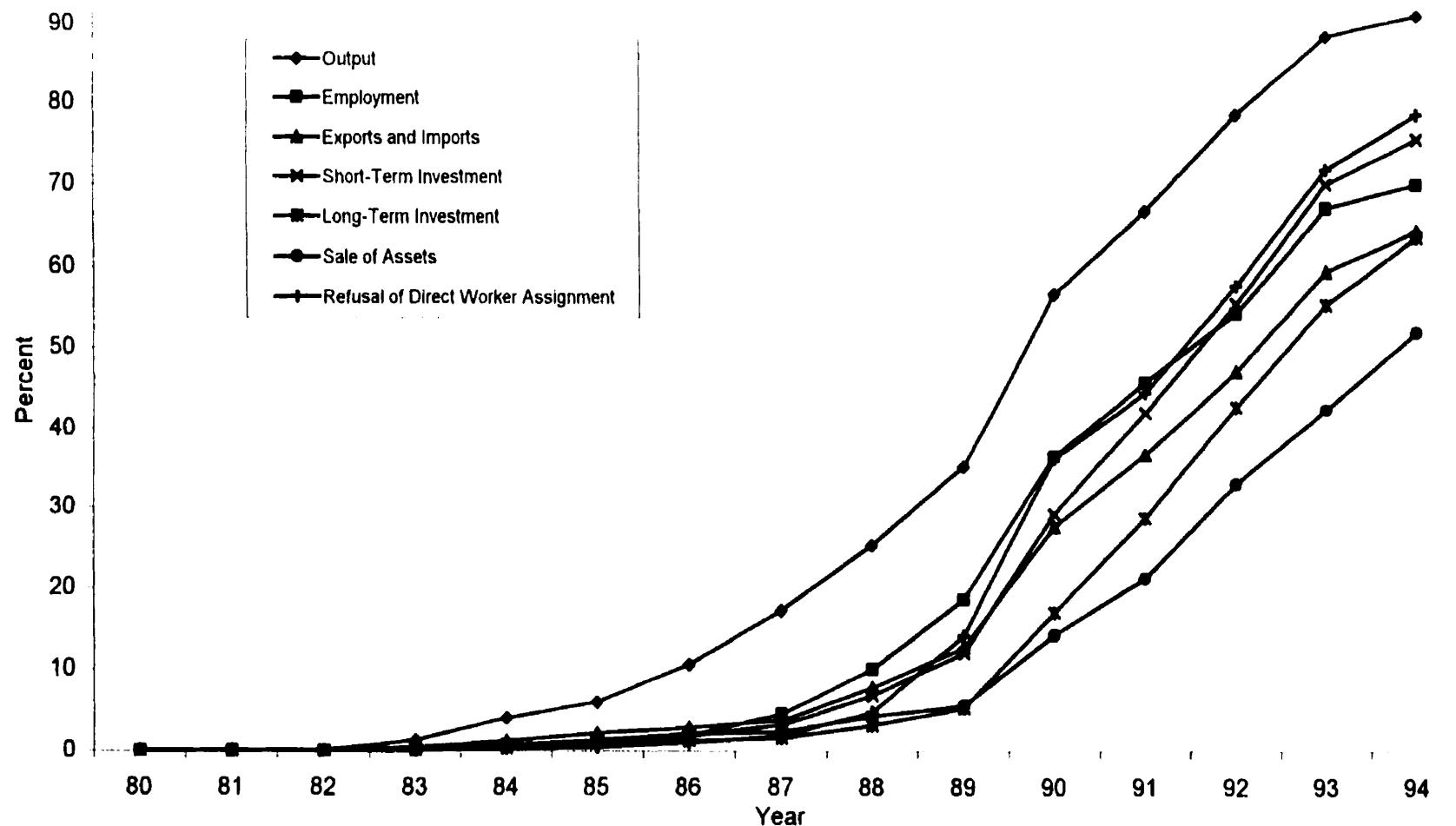


Figure 2.6 Percentage of Enterprises with Autonomy on Various Decisions, 1980-94



CHAPTER 3

Employment Dynamics

3.1 Introduction

After two decades of economic reform, surplus labour remains a formidable obstacle to the successful transformation of SOEs into modern corporations. The labour contract system was introduced in the mid-1980s in an attempt to increase flexibility of the rigid “iron bowl” system. However, this policy has had little success in rectifying the chronic redundancy problem. Despite the decline in the state sector’s share of industry from 78 percent in 1978 to 34 percent in 1995, there was no corresponding decline in state employment, which stayed around 74 percent¹ of the total urban employment.² Brandt and Zhu (2000) argue that the disproportionate employment growth is supported by the government through financial subsidies in the forms of preferential bank credits and money creation.

Beginning in 1993, the Chinese government decided to adopt a more aggressive approach of laying off (Xiagang) excess workers.³ As a result, the number of laid-off

¹ China Labour Statistical Year Book, 1996.

² Definitions of industrial output and urban employment, see Chapter 1 footnote 2 and 3 respectively.

³ Details of the employment reform, see Chapter 1.

workers increased 30 fold from 0.2 million in 1993 to over 6.3 million in 1997.⁴ Although the total number of layoffs as a percentage of total workers in the state sector has reached a record high of 20 percent in 1997, the estimated redundancy rate of 30 percent⁵ implies that an additional 8 to 10 millions of workers have to be laid off in order to achieve the efficient profit-maximizing level.⁶ This, in turn, may create social unrest which hinders the sustainability of the industrial reform.

The goal of this chapter is to investigate the redundancy problem from an alternative perspective, namely, examining the underlying employment-setting behaviour at the enterprise level. The evolution of labour allocation in China's state sector exemplifies the fundamental principle of a progressive decentralized socialist market. Employment decisions, which used to be under mandatory plans, are delegated gradually to managers through negotiations. The fundamental question is that to what extent China's labour market is evolving from a centrally planned system to a competitive environment. In particular, if SOEs begin to behave like profit-maximizing firms, what would be the emerging employment patterns?

To illustrate the potential impact of decentralization on employment determination, it is useful to consider two polar models. In a centralized framework where workers are directly assigned to the enterprises, the optimal level of employment is determined by the

⁴ China Labour Statistical Year Book, various issues.

⁵ For example, see Chen (1996), Wu (1998) and World Bank (1996).

⁶ However, a recent study by Dong and Puttermann (1997) provides an alternative interpretation to the problem of overstaffing. They argue that SOEs acted like a collective monopsonist in the pre and early reform era. Hence, employment was set below the socially efficient level. When the state's monopsony power was gradually eroded by competition from the private sector, they argue that profit maximizing SOEs would have expanded employment towards the competitive levels.

outside opportunity costs. In this case, the firm's specific wage has no role to play in setting employment and can be considered as a pure transfer between the enterprise, government and workers. In contrast, a perfectly competitive labour market predicts that workers will be paid according to their real marginal product. Labour is adjusted along a downward sloping labour demand; that is, employment is responsive to wage costs. Therefore, a simple test to distinguish these two polar models is whether employment is independent of the firm's specific wage rates.

Using a dynamic factor demand framework (e.g., see Card 1986), I find that the central planning model provides a more consistent interpretation of the employment patterns between 1980 and 1994. This result suggests that, though SOEs have more autonomy over wage determination (as documented in Chapter 2), the government maintains a tight control on labour allocation after reforms. Workers are employed such that the marginal product of labour is equal to its opportunity costs as measured by the alternative wage, rather than to the firm's specific wage. Moreover, despite the institutional changes targeted at the restrictive "iron bowl" system, there is no evidence of increased flexibility of the labour market. The speed of employment adjustment to output, wage, or price shocks was roughly constant over the sample period.

The next section presents a Nash bargaining model that conceptualizes the underlying wage- and employment-setting behaviour before and after the economic reform. Section 3 extends the static bargaining outcomes into a dynamic setting with adjustment costs. Section 4 describes the overall employment trend of the longitudinal data set. Empirical results are discussed in Section 5, while Section 6 offers concluding remarks.

3.2 Conceptual Framework

The distinctive feature of Chinese labour reform is to expand enterprise autonomy progressively by delegating power from higher authorities to enterprise managers. In this section, I develop a conceptual model to illustrate the impact of this process on wage and employment setting behaviour.

3.2.1 Pre-Reform: Central Planning

In the pre-reform era, SOEs served not only as the government's major source of income, but they also created urban employment. This can be captured in a social planner model in which workers are centrally allocated in order to maximize social welfare, which depends on the "social rents" and total employment in state sector.

Assuming workers are homogeneous, one representation of the social planner's problem is given by

$$\underset{n_i}{\text{Max}} \quad U^S = \left(\sum R'(n_i) - a \sum n_i \right)^{\gamma_1} \left(\sum n_i \right)^{\gamma_2} \quad (1)$$

where $R'(n_i)$ and n_i is the revenue function and the number of workers employed in enterprise i. The outside opportunity costs of employment is a, which is usually measured by the alternative wage rate.⁷ The firm-specific revenue function reflects the differences in productivity and technology across firms, as well as any price and investment distortions due

⁷ In a perfectly competitive market, the alternative wage rate is considered as the market clearing competitive wage.

to ideological preferences of the CCP. Rents generated in enterprise i are defined as revenues in excess of the opportunity costs of employment, $R^i(n_i) - an_i$.⁸ The first term in equation (1), $\sum R^i(n_i) - a \sum n_i$, therefore, represents the “social rents” of the entire state sector. γ_1 and γ_2 are the weights assigned to social rents and state employment respectively.

The first order condition for n_i can be written as

$$R_{n_i}^i(n_i) = \frac{-\gamma_2}{\gamma_1} \frac{\sum R^i(n_i) - a \sum n_i}{\sum n_i} + a. \quad (2)$$

If the workers share a portion (s_w) of the “social rents” from the government, their wage rate takes the general form

$$w_i = s_w \left(\frac{\sum R^i(n_i)}{\sum n_i} - a \right) + a. \quad (3)$$

Equations (2) and (3) provide a simple characterization of the wage- and employment-setting behaviour in Chinese SOEs before the reforms. First, workers are allocated administratively so that the marginal product of labour is equal across enterprises. From equation (2), the optimal level of employment depends on the outside opportunity wage (a) and the relative importance of “social rents” (γ_1) and total employment (γ_2).

⁸ In a standard two-factor model with labour and capital, $R^i(n_i) - an_i$ may simply represent the cost of capital inputs. As discussed in Lardy (pp. 33-52, 1998), investments and even money losses in Chinese SOEs are either financed by fiscal subsidies or “interest-free” bank loans. In addition, cash-based accounting before

Employment determination is independent of the firm's own wage (w_i). The strong distributive objective (e.g., Gordon and Li 1997) of the Chinese government and the thorny redundancy problem reported in SOEs suggest that γ_2 is likely to be greater than zero. In this case, firms are "overstaffed" in the sense that the marginal product of labour is even below its opportunity cost (a). Second, all state workers are paid equally. Given the pre-reform egalitarian wage policy after bonuses were abolished, it is reasonable to assume that the "social rents" are evenly distributed between SOE workers as shown in equation (3). Therefore, the wage level depends only on the average labour productivity of the entire state sector, and is unrelated to the financial performance of each individual firm.

3.2.2 Post-Reform: Nash Bargaining

In the post-reform era, wage and employment decisions are made through formal or implicit bargaining between managers and the government rather than mandatory plans. However, details of the negotiation process are not documented. The objectives and bargaining power of each party may differ substantially over time and across provinces, industries, and levels of subordinations. In addition to firms' profits, other goals may also be pursued at the bargaining table. A common perception is that the Chinese government put strong emphasis on employment creation. Likewise, SOE managers may have multiple goals other than profitability. In the early 1980s, a manager was evaluated on the basis of not only the firm's financial performance but also the prosperity of all his workers. As described in Walder

1993 allows enterprises to exclude any debt attributable to interest payment in their expenses. For simplicity, I assume there is no capital input cost.

(1989), a manager can be considered as a socio-political community leader who is responsible for the welfare of the workers and their families.⁹

For simplicity, and with no substantial loss of generality, the interests of government, managers, and workers can be conceived as lying in three different objectives: enterprise profits, employment, and workers' compensation. In a Nash bargaining framework, the optimal levels of wage and employment are jointly determined within each enterprise so as to solve

$$\text{Max}_{n_i, w_i} U^B = (R^i(s_{i,w}, n_i) - w_i n_i)^{\alpha_1} n_i^{\alpha_2} (w_i - a)^{\alpha_3} \quad (4)$$

where $R^i(s_{i,w}, n_i)$ denotes the revenue function of enterprise i .¹⁰ Since workers in a particular SOE are no longer entitled to the "social rents" of the entire state sector, $s_{i,w}$ in equation (4) only refers to the workers' share of the rents within their own enterprise. Furthermore, I assume that profit sharing is effective in inducing workers' effort. Therefore, labour productivity will be increasing in $s_{i,w}$ which, in turn, will have positive effects on enterprise

⁹ Large enterprises provide a number of services to their workers, for example, housing, schooling, and health care.

¹⁰ As mentioned in Svejnar (1986), the solution to the bargaining model (4), which maximizes the weighted geometric average of the bargainers' utilities, represents a generalization of the Nash (1950, 1953) outcome. In particular, dropping the subscript i , the model can be rewritten as:

$$\text{Max}_{n, w} U^B = u_g^p u_m^{1-p} = [(R(\cdot) - wn)^{\alpha_1} n^{\alpha_2} (w - a)^{\alpha_3}]^p [(R(\cdot) - wn)^{\alpha_1} n^{\alpha_2} (w - a)^{\alpha_3}]^{1-p}$$

where u_g and u_m are the objective functions of the government and manager respectively. The bargaining power is represented in index p . Therefore, parameters α_i ($i = 1, 2, 3$) in equation (4) measure the "joint" interests and bargaining power of the government and managers.

profitability (e.g., see Zhuang and Xu 1996; Li 1997). This implies that $\partial R^i(s_{i,w}, n_i)/\partial s_{i,w} > 0$ and $\partial^2 R^i(s_{i,w}, n_i)/\partial s_{i,w}^2 < 0$.

If managers have to offer their workers at least the outside alternative wage (a), the difference between the firm's specific wage (w_i) and the outside alternative wage represents the amount of rents per worker. Assuming that bonuses are distributed in an egalitarian manner within the enterprise, workers' compensation takes the general form

$$w_i = s_{i,w} \left(\frac{R^i(s_{i,w}, n_i)}{n_i} - a \right) + a \geq a. \quad (5)$$

In the general case when emphasis is attached to all three objectives with $0 < \alpha_i < 1$ and $i = 1, 2, 3$, the first order conditions for wage and employment determination for the post-reform Nash bargaining model (4) are

$$\begin{aligned} w_i^* &= \frac{\alpha_1 \varepsilon_r^i + \alpha_3}{\alpha_1(1 + \varepsilon_r^i) + \alpha_3} \left(\frac{R^i(s_{i,w}, n_i)}{n_i} - a \right) + a \\ &= \left(\varepsilon_r^i + \frac{\alpha_3}{\alpha_1} \right) \left(\frac{R^i(s_{i,w}, n_i)}{n_i} - w_i^* \right) + a = \left(\varepsilon_r^i + \frac{\alpha_3}{\alpha_1} \right) \left(\frac{\pi_i}{n_i} \right) + a \end{aligned} \quad (6)$$

$$R_{n_i}^i(s_{i,w}, n_i^*) = \left(1 - \frac{\alpha_2}{\alpha_3} \right) w_i + \frac{\alpha_2}{\alpha_3} a \leq w_i \quad (7)$$

where $\varepsilon_r^i = R_{s_{i,w}}^i(s_{i,w}/(R^i(s_{i,w}, n_i) - a n_i)) > 0$ is the elasticity of rents with respect to $s_{i,w}$.

Compared with the social planner outcomes (2) and (3), during transition the implications of the Nash bargaining solutions on wage- (6) and employment- (7) setting behaviour are:

- i) Workers' pay is related to their enterprise's financial prosperity. Equation (6) indicates that the optimal incentive payment scheme depends on the relative weight of workers' compensation to enterprise profits (α_3/α_1), and the extent to which rent-sharing raises the firm's total revenue (ε_r^t). Workers in a planned economy, by comparison, are rewarded uniformly, regardless of their individual or enterprise performance (i.e., wage equation (3)).
- ii) The enterprise-specific wage will play a more decisive role in employment determination. For equation (7), the optimal level of employment varies with both the firm's specific and its alternative wage rates. Beginning in the mid-1980s, China's reform policies seem to suggest that the bargaining focus shifted from non-financial goals towards profitability. For example, performance contracts,¹¹ which set financial indicators¹² as the primary target, were signed between managers and the government. Some firms were also reportedly given more autonomy over employment. That means α_2 and α_3 are decreasing relative to α_1 as reform advances. In the extreme case in which no emphasis is attached to creating employment ($\alpha_2 = 0$), the first order condition for employment (7) reduces to

¹¹ For details on the implementation of performance contracts in China, see Byrd (1991) and White (1987).

¹² In my sample, 88 percent of the SOEs were under performance contracts by 1989. Seventy percent of the contracts indicated that the primary target was either profits or taxes.

$$R_{n_i}^i(s_{i,w}, n_i^*) = w_i .^{13} \quad (7')$$

As predicted in the traditional labour demand model, the firm's profit is maximized when workers are paid by their marginal revenue product. In contrast to the pre-reform employment equation (2), the outside opportunity wage plays no role in employment determination.

It is instructive to look at the special case where employment decisions are identical for the central planning model and Nash bargaining. When $\gamma_2 = 0$ in equation (1) or $\alpha_2 = \alpha_3$ in equation (4), we have the same first order condition for employment in the social planner's case (2) and Nash bargaining (7):

$$R_{n_i}^i(\cdot) = a . \quad (7'')$$

The key assumptions of $\gamma_2 = 0$ and $\alpha_2 = \alpha_3$ imply that the primary objective of the enterprise is to maximize the total amount of rents (i.e., $R^i(\cdot) - an_i$) that can be shared between managers, workers, and the government. As a result, the firm's specific wage is a pure transfer between them. The "efficient" level of employment sets the marginal revenue product of labour equal to the alternative wage. Employment is independent of the firm's specific wage, and only depends on the alternative wage. In a Nash bargaining model, this

¹³ Although the employment outcome (7') is identical to the traditional labour demand model, SOEs are not simply price takers in wage determination. Under the assumption that profit-sharing improves productivity, the optimal level of wage is set above the alternative wage and is related to the firm's profitability. For example, in the case where SOEs are profit maximizing firms with $\alpha_2 = \alpha_3 = 0$, the first order condition for wage (6) reduces to $w_i = \varepsilon_i \frac{\pi_i}{n_i} + a$.

result is normally referred to the “strong efficient” contracting outcome (e.g., see Brown and Ashenfelter 1986). Since the employment outcomes are identical for the social planner and Nash bargaining, we cannot empirically identify who has the control over employment determination without additional evidence.

3.3 Employment Dynamics with Adjustment Costs

A first order approximation of employment equation (7)¹⁴ gives a general reduced form employment equation:

$$\log n^* = \text{cons} + e_1 \log X + e_2 \log w + e_3 \log a + \varepsilon^{15} \quad (8)$$

where $e_2 = -(1 - \alpha_2/\alpha_3)$, $e_3 = -(\alpha_2/\alpha_3)$, and X represents other explanatory variables that affect workers’ marginal revenue product. It is useful to illustrate the implications of two polar cases of employment determination:

- i) Workers are allocated administratively by the government under central planning.

The first order condition (2) indicates that employment only depends on the alternative wage (a) and is independent of the firm’s specific wage (w_i). This implies $e_2 = 0$ in equation (8).¹⁶

¹⁴ Dropping the subscript i, $\log R_n(s_w, n) = (1 - \alpha_2/\alpha_3) \log w + (\alpha_2/\alpha_3) \log a$. I also assume that $\log R_n(s_w, n) = \text{cons} + e_1 \log X - \log n$. For example, consider the simple case of a downward sloping demand, $p(q)$, and a Cobb-Douglas production function, $q = (s_w n)^{\kappa_1} m^{\kappa_2}$, $R_n(s_w, n) = \frac{\kappa_1}{n} pq(1 + 1/\varepsilon_p)$ where m and ε_p are the other inputs and elasticity of demand respectively. Then $\log R_n(s_w, n) = \log \kappa_1 + \log pq + \log(1 + 1/\varepsilon_p) - \log n$.

¹⁵ For simplicity, henceforth, I drop the subscript i from equation (7).

ii) Enterprises have direct control over employment decisions. According to equation (7') profits are maximized when the marginal product of labour is equal to the firm-specific wage. Employment is independent of the alternative wage. In a completely decentralized labour market with profit maximization, $e_3 = 0$ in equation (8).

In general, labour decisions in the post-reform era are made through negotiations between the government and managers. If the Nash bargaining hypothesis is correct, the first order condition for employment (8) implies that both e_2 and e_3 will be significantly different than zero.¹⁷ As the Chinese labour market is evolving from a centrally planned system to a decentralized competitive one, we expect e_2 to be decreasing (more negative), while e_3 approaches zero. Therefore, a simple test of decentralization in employment decisions is whether the coefficient of the firm-specific wage is zero ($H_0: e_2 = 0$). Rejection of the null hypothesis supports the Nash bargaining model in which the firm-specific wage plays at least some role in employment determination. A typical approach to this test is to estimate equation (8) using lagged wages as instruments for w (e.g., Brown and Ashenfelter 1986; Currie 1991).¹⁸

However, an important feature of the labour market is missing in the static model (8) – employment dynamics. Even in market economies, it takes time for firms to adjust their labour demand in response to input shocks.¹⁹ The conventional explanation for this

¹⁷ As noted in section 3, both the social planner model and the special case of "strong" efficient contracting in Nash bargaining give $e_3 = 0$. It is necessary to rely on other evidence to distinguish between these two models.

¹⁸ The expected sign for e_2 can be positive or negative depending on whether α_2 is greater or smaller α_3 .

¹⁹ In the Nash bargaining context, the firm's specific wage (w) and employment (n) are jointly endogenous. In order to identify equation (8), it is necessary to find instrumental variables which correlate with w , without influencing the efficient level of employment.

stickiness is the adjustment costs of changing the amount of input used. In addition to the costs of hiring, training, severance pay and disruptions to production due to restructuring, adjustment costs in transitional economies directly relate to the flexibility of the emerging labour market. Changes in government policies that affect the flexibility in hiring and dismissal decisions will have an impact on the speed and the optimal path of labour adjustments. For example, if the labour contract system is effective in increasing flexibility in the “iron bowl” in China, the employment adjustments to demand shocks will be improved. It is important to examine the differences in employment dynamics at various phases of the reform.

Following Kennan (1979) and Card (1986), the traditional method of extending the static model to a dynamic setting involves two additional adjustment costs. The first is the cost of maintaining a sub-optimal level of employment, $n_t \neq n_t^*$. Since $C'(n_t^*) = 0$,

$$C(n_t) \geq C(n_t^*) + \frac{g_1}{2} (\log n_t - \log n_t^*)^2 \quad (9)$$

where $C(n_t^*)$ denotes the minimum cost of producing y_t , given w_t and r_t . The second order expansion coefficient g_1 is assumed to be constant over time.²⁰ The second adjustment cost

¹⁹ For an extensive literature review on the effect of adjustment costs on factor demand, see Hamermesh and Pfann (1996).

²⁰ In general, $g_{tt} = C''(n_t^*)$ is a function of t . I assume that its sample average (\bar{g}_1) provides a reasonable approximation.

is the cost of changing the size of employment between periods t and $t - 1$. For empirical tractability, I impose a symmetric²¹ convex structure on this cost that can be summarized as:

$$d(n_t, n_{t-1}) = \frac{g_2}{2} (\log n_t - \log n_{t-1})^2 \quad (10)$$

Therefore, the optimal employment decision in a dynamic model is made by comparing the expected cost of maintaining a sub-optimal level of employment with the cost of adjusting the number of workers. With this setup, the dynamic employment equation is derived by minimizing the expected present value of the firm's total cost,

$$\min_{n_t} E \sum_{j=0}^{\tau} \delta^j \left[c(n_t^*) + \frac{g_1}{2} (\log n_{t+j}^* - \log n_{t-1}^*)^2 + \frac{g_2}{2} (\log n_{t+j}^* - \log n_{t+j-1}^*)^2 \right] \quad (11)$$

where δ is a constant discount factor that lies between zero and one. First order necessary conditions for the cost minimization of (11) consists of the standard partial adjustment solution²²

$$\log n_t = \eta \log n_{t-1} + (1 - \eta)(1 - \eta\delta) \sum_{j=0}^{\tau} (\eta\delta)^j E_t \log n_{t+j}^* \quad (12)$$

²¹ Given the rigidity of the 'iron rice bowl' employment, negative adjustments (layoffs) are more costly than positive ones. However, there is no explicit analytical solution for the reduced form employment equation in the case of asymmetric costs.

where $\eta^2 - \left(\frac{1 + \delta + g_1/g_2}{\delta} \right) \eta + \frac{1}{\delta} = 0$. The adjustment parameter η , which lies between zero and one, reflects the persistence of the employment level. It depends on the relative size of the two adjustment costs (g_1/g_2), and is increasing with g_2 . Intuitively, a relatively high cost of changing the size of the labour force (g_2) will slow down the adjustment process. Substituting equation (8) into the first order employment condition (12) yields

$$\log n_t = \eta \log n_{t-1} + (1 - \eta) \left\{ (1 - \eta\delta) \sum_{j=0}^{\infty} (\eta\delta)^j E_t [\text{cons} + e_1 \log X_{t-j} + e_2 \log w_{t-j} + e_3 \log a_{t-j} + \varepsilon_{t-j}] \right\} \quad (13)$$

where X_t only includes firm's output (y_t) as an explanatory variable that affects workers' marginal revenue product. In fact, employment may be dependent on other factor inputs and their prices, such as capital and non-labour inputs. For the lack of reliable series, these effects on employment are assumed to be captured by enterprise's fixed effects and year dummies. According to the employment equation (14), present employment is the weighted average of past employment and the discounted expected future values of output, firm-specific wages, and alternative wage rates. Finally, in order to derive a reduced form equation for empirical estimation, it is necessary to further restrict the stochastic processes

²² For details of solving this quadratic control problem and the transversality conditions, see Sargent (1978) Chapters 9 and 14.

of output, firms' specific wages, and alternative wages. I adopt the following AR(2) forecasting equations:

$$\log y_t = \phi_0 + \phi_1 \log y_{t-1} + \phi_2 \log y_{t-2} + \zeta_{yt} \quad (14a)$$

$$\log w_t = \psi_0 + \psi_1 \log w_{t-1} + \psi_2 \log w_{t-2} + \zeta_{wt} \quad (14b)$$

$$\log a_t = \varphi_0 + \varphi_1 \log a_{t-1} + \varphi_2 \log a_{t-2} + \zeta_{at} \quad (14c)$$

All the forecasting errors (ζ_{yt} , ζ_{at} , ζ_{wt}) are serially uncorrelated. Substitute equations (14a)-(14c) into (13) to get

$$\begin{aligned} \log n_t = & \text{cons} + \eta \log n_{t-1} + (1 - \eta) \left[(e_{11}^a \log y_t + e_{12}^a \log y_{t-1}) \right. \\ & \left. + (e_{21}^b \log w_t + e_{22}^b \log w_{t-1}) + (e_{31}^c \log a_t + e_{32}^c \log a_{t-1}) + \varepsilon'_t \right] \end{aligned} \quad (15)$$

where each e_{ij}^k depends on the coefficient e_i in employment equation (15) and the free parameters in forecasting equation (14k). A detailed derivation of equation (15) is presented in Appendix.

In order to capture the second-order autoregressive representation of employment²³, I assume the productive shock ε_t in (8) is specified as the AR(1) process, $\varepsilon_t = \rho \varepsilon_{t-1} + \xi_t$, where ξ_t is white noise and uncorrelated with output, employment and wages. In order to eliminate the serial correlation in error terms ε'_t , the final reduced form equation is obtained

²³ A simple AR(2) specification of employment with enterprise fixed effects and year dummies suggests that it follows a second order autoregressive process.

by subtracting ρn_{t-1} from both sides of (15), and then using (14a)-(14c) to substitute for the current values of output, wages, and prices. As a result, the model generates a second order employment equation that expresses current employment in terms of two lagged values on employment, firm's output, wage rates, and alternative wages:

$$\begin{aligned} \log n_t = & \text{cons} + (\eta + \rho) \log n_{t-1} - \rho \log n_{t-2} + (1 - \eta) \\ & [(E_{11} \log y_{t-1} + E_{12} \log y_{t-2} + E_{21} \log w_{t-1} + E_{22} \log w_{t-2} \\ & + E_{31} \log a_{t-1} + E_{32} \log a_{t-2}) + (\varepsilon'_t - \rho \varepsilon'_{t-1})] \end{aligned} \quad (16)$$

The implied coefficients (E_{ij}) of the reduced form equation (16) are functions of the coefficients of equations (13) and (14), and the serial correlation coefficient ρ of the productive shock.²⁴

One point worth mentioning is the difference between equation (16) and its unrestricted version in the role of alternative wage in employment determination. If the forecasting equation for firm-specific wage (14b) is not a simple AR(2), but also depends on the lagged alternative wages, the alternative wage will influence employment directly in a Nash bargaining model, and indirectly as predictors of firm's future wages. To disentangle these two effects, it is necessary to focus on the underlying structural coefficients (i.e., e_2 and e_3 in equation (8)).

²⁴ For example, $E_{11} = e_{11}^* \phi_1 + e_{12}^* - e_{11}^* \rho$. The results are similar for other coefficients E_{ij} in equation (14).

3.4 Data

This paper utilizes an extensive establishment-level panel data covering the period between 1980 and 1994. Annual data of 769 SOEs²⁵ in four provinces (Jiangsu, Sichuan, Shanxi and Jilin) were collected in two surveys conducted by the Chinese Academy of Social Sciences. The same data set was used in Chapter 2 as well as other studies on Chinese economic reform (e.g., Groves et al. 1994 and 1995).²⁶

Summary measures for the sampling distribution of enterprise employment are presented in Table 3.1. The mean number of workers employed per firm increased from 1600 in 1980 to around 2000 in 1994. This growth was steady throughout the period. With the mean level of employment per firm substantially greater than the median, the employment distribution is heavily skewed to the left.²⁷ About 80 percent of the enterprises had employment below the mean. In contrast to the increasing wage inequality across SOEs documented in the previous chapter, the coefficient of variation of firms' employment decreased continuously by about 15 percent (Figure 3.1). Figure 3.2 graphs the tenth, fiftieth and ninetieth percentiles of the employment for 1980-94. For ease of comparison, all series are indexed to 100 in 1980. As observed in the figure, the decline in employment dispersion across enterprises is due to the fact that small enterprises expanded more rapidly than large enterprises after 1984. The number of workers employed at the tenth percentile grew by 40 percent over the sample period, but by only 25 percent increase at the ninetieth

²⁵ The sample for empirical estimations only contains 680 enterprises because of coding errors, inconsistencies and missing values.

²⁶ For a detailed description of the panel data set, see Chapter 2.

²⁷ The coefficient of skewness is about 9.5 depending on the sampling year.

percentile. The steady employment growth with no increase in dispersion across firms is consistent with the common belief that the Chinese government has maintained tighter control over employment than wages during the reform. If this casual observation is correct, we would expect the central planning model to be more successful in capturing the employment dynamics. That is, employment only depends on the alternative wage and the structural parameter e_2 equals zero in equation (8).

3.5 Empirical Estimation and Results

The entire empirical model consists of the reduced form employment equation (16) and three forecasting questions for an enterprise's total output (14a), average wage (14b),²⁸ and alternative wage (14c). As noted above, the test of a competitive labour market relies on the effect of alternative wages on employment; that is, whether $e_3 = 0$ in equation (8). Therefore, it is crucial to obtain an appropriate measure of the alternative wage that, in theory, refers to the outside opportunity cost of labour. Since there is no clear basis for the "correct" measure, a common approach is to pick the one which appears to be most relevant. For example, Card (1986) uses manufacturing wage rate as the alternative wage for airline mechanics and Currie (1991) uses wages in surrounding school districts as the proxy for Ontario teachers. Another approach is to check the robustness of results with different alternative wage measures (e.g., see Brown and Ashenfelter 1986). To obtain an appropriate alternative wage measure for Chinese state workers is even harder because most

²⁸ For details of the formal definitions of each variable, see Appendix in Chapter 2.

of the relevant data was not published until the mid-1980s. The most direct measure I can find is the provincial average wage in collective-owned enterprises.

All series including the lags are detrended by regressing them on an enterprise specific intercept and year dummies. Then the residuals from these regressions are used in the estimation. Fitting the enterprise fixed effects and year effects outside the main model can simplify the estimation by dropping the constants in (14) and (16). Furthermore, I assume that the effects of other non-labour factor inputs on employment determination can be partially captured in the detrending procedure.

The method of maximum likelihood is used to estimate the structural parameters $(\phi, \psi, \eta, \rho, e_1, e_2, e_3)$.²⁹ These estimates are obtained by maximizing the negative of the log determinant of the residual covariance matrix associated with the vector autoregression (14) and (16). I begin with the two polar cases of employment determination by setting $e_3 = 0$ in the decentralized “competitive” model and $e_2 = 0$ in the social planner model. For the period 1982-94, estimates of the structural parameters are presented in columns 1 and 2 of Table 3.2. A simple comparison of these two sets of results seems to suggest that the social planner model provides a better fit to the employment series. The key parameter of interest, e_2 , is positive, but virtually zero in the restricted decentralized “competitive” model. The standard error is much greater than the estimate. On the other hand, e_3 is statistically significant with the expected negative sign in the alternative model. Both polar models provide very similar estimates of the output elasticity (e_1), adjustment parameter (η) and serial correlation coefficient (ρ). In column 3, I present the estimates for the general Nash

²⁹ The discount rate δ is treated as constant equal to 0.99.

bargaining model which allows the shadow value of labour to depend on both the firm's specific and alternative wages. The estimated own wage elasticity (e_2) is still positive and becomes marginally significant at the 10 percent level. The link between alternative wages and employment remains very strong ($e_3 = -1.52$). Since employment is insensitive to the firm's specific wage, it appears that employment is not adjusting along a downward sloping labour demand where workers are paid according to their marginal products. This result poses a question of the validity of other empirical studies that support the standard neoclassical model. For example, Hay et al. 1994 and Jefferson et al. 1998 estimated a system of structural equations and concluded that SOE employment is sensitive to wage costs.

In order to examine changes in employment setting behaviour over the reform period, I re-estimate the model on two sub-periods. Results for the periods 1982-85 and 1991-94 are reported in columns 4 and 5 of Table 3.2 respectively. The basic conclusion is that there was no significant change in the underlying employment setting behaviour between the early 1980s and 1990s. Only the outside opportunity wage played a significant role in determining the employment level.

As discussed in the conceptual framework, this result can be explained in both the social planner model and the Nash bargaining framework. To distinguish between them, the speed of labour adjustments may provide additional information on the labour market. Even though an increase in the flexibility of the "iron bowl" system was a main focus of the labour reform, empirical results do not reflect any impact of this policy change. Employment does not seem to adjust more rapidly in response to demand shocks. The structural parameter η , which infers the speed of adjustment, remains constant at 0.8 in both

sub-samples. This combination of slow employment adjustments and employment setting on the basis of alternative wage favour the social planner model, in which government continues to play an important role in labour decisions after a decade of reform.

3.6 Conclusion

One of the fundamental questions in centrally planned economies is how state-owned units adjust their employment in response to the transition towards a market economy. In particular, reallocating the surplus state workers becomes the thorny challenge of the labour reform. This study provides some insights on such an adjustment process under gradual decentralization in Chinese SOEs during the period 1980-94.

While redundancy is described as one of the major problems in Chinese SOEs, I find no empirical support that employment is adjusting according to a downward sloping demand with the marginal revenue product of labour equal to the firm's own wage. It appears that the central planning model provides a more consistent interpretation of the employment patterns. Moreover, increasing managers' autonomy in personnel decisions and the use of contract workers seem to have minimal effect on the flexibility of the traditional "iron bowl" system. The speed of labour adjustment in response to demand shocks was constant between 1980 and 1994. These results suggest that labour reforms had very limited impact on employment decisions at least through the mid-1990s. In order to maintain a low urban unemployment rate, the Chinese government continues to play a dominating role in employment decisions. However, given the existing distortions in price levels and investments in the state sector, this administrative labour allocation process is "efficient": the

marginal product of labour is equal to its opportunity costs as measured by alternative wages.

How robust are these empirical results? While they are illustrative, a number of extensions deserve to be considered in order to have a more conclusive picture of the decentralizing labour market in China. First, due to the lack of relevant data in the early 1980s, only one alternative wage measure is available for empirical estimations. A major criticism is that the results might be sensitive to the choice of alternative wage measures.³⁰ To evaluate this objection, one possibility is to check the stability with other alternative wage measures which become accessible in the late 1980s.³¹ The trade-off is to shorten the panel and confine the sample period to the later stage of the economic reform. Second, the test of labour market flexibility is based on variations across time. The behavioural differences across provinces and enterprise autonomies documented in Chapter 2, pave way for future research to explore these cross-section variations. It is possible that enterprises with more autonomy on wage decisions are also more flexible in employment adjustments. If this hypothesis is correct, we would expect the province of Jiangsu, which exhibits the strongest pay-performance link, to have the most decentralized labour market. Finally, the panel data only covers the period until 1994 which is the initial phase of aggressive institutional reforms, such as the implementation of Xiagang. It is interesting to question whether the employment patterns have changed accordingly in the late 1990s.

³⁰ For example, Brown and Ashenfelter (1986) use 11 different alternative measures for the sensitivity analysis.

³¹ Another possibility is to construct other measures based on the available data. For example, Prasnikar et al. (1994) combine the average outside opportunities (\bar{w}_t) with the firm-specific wage (w_{it}):

$$a_t = \bar{w}_t \sum_{i=1}^T w_{it} / \sum_{i=1}^T \bar{w}_t, \text{ where } T \text{ is the length of the panel.}$$

In conclusion, decentralization in China's labour market remained far from complete at least until the mid-1990s. Enterprise autonomy on labour issues was heavily skewed towards wage determination. The government maintained tight control over employment decisions. From a public policy perspective, wages and employment are separate instruments to maintain a balance between efficiency and equality during transitions. The aim of introducing group incentive payment schemes is to enhance productivity, while the rigidity of employment stabilizes income inequality by controlling the urban unemployment rate. Since China has no unemployment insurance program,³² SOEs may serve the same function that a social security system does in the market economy. A parallel development in the social safety net to protect the laid-off workers is crucial to the success of the labour reform.

³² Although there is no formal unemployment insurance program in China, the government provides financial support to the layoffs. As mentioned in the second meeting of the Ninth National People of Congress in March 1999, there are three levels of protection to the laid-off workers. First, they receive "subsidies" from their own SOEs for three years. Then, the government provides "unemployment insurance" for another two years. If they remain unemployed after five years, they are entitled to the minimum living welfare.

Appendix

Derivation of the Reduced Form Dynamic Employment Equation

Following Sargent (1978), forecasting equation (15a) can be written as

$$z_t = Az_{t-1} + \varepsilon_t^a,$$

$$\text{where } z_t = \begin{bmatrix} \log y_t \\ \log y_{t-1} \end{bmatrix} \quad A = \begin{bmatrix} \phi_1 & \phi_2 \\ 1 & 0 \end{bmatrix} \quad \varepsilon_t^a = \begin{bmatrix} \zeta_{yt} \\ 0 \end{bmatrix}$$

$$\text{Therefore, } z_{t+j} = Az_t + \varepsilon_{t+j}^a$$

$$z_{t+j} = A^j z_t + \varepsilon_{t+j}^a + A\varepsilon_{t+j-1}^a + \dots + A^{j-1}\varepsilon_{t+1}^a$$

$$\text{Since } E_t \varepsilon_{t+k}^a = 0 \text{ for } k \geq 1, E_t z_{t+j} = A^j z_t.$$

$$\therefore E_t(\log y_{t+j}) = E_t(hz_{t+j}) = hA^j z_t, \text{ where } h = (1 \ 0).$$

Assuming A has distinct eigenvalues, λ_1 and λ_2 with the corresponding eigenvectors t_1 and t_2 ,

$$A = P\Lambda P^{-1} = \begin{bmatrix} t_{11} & t_{21} \\ t_{12} & t_{22} \end{bmatrix} \begin{bmatrix} \lambda_1 & 0 \\ 0 & \lambda_2 \end{bmatrix} \begin{bmatrix} t_{11} & t_{21} \\ t_{12} & t_{22} \end{bmatrix}^{-1}$$

$$\begin{aligned} \therefore (I - \eta\delta) \sum (\eta\delta)^j E_t(e_i \log y_{t+j}) &= e_i(I - \eta\delta) \sum (\eta\delta)^j hA^j z_t \\ &= e_i(I - \eta\delta) \sum (\eta\delta)^j hP\Lambda^j P^{-1} z_t \\ &= e_i(I - \eta\delta) hP \sum (\eta\delta\Lambda)^j P^{-1} z_t \\ &= e_i(I - \eta\delta) hP \begin{bmatrix} \frac{1}{1 - \eta\delta\lambda_1} & 0 \\ 0 & \frac{1}{1 - \eta\delta\lambda_2} \end{bmatrix} P^{-1} z_t \\ &= \frac{e_i(1 - \eta\delta)}{|P|} \left\{ \left(\frac{t_{11}t_{22}}{1 - \eta\delta\lambda_1} - \frac{t_{21}t_{12}}{1 - \eta\delta\lambda_2} \right) \log y_t + \left(-\frac{t_{11}t_{21}}{1 - \eta\delta\lambda_1} + \frac{t_{21}t_{11}}{1 - \eta\delta\lambda_2} \right) \log y_{t-1} \right\} \\ &= e_{i1}^a \log y_t + e_{i2}^a \log y_{t-1} \end{aligned}$$

Derivation is similar for parameters e_{21}^b , e_{22}^b , e_{31}^c and e_{32}^c .

Table 3.1
Summary Measures of the Sampling Distribution
of Enterprise Employment

	1980	1983	1986	1989	1990	1994
Mean	1604.53	1765.56	1837.90	1952.15	1956.68	1997.93
Percentile:						
10	291.0	314.0	385.0	400.0	419.0	402.0
50	870.0	973.0	1052.0	1087.0	1106.0	1094.0
90	3017.0	3364.0	3503.0	3480.0	3712.0	3780.0
Std. Deviation	3334.10	3492.14	3514.82	3718.82	3456.01	3614.46
Coefficient of Variation	2.0779	1.9779	1.9124	1.9050	1.7663	1.8091

Table 3.2
Structural Estimates for Partial Adjustment Employment Equation
 (Standard errors in parentheses)

	1982 - 94		1982 - 85		1991 - 94	
	Labour Demand	Strong Efficiency	General	General	General	General
Partial Adjustment (η)	0.7749 (0.0093)	0.7757 (0.0092)	0.7770 (0.0093)	0.8319 (0.0132)	0.8290 (0.0144)	
Output Elasticity (e_1)	0.3423 (0.0332)	0.3488 (0.0329)	0.3405 (0.0335)	0.4260 (0.0718)	0.3878 (0.0659)	
Wage Elasticity (e_2)	0.0231 (0.0760)	0 (0.0832)	0.1538 (0.0832)	0.2147 (0.2244)	0.0865 (0.1178)	
Alt. Wage Elasticity (e_3)	0	-1.3201 (0.2899)	-1.5183 (0.3164)	-1.8585 (0.6102)	-2.8901 (0.8092)	
Serial Correlation (η)	0.0554 (0.0145)	0.0514 (0.0144)	0.0546 (0.0145)	0.0301 (0.0221)	0.0590 (0.0247)	

Figure 3.1
Coefficient of Variation of Enterprise Employment, 1980-94

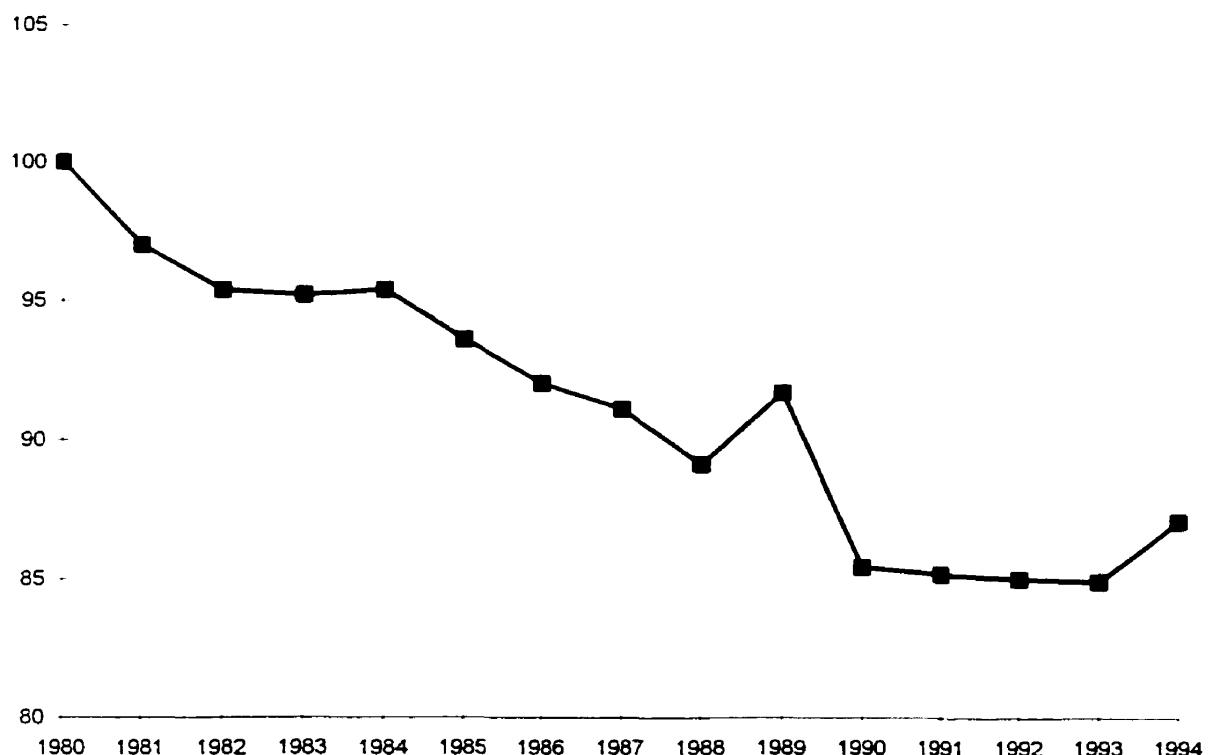
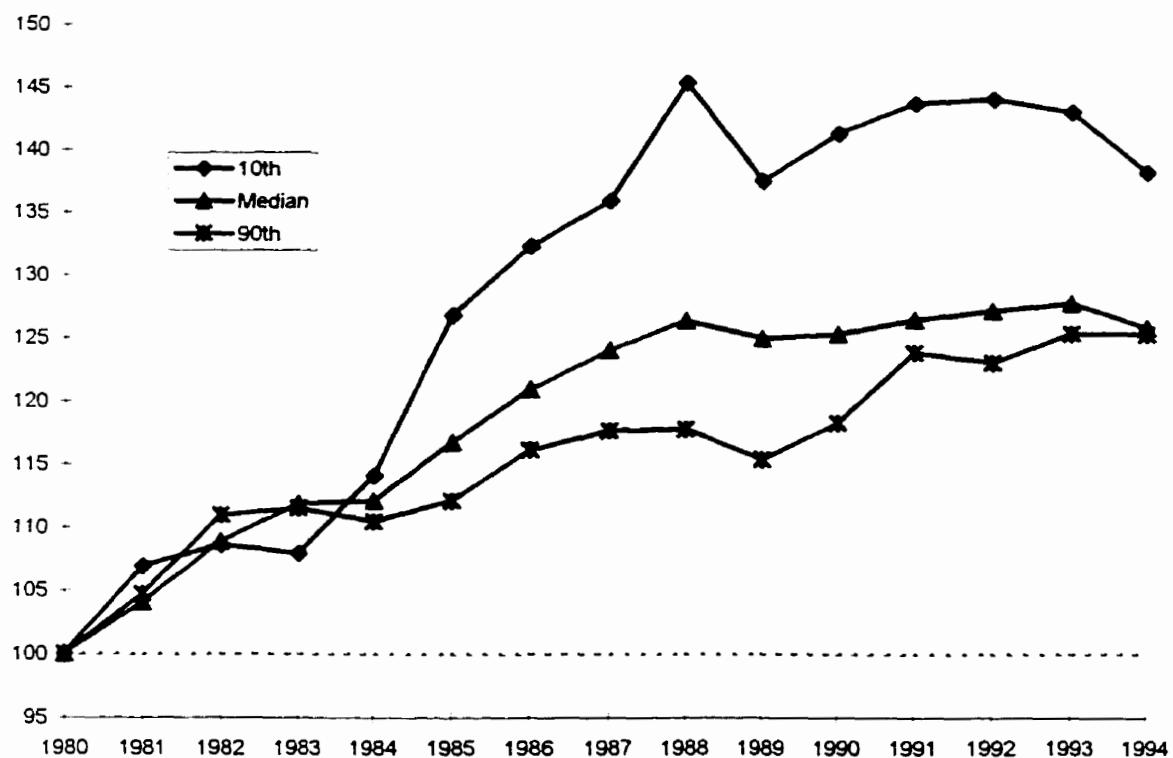


Figure 3.2
Indexed Enterprise Employment by Percentile, 1980-94



PART II

Minimum Wage Legislations in Canada 1988 - 1990

CHAPTER 4

The Effect of Minimum Wages on Youth Employment in Canada: A Panel Study

4.1 Introduction

In the conventional supply-and-demand framework, an increase in the minimum wage reduces employment for those workers with wages at or near the minimum level. Most of the early U.S. and Canadian empirical evidence is consistent with this ‘standard prediction’ of a negative employment effect (Brown 1988, Swidinsky 1980, Schaafsma and Walsh 1983). In general, aggregate studies using time series data from the 1970s and early 1980s conclude that a 10 percent increase in minimum wage decreases the teenage employment by 1 to 3 percent¹ (Brown 1988). The validity of the time-series evidence, however, has recently been called into question. A number of studies (Grenier and Séguin 1991, Wellington 1991, Card 1992a and 1992b, Katz and Krueger 1992, Card and Krueger 1994, Machin and Manning 1994) suggest that the employment effect of the minimum wage is insignificant or perhaps marginally positive².

¹ The effects for young adults are often smaller and insignificant, reflecting their smaller representation in the minimum wage population

² In addition, Card and Krueger (1995b) argue that the time-series literature is affected by publication bias, leading to a tendency for significant negative results to be over-represented in the published literature.

A number of attempts have been made to bring these divergent results into line. One strand of the reconciliation examines workers' employment patterns before and after an increase in the minimum wage using individual-level panel data. Linneman (1982) is an early study adopting this approach. More recently, Currie and Fallick (1996) examine increases in the U.S. minimum wage in 1980 and 1981 using this framework. They find that young people who are 'bound' by the two minimum wage changes (i.e., their current wage rate is between the old and new minimum) are 3 percent less likely to be employed in the following year.

Both the Currie and Fallick results and those in Linneman's study have been criticized on the grounds that panel estimates of minimum wage effects are biased due to the lack of a suitable control group. Since the minimum wage in the U.S. is under the jurisdiction of the federal government, all workers in the covered sectors with wage rates near the minimum are affected simultaneously by a change in the legislation. Therefore, there are few candidates to serve as a control for unrelated concurrent changes in labour market outcomes; typically higher wage workers are used as a control group. In other words, the panel results are based on a comparison of 'low wage' and 'high wage' individuals. It is possible therefore, that the panel estimates partly capture any differences in employment stability between the two wage groups. For instance, Card and Krueger (1995a, p. 224) observe:

High-wage workers provide a poor comparison group for studying the employment histories of low-wage workers. The insight from the "natural-experiments" approach to empirical research is that it is crucial to have a control group representing the experiences that the affected group of workers would have had in the absence of the minimum wage increase.

Obtaining an appropriate control group becomes the central challenge for panel studies of minimum wage. Perhaps the most convincing control group that has been used in U.S. studies is low wage workers in the uncovered sectors. For example, Ashenfelter and Card (1981) re-examine Linneman's analysis, comparing low wage workers in the covered sectors to those in uncovered sectors. As reported in Card and Krueger (1995a), their results indicate that both groups of low wage workers share similar employment experiences following the minimum wage increases in 1974 and 1975. This suggests that the significant disemployment effect of the minimum wage found in Linneman's study is a result of the heterogeneity between high wage and low wage individuals. Canada, arguably, provides an even better environment in which to address this issue. In contrast to the U.S., the minimum wage in Canada is under provincial jurisdiction. Therefore, for an increase in the minimum wage in a given province, low wage workers in other provinces can serve as the control group. In this case, the minimum wage effect is identified by variation between two groups of low wage individuals with comparable experience.

Using data from the Labour Market Activity Survey, I examine the effects of provincial minimum wage increases in Canada between 1988 and 1990. Over the sample period, there were a total of 19 separate changes in minimum wage across the 10 provinces. I begin by adopting the U.S. panel methodology: that is, including high wage individuals in the control group. Fixed effect estimates of the effect of the minimum wage on employment probability are negative and significant for both teens and young adults. This result is consistent with other U.S. panel estimates of minimum wage effect. I next replicate the analysis limiting the control group to low wage workers in provinces with no minimum wage change. The resulting estimates of the minimum wage effect are

insignificant and virtually zero. The difference in the results across these two methods appears to validate the criticism of past panel studies of minimum wage. The negative and significant estimates from the first method are driven by differences in employment stability between high wage and low wage workers.

A closer examination of the low wage sample, however, indicates that the minimum wage has different impacts within this group of seemingly homogenous workers. For 'transitory' low wage workers, who have less than 3 quarters of low wage employment over the sample period, the minimum wage effect is small and insignificant. In contrast, the minimum wage effect is both statistically and economically significant for those with longer low wage employment histories. For these workers with more than 3 quarters of low wage employment, teens are 7 percent less likely to be re-employed after a 8.4 percent increase in the minimum. The impact on young adults is even larger at 10 percent. An account of the difference in the minimum wage effect across these two groups is that most of the 'transitory' low wage workers are either full time students working in low paid summer jobs or 'high wage' workers temporary trapped in low wage positions. Thus, their current wage rates are likely lower than their marginal productivity. In terms of the target group in a supply-and-demand framework, they are less likely to be affected by the minimum wage.

This chapter proceeds as follows: Section 2 describes the key aspects of the longitudinal data set. Since no micro panel study has previously been conducted for Canada, Section 3.1 replicates the U.S. panel studies by including high wage individuals. In Section 3.2, I limit my sample to only low wage observations in order to determine

whether the results are sensitive to the definition of the control group. Section 4 contains some concluding remarks.

4.2 Data

The Labour Market Activity Survey (LMAS) is a longitudinal labour market data set which is a representative of the Canadian population³. Individuals are initially (1988) sampled through an addendum to the Labour Force Survey. They are then recontacted annually (1989 and 1990) and questioned about their labour market behaviour in the intervening period. In addition to general demographic information, the survey contains detailed employment information, such as weekly employment status and the beginning and end dates of different non-employment spells. Since the primary objective of this paper is to retrieve panel estimates of minimum wage effects on youth employment, only people between ages 16 and 24 in 1988 are included in my sample⁴.

The LMAS provides weekly employment status for each individual and it is possible to construct a weekly panel on the labour market activity of each individual every year. However, control variables, such as provincial unemployment rate and consumer price index, are provided at most on a monthly basis, and changes in the main variable of interest, the minimum wage, are even less frequent. I therefore work with a quarterly data which captures each individual's employment status⁵ at the middle of each quarter⁶; that is,

³ Individuals living in the Yukon and Northwest Territories are not sampled in the LMAS.

⁴ Because my sample 'ages' over time, these individuals will be 18-26 by the last year of the panel.

⁵ The LMAS attempts to decompose nonemployment into three states: unemployment with job search, unemployment without job search and not in the labour force. As pointed out by Jones and Riddell (1994), there are problems with this filter of the data. It may lead to biased measurement of the incidence and duration of nonemployment when there are only two meaningful nonemployment states. However, the

at most 12 observations for each individual during the three year sample period. Also, I exclude any individual who moves to the Yukon and Northwest Territories over the sample period because a complete series of all the control variables is not available for these areas.

I focus on the effect of the minimum wage on the transition from employment to nonemployment. Therefore, I confine my sample to those who are employed with a positive wage rate in a given quarter. In the LMAS, an hourly wage rate may not be directly reported by the individual. Any wage or salary, which is not reported on an hourly basis, is converted to an hourly equivalent rate as the usual wage or salary (e.g. daily, weekly or monthly) divided by the total hours worked. Observations with hourly wages lower than \$2 or higher than \$50 are excluded since they likely result from measurement error, especially for young adults. I also note that individuals with multiple jobs may have more than one hourly wage rate for a given period. Different weighted averages of the wage rates for different jobs can be used as the final measure of individual wage at a given time. It is reasonable to assume that the likelihood of losing a job decreases as the wage rate increases. Therefore, for those who hold more than one job in a period, what I am really interested in is to see whether they will lose their highest paid jobs and become unemployed as a result of a minimum wage increase. Taking the highest among all the wage rates as the final measure seems to be more appropriate⁷.

My full sample contains 71002 observations on 9379 individuals. There are 4379 teenagers between the ages of 16 to 19 (in 1988), while the remaining 5000 are young

LMAS longitudinal file provides a perfect forum for my analysis that only focuses on movements between employment and nonemployment in a two-state framework.

⁷ That is observations from the 7th, 20th, 33rd and 46th week.

⁸ In fact, I have replicated the empirical analysis with alternative definitions, such as the lowest and the simple average of all the wage rates. The results are very robust to these changes.

adults of ages 20 to 24. The percentage male are 52.3 and 50.1 for teenagers and young adults respectively. Descriptive statistics for the pooled cross section (1988 to 1990) are presented in Table 4.1. Not surprisingly, the marriage rate and education level of young adults are significantly higher than for teens. Young adults work longer hours at higher wages. The mean wages are 6.78 and 9.22 for the teens and young adults respectively. In addition, the average employment history of young adults is almost half a year longer than for teens. Young adults have 8.4 quarters employed throughout the three year sample period while the mean is only 6.6 for teens. As shown in Figure 4.1, the sample distribution of the number of total employment periods for young adults is heavily skewed to the right. More than 25 percent of the young adults are employed in all 12 quarters between 1988 and 1990.

Using individual wage rates, I identify individuals who are directly affected by an increase in the minimum wage. Formally, given that there is a minimum wage increase at t , individuals are defined 'at risk' if their wage rate at period $t-1$ is between the old minimum (MinW_{t-1}) and the new minimum (MinW_t). The percentage of teens and young adults, who are considered 'at risk' by this definition, is reported in Table 4.2. For teens, the percentage ranges from 2.8% (2nd quarter of 1990 in British Columbia) to 17.9% (1st quarter of 1989 in Nova Scotia). As expected the percentage for young adults is always lower, it ranges from 0.6% (2nd quarter of 1988 in Newfoundland) to 7.7% (1st quarter of 1988 in Nova Scotia). On average 9.5% of the teens and 2.4% of the young adults are considered 'at risk'.

As noted above, over the three year sample period, there were 19 minimum wage changes in different provinces. As shown in Figure 4.2, there has been at least one

minimum wage increase in all provinces, except Manitoba. We might expect the nominal minimum wage to trend upward over the period, as provincial governments may adjust the level in order to match the inflation rate. On the other hand, there is no common pattern in the trends of the relative minimum wage, measured as the ratio of the nominal minimum wage to the average provincial manufacturing wage⁸ (MinW/AvgW). This is in part due to the fact that there has been distinct minimum wage policies in the provinces over the period⁹. As expected, provinces like Ontario and Quebec, which revised their minimum wages yearly during the sample period, have a more stable pattern in the relative minimum wage.

4.3 Empirical Framework

4.3.1 The “Traditional” Approach - All Employed Individuals

If minimum wages and employment are negatively correlated, an increase in minimum wage will increase the likelihood of those currently employed being laid off or unable to find new jobs through regular turnover in the next period. In other words, the probability of shifting from employment to nonemployment increases. Given that an individual is employed in period $t-1$, the probability of being employed in the next period is modeled as a function of a set of control variables and the variable measuring exposure to the minimum wage increase.

⁸ It is the provincial average manufacturing wage including overtime.

⁹ Besides minimum wage policy, AvgW differs across provinces. This may also lead to difference in $(\text{MinW}/\text{AvgW})$. For example, the exceptionally high relative minimum wage in P.E.I. is due to its relatively low manufacturing wage compared with other provinces.

$$\Pr(S_{i,t}^j = 1 | S_{i,t-1}^j = 1) = f(AtRisk_{i,t}^j, I_{i,t}^j, V_t^j, D_p, D_y, D_s) + \epsilon_{i,t}^j \quad (1)$$

$S_{i,t}^j$ is the employment status of individual i living in province j at time t . The binary dependent variable ($E_{i,t}^j$) = 1 if the individual, who is employed at $t-1$ ($S_{i,t-1}^j = 1$) is also employed at t ($S_{i,t}^j = 1$), and = 0 if nonemployed at t . The dummy variable, $AtRisk_{i,t}^j$, is used as the control for minimum wage. $AtRisk_{i,t}^j = 1$ if the wage rate of individual i at period $t-1$ is between the old minimum ($MinW_{t-1}$) and the new minimum ($MinW_t$) when there is a minimum wage increase in province j at t , and = 0 otherwise¹⁰. Thus, individuals with wages outside this range ($[MinW_{t-1}, MinW_t]$), as well as all workers in other provinces with no minimum wage change, are used as the control group for other changes in the labour market. This ‘traditional’ approach have been adopted in other U.S. panel studies, such as Currie and Fallick (1996)¹¹.

The demographic information for individual i (marital status, education level and gender) is represented by $I_{i,t}^j$. One point worth mentioning is that labour force experience or potential experience is not included as one of the control variables. Because the LMAS records age and education level by categories, it is not possible to infer the exact age and years of schooling of each individual from this classification. V_t^j represents the economic environment of province j at time t , which includes the real GDP at time t , and the change in unemployment rate of males of prime age (25 to 54) between period $t-1$ and t . D_p are

¹⁰ $AtRisk_{i,t}^j = 0$ if (i) there is no minimum wage in province j at t or (ii) the wage rate of individual i is below the old minimum ($MinW_{t-1}$) or above the new minimum ($MinW_t$).

¹¹ There is a difference between my approach and the framework in Currie and Fallick. They compare the ‘at risk’ individuals to those who are unlikely to be affected by an increase in the minimum wage. As noted above, my comparison is not limited to individuals within the same province who are not likely to be affected, but also uses individuals in other provinces with no minimum wage change. It is possible to replicate the work of Currie and Fallick by estimating equation (1) separately for each province. However, the results (not reported) are not particularly informative because of the very small number of ‘at risk’ individuals in many provinces.

provincial dummy variables to capture the provincial fixed effects. Dummy variables, D_y and D_s , are year and season effects respectively. Detailed descriptions of each group of independent variables are given in Table 4.3.

A set of estimates of the linear probability model given in equation (1) is reported in Table 4.4. Starting with the OLS estimates, the coefficient on $AtRisk_{i,t}$ is negative and statistically significant¹² for both teens and young adults. On average, 'at risk' teenagers are 6.9 percent less likely to be re-employed after a 8.4 percent¹³ increase in minimum wage. The impact is even greater on young adults at 14.8 percent¹⁴.

The OLS estimates are subject to the same criticism leveled at other panel studies of minimum wage. The control group consists primarily of high wage workers. If high wage workers are 'better' than low wage workers in some unobserved quality that has a positive effect on employment and earnings, the results from the OLS estimation are biased. More precisely, the estimates of the minimum wage effects also capture these differences between high and low wage workers. In order to control for the unobserved heterogeneity between the two wage groups, I re-estimate equation (1) using a fixed effect (FE) model. To ensure that there is sufficient variation in the explanatory variables, only individuals with 3 or more observations are included in my sample for this part of the analysis¹⁵. Results are shown in the second and fifth columns of Table 4.4. For both age groups, the

¹² Standard errors in all OLS and FE models have been corrected by the White (1980) procedure.

¹³ This is the average percent increase of all 19 provincial minimum wage changes weighted by the number of 'at risk' teens in each change.

¹⁴ The weighted average percent increase in the minimum wage for young adults is 7.7%. Although both teens and young adults are affected by the same minimum wage changes, the weighted average percent increase is different for each age group. This is because the number of 'at risk' teens is different from the number of 'at risk' young adults.

¹⁵ As a result, 1605 observations are dropped from the original sample.

FE estimates are still negative and statistically significant, but their magnitude is slightly less than the OLS estimates. Although the differences are not substantial, there is indeed some indication that the unobserved heterogeneity across individuals is correlated with inclusion in the 'at risk' set¹⁶. The orthogonality of the unobserved heterogeneity and the regressors can be formally tested by the Hausman specification test. The random effect estimates for comparison to the fixed effect estimates are reported in columns 3 and 6. At 5 percent confidence level, the test¹⁷ rejects the hypothesis of no correlation between the individual effects and other regressors for both age groups.

Another point worth mentioning is that the minimum wage effect is always greater for young adults' employment than for teens. This may be due to the fact that current wage rate is a noisy measure of an individual's productivity, especially for teens. Some good quality teenage workers may be 'trapped' in minimum wage jobs because that is where most employment opportunities are (e.g., in the fast food industry). The current wage rates of these teens do not necessarily reflect their potential productivity. On the other hand, given that the average young adult wage is much higher than the teenage average, young adults in the 'at risk' group are more likely to have really poor labour market prospects. Therefore, they may be more 'vulnerable' to the impact of minimum wage¹⁸.

¹⁶ The less negative coefficient in FE estimation may also be measurement error which biases the coefficients towards zero. In the LMAS, the wage rate for a particular job is measured annually. Therefore, measurement error may exist in quarterly observations, especially in defining the 'at risk' group.

¹⁷ The Hausman test statistics, distributed $\chi^2(24)$, are 622 for teens and 128 for young adults. Both are greater than critical value at 5%.

¹⁸ In fact, I have replicated the analysis on adults between the ages of 25 and 34. In this case, the effect of minimum wage on the 'at risk' group is slightly greater than for young adults (age 20-24). The minimum wage effect on re-employment probability ranges from 10 to 12 percent. This further confirms the idea that an individual considered 'at risk' in a group with a higher average wage is more likely to be a lower 'quality' worker.

Based on the results in Table 4.4, the conclusion is that the minimum wage has a significant negative effect on the employment probability of the 'at risk' group. After controlling for the unobserved heterogeneity across individuals, 'at risk' teens are 6 percent less likely to be employed after a 8.4 percent increase in minimum wage. The impact on young adults employment is even larger at more than 10 percent¹⁹. These results are consistent with other U.S. panel studies, such as Currie and Fallick (1996). Using a similar specification²⁰, they find that 'at risk' teenagers are 3 percent less likely to be employed as a result of a 7 percent²¹ increase in the U.S. federal minimum wage in 1980 and 1981. Canada would appear to share a comparable experience to the U.S.

More generally, we must be careful comparing this set of results with other minimum wage studies. First, I am focusing on the disemployment effect on the 'at risk' workers who represent a very small portion of the entire youth population. In my sample, 9.5 percent of the teens and 2.4 percent of the young adults are considered 'at risk'. Therefore, even though an increase in the minimum wage has a negative and significant impact on 'at risk' employment, it is very unlikely to lead to a reduction in overall youth employment. Second, the estimated minimum wage effect only refers to the transition from employment to non-employment. Ideally, I should also look at the transition from

¹⁹ See footnote 14.

²⁰ Instead of the dummy variable 'At Risk', they use a continuous variable WageGap to control for the effect of minimum wage. WageGap_{it} is defined as the difference between the minimum wage at t and the wage rate of individual i at $t-1$ if he is considered as 'at risk' in the minimum wage change at t . $\text{WageGap}_{it} = 0$ otherwise. Conceptually, WageGap_{it} is just a refinement of AtRisk_{it} . WageGap_{it} further distinguishes the 'at risk' individuals based on the difference between their current wages and the minimum. I have also replicated the empirical analysis using WageGap. The results (not reported) are robust to this change in specification. The coefficients on WageGap are all significant and negative. For teens, the estimates imply that on average the 'at risk' group is 4 to 5 percent less likely to be employed in the following year if there is a minimum wage increase. The implied effect on young adults is larger at -9 to -11 percent.

²¹ Currie and Fallick do not report the average percent increase in minimum wage explicitly equal to 7%. From Table 4.1 in their paper, I calculate the average percent increase in the minimum in 1980 and 1981 weighted by the number of 'bound' individuals in each change.

non-employment to employment in order to obtain a complete picture of the minimum wage effect on employment probability. However, I cannot use current wage rates to identify the non-employed as ‘at risk’.

4.3.2 A Refinement of the Control Group - Only “Low Wage” Individuals

As noted above, most criticism of the ‘traditional’ panel model focuses on the definition of the control group. Since the control group in the previous section is dominated by the high wage individuals outside the ‘at risk’ range [MinW_{t-1} , MinW_t], the coefficient on $\text{AtRisk}_{it}^{j,i}$ not only captures the effect of minimum wages on the re-employment probability, but also any differences in employment stability between low wage and high wage individuals. If high wage workers always have higher employment rates than low wage workers, the estimates of the minimum wage effect in the previous section may be biased away from zero. One way to address this problem is to exploit the panel nature of the data and estimate a FE model, as reported in the previous section. Yet, assuming the individual effects for youth are fixed over time is subject to question. In commenting on Currie and Fallick (1996)²², Card and Krueger (1995a, p. 228) argue:

... there is little reason to believe that, for the NLSY sample, the unobserved individual effects that are correlated with base-year pay are fixed, or even approximately fixed, over time. ... In such a sample, one would expect productivity, wages, and employment rates to evolve rapidly over time, as workers move in and out of school and shop among jobs.

²² In addition to the basic FE model, they include a dummy variable for workers with wage rates no more than 15 cents above the minimum. Also, they decompose the control into 3 different groups. Their results indicate a negative minimum wage effect even after employed these different treatments for the unobserved heterogeneity.

An alternative solution to this heterogeneity problem is to obtain a better control group. That is replacing the high wage workers with a group of workers with wage rates comparable to the 'at risk' individuals but who are not affected by the increase in the minimum wage. The comparison group in the analysis of the previous section consists of two different types of people: those outside the 'at risk' range [MinW_{t-1} , MinW_t] in the province with an increase in the minimum, and all workers in other provinces with no minimum wage change. In this section, I focus on the 'low wage' individuals from the latter group since they are potentially a good control for the 'at risk' individuals. They have similar wages to the 'at risk' workers and therefore are more likely to have similar employment stability.

There are at least three ways to define a control group of low wage workers in a province where there is no change in the minimum wage. First, we could consider a worker as low wage if his wage rate is within a certain fixed dollar interval above the existing minimum in his province. A second definition would be to replace the fixed dollar interval by a fixed percentage interval. By these two definitions, the wage interval is insensitive to the minimum wage changes in other provinces. Therefore, instead of imposing a time invariant margin, a changing interval could be used. It could be equal to the maximum/minimum percentage or dollar change in the minimum wage observed concurrently in other provinces²³. In the following analysis, I simply choose a fixed dollar interval of 25 cents since two thirds²⁴ of the increases in the minimum wages observed in

²³ Mathematically, three low wage control definitions are: (i) $\text{MinW}_{t-1} + \text{a fixed amount}$, (ii) $\text{MinW}_{t-1} \times (1 + \text{a fixed \% change})$, and (iii) $\text{MinW}_{t-1} + \text{maximum/minimum dollar change of the minimum in other provinces}$ or $\text{MinW}_{t-1} \times (1 + \text{maximum/minimum \% change of the minimum})$.

²⁴ 12 of 19 provincial minimum wage changes are exactly \$0.25.

the sample period are exactly this amount²⁵. Formally, individuals in province j are considered as a low wage control, i.e., $\text{AtRisk}_{i,t}^j = 0$, if their wages are between MinW_{t-1}^j and $\text{MinW}_{t-1}^j + 0.25$ when the minimum wage of province j remains unchanged at time t . It is important to note that more than 93 percent of the control group used in the previous section is excluded by this definition²⁶. A detailed decomposition of the entire sample is presented in Figure 4.3.

Equation (1) is re-estimated using this alternative methodology. The results are presented in Table 4.5. Again, I begin with a linear probability model estimated by OLS. For teens, the estimate of the minimum wage effect is negative, but virtually zero. As well, the standard error is much greater than the estimate. For young adults, the estimate is negative with greater precision and magnitude, but still is not significant even at 10 percent confidence level. Therefore, the OLS evidence would seem to confirm the criticism of previous U.S. panel studies. Once the comparison group is restricted to low wage individuals, there is no minimum wage effect on youth employment, even for those 'at risk'.

The purpose of focusing on low wage workers is to eliminate the unobserved heterogeneity among workers. The treatment and the control groups are supposed to have comparable employment experience *ex ante*. Therefore, we would expect the results from a FE model to be very similar to the OLS. Surprisingly however, the FE model provides a very different picture. The results are reported in the second and fifth columns of Table 4.5. Here the estimated parameters on $\text{AtRisk}_{i,t}^j$ are negative and statistically significant for both age groups.

²⁵ I have replicated the analysis with all 3 measures. The results (not reported) are similar to those reported in Table 4.5.

²⁶ As shown in Figure 4.3, 60296 are excluded from the control.

Unless there is a strong reason to believe that individual fixed effects are correlated with changes in the provincial minimum wage, the difference between the OLS and FE estimates cannot be solely explained by unobserved heterogeneity among workers. Another possible explanation is sample selection. In order to ensure sufficient variation in the explanatory variables, FE estimations typically exclude some of the observations from the original OLS sample. For example, individuals with only one observation in an unbalanced panel have to be dropped. If the excluded individuals are systematically different from those in the FE sample, the difference between the OLS and FE estimates does not necessarily reflect the individual effects, but the sample selection. In my FE sample, only individuals with three or more observations are included. As a result, 40 percent²⁷ of the OLS sample is excluded. In order to identify the effects of this sample selection, I present OLS estimates using the FE sample. The results for both age groups, reported in columns 3 and 6, are very similar to the FE estimates: The estimated minimum wage effects are negative and statistically significant. Thus the difference between the FE estimates and the OLS estimates in columns 1 and 4 is due to sample selection rather than heterogeneity. This further supports the argument that low wage workers from provinces with no minimum wage change provide a good control for the ‘at risk’ individuals. Because the variation in the minimum wage in the sample is geographical, it would be surprising if it was correlated with individual effects.

The estimates from the different sub-groups of the low wage sample indicate that the minimum wage has a significant effect on individuals with three or more low wage employments (FE sample), but not on the complementary group. This implies that the worker’s wage is not a sufficient statistic to identify those who are directly affected by the

²⁷ 40.4% of the teens and 39% of the young adults sample are excluded.

minimum wage. These groups of low wage individuals differ in two main areas. First, individuals excluded from the FE sample have a shorter average employment history. Including all low and high wage employments, they are employed for only 5.7 quarters throughout the three year sample period, while the mean in the FE sample is 8.1 quarters. Second, they appear to be transitory low wage workers. Only one in three of their employments is considered low wage²⁸. I next re-examine these excluded individuals to discover how the minimum wage effect is correlated with the number of total employment periods and the percentage of low wage employment. They may be sub-divided into the following two groups:

i) individuals with low wage employments < 3 and total employments < 3

One reason workers will have fewer than three periods of low wage employment is that they are employed in only one or two quarters throughout the entire sample period. A prominent feature of this group is that they have an extremely high job separation rate. On average, given that they are employed in the present period, the probability of being nonemployed in the next period is 70 percent. Considering that my sample only consists of young people between the ages of 16 and 24, there are at least two hypotheses to account for short employment histories combined with high separation rates. One is that this group is comprised of low wage workers with extremely poor labour market prospects. Alternatively, this group could be full time students who only work in low paid jobs during the summer. One way to distinguish these two hypotheses is by looking at the distribution of their employment periods. We would expect the employment of those in the former category to be evenly distributed throughout the sample period, and a strong seasonal

²⁸ Low wage employments include both 'at risk' and low wage control group.

pattern for the latter. As shown in Figure 4.4, three large spikes occur in the third quarter of each year. This supports the hypothesis that this group of low wage individuals with extremely short employment histories is dominated by summer job workers. Therefore, an increase in the minimum wage is likely to have little impact on their voluntary summer job separations.

ii) individuals with low wage employments < 3 but total employments ≥ 3

As shown in Figure 4.3, most of the individuals excluded from the FE sample have at least three periods of employment, but only one or two of them are considered as low wage. The distribution of the percentage of low wage employment for these workers is presented in Figure 4.5. On average, only 1 in 5 of their employment periods is defined as low wage. In contrast, individuals in the FE sample have 3 in 5 of their employment periods defined as low wage. Intuitively, the probability of individuals being ‘real’ low wage workers should be positively correlated with their percentage of low wage employment. If only 1 in 10 of an individual’s employment periods is low wage, it is unlikely that he is a ‘real low wage worker’. Instead he is likely a high wage worker who works temporarily in some low paid jobs. This suggests that the current wage rate may provide a noisy measure of an individual’s permanent marginal product. For example, an individual may be in the low wage group transitorily because of a negative shock to his wage. In addition, a transitory period of low wage employment at the early stage of an individual’s employment history may be due to summer jobs. Approximately 50 percent of the low wage employments for this group are in the first two periods of the workers’ employment history. As well as having a lower percentage of low wage employment, these workers are also 5 percent less likely to be employed in below minimum wage jobs. Finally, their average earnings in

high wage employments are \$0.5 higher than in the FE sample. All these observations suggest that the minimum wage might have a smaller impact on this group of effectively 'high wage' individuals.

In summary, this seemingly homogeneous group of low wage workers can be divided into 'transitory' (excluded sample) and 'permanent' (FE sample) low wage workers. An increase in the minimum wage displays opposite effects on these two groups. It has significant impact on the 'permanent' low wage workers employment, but is trivial on the 'transitory' individuals. These different results across the groups highlight the importance of carefully defining the target group in a minimum wage study. Most previous studies use current wage rates to identify low wage workers as those who are the most likely affected by the change in minimum wage policy. The preceding analysis indicates that relying on current wage rates to make the identification may be insufficient. For individuals who have extremely limited low wage employment histories, current wages may underestimate their marginal products. A close examination of the 'transitory' low wage workers in my sample reveals that they are mainly students working in low paid jobs during the summer, or 'high wage' workers temporarily trapped in low wage positions. In terms of the target group in a supply-and-demand framework, they are less likely to be affected by the minimum wage.

4.4 Conclusion

Previous U.S. panel estimates of minimum wage effects have been criticized on the grounds that they are based on comparisons between low wage and high wage workers. As a result, the estimated disemployment effect may be driven by the difference in

employment stability between the two groups. Using Canadian panel data for the period 1988 to 1990, I find some empirical support for this criticism. When high wage workers are included in the control group, changes in the minimum wage has a strong negative impact on low wage employment. This result is consistent with other U.S. panel studies of minimum wage. However, the estimated minimum wage effect becomes insignificant once the control group is limited to low wage workers in provinces with no minimum wage change.

A closer examination of the low wage workers in my sample reveals considerable heterogeneity within this group of individuals. For 'transitory' low wage workers, who have less than 3 quarters of low wage employment throughout the sample period, the effects of the minimum wage are virtually zero. There is a significant disemployment effect, however, for the complementary group. For workers with more than 3 quarters of low wage employment, a minimum wage increase of 8.4 percent leads to a 7 percent decrease in teens' employment. The effect on young adults is even greater at 10 percent.

From a public policy perspective, these results suggest that an increase in the minimum wage is very unlikely to lead to a reduction in overall youth employment level, even for the 'transitory' low wage workers. Yet, it has a significantly negative impact on workers with poor economic prospects. A tradeoff exists between wage level and employment for those who are the primary focus of the minimum wage policy. In other words, when both the treatment and the control groups are defined appropriately, the standard 'textbook prediction' of a negative employment effect can still be retrieved

Table 4.1
Summary Statistics for the Pooled Cross Sections
1988 - 1990

	Teens	Young Adults
No. of Observations	28849	42153
No. of Individuals	4379	5000
Male Ratio (%)	52.27	50.14
Marriage Rate in 1990 (%)	6.86	47.71
Education in 1990 (%)		
0 - 8 Yrs of Education	2.57	6.42
Some Secondary Education	49.14	15.60
Graduated from High School	21.43	30.28
Some Post-Secondary	19.14	19.27
Post-Secondary Diploma	4.29	11.01
University Degree	0.29	10.99
Trade Certificate or Diploma	3.14	7.34
Province (%)		
Newfoundland	6.04	5.65
P.E.I.	2.66	3.10
Nova Scotia	5.90	7.34
New Brunswick	8.73	8.21
Quebec	13.43	16.91
Ontario	22.44	21.50
Manitoba	7.65	7.07
Saskatchewan	8.95	8.39
Alberta	14.02	13.47
British Columbia	10.19	8.38
Avg. Total Employment Periods	6.59	8.44
Avg. Wage (\$)	6.78	9.22

Notes: Data are from the LMAS 1988 - 1990 Job File. Teens are defined as individuals aged 16 - 19 in 1988. Young adults are individuals aged 20 - 24 in 1988

Table 4.2
Percentage of Individuals "At Risk" by Province

	1988				1989				1990			
	1st Qrt	2nd Qrt	3rd Qrt	4th Qrt	1st Qrt	2nd Qrt	3rd Qrt	4th Qrt	1st Qrt	2nd Qrt	3rd Qrt	4th Qrt
Newfoundland	T	4.00										
	Y	0.65										
P.E.I.	T				10.53	3.85						
	Y				2.86	4.49						
Nova Scotia	T						17.95					
	Y						7.72					
New Brunswick	T					10.34			9.52			
	Y					2.87			2.17			
Quebec	T				12.97				7.33			
	Y				1.98				2.33			
Ontario	T						9.57		4.93			
	Y						1.92		1.84			
Manitoba	T											
	Y											
Saskatchewan	T									13.55		
	Y									2.13		
Alberta	T								13.03			
	Y								1.62			
British Columbia	T					17.55				6.71		
	Y					2.91				3.19		

Notes: Data are from the LMAS 1988 - 1990 Job File. An individual is defined 'at risk' if there is minimum wage increase at t and his wage rate is between the old and the new minimum wage. T = teens and Y = young adults

Table 4.3
Description of Control Variables, $X_{i,t}$

Variable	Definition	Group	Source
MAR	= 1 if married, 0 otherwise	I _{i,t}	LMAS
SEX	= 1 for male, 0 for female	I _{i,t}	LMAS
SEC ¹	= 1 some secondary education, 0 otherwise	I _{i,t}	LMAS
HIGH	= 1 graduated from high school, 0 otherwise	I _{i,t}	LMAS
PSE	= 1 some post secondary education, 0 otherwise	I _{i,t}	LMAS
DIP	= 1 post secondary diploma, 0 otherwise	I _{i,t}	LMAS
DEG	= 1 university degree, 0 otherwise	I _{i,t}	LMAS
TRD	= 1 Trade Certificate or Diploma, 0 otherwise	I _{i,t}	LMAS
UNEMPGP	Difference between Provincial Unemployment Rates for Males (25 - 54) at period t-1 and t	V _{j,t}	CANSIM
RGDP	(Provincial GDP at market price) / (Provincial CPI) ²	V _{j,t}	CANSIM
NF	= 1 if individual living in Newfoundland, 0 otherwise	D _p ³	N/A
PEI	= 1 if individual living in Prince Edward Island, 0 otherwise	D _p	N/A
NS	= 1 if individual living in Nova Scotia, 0 otherwise	D _p	N/A
NB	= 1 if individual living in New Brunswick, 0 otherwise	D _p	N/A
MAN	= 1 if individual living in Manitoba, 0 otherwise	D _p	N/A
ALB	= 1 if individual living in Alberta, 0 otherwise	D _p	N/A
BC	= 1 if individual living in British Columbia, 0 otherwise	D _p	N/A
QUE	= 1 if individual living in Quebec, 0 otherwise	D _p	N/A
SAS	= 1 if individual living in Saskatchewan, 0 otherwise	D _p	N/A

Notes. (1) Base Group has 0-8 years of education (2) Base year = 1986 (3) Ontario is used as the reference group

Table 4.4
Estimates of the Effects of Minimum Wages
on the Employment Continuation Probability for the "At Risk" Group
All Employed Individuals
(standard errors in parentheses)

Variable	Teens: Ages 16 - 19			Young Adults: Ages 20 - 24		
	OLS	Fixed Effects	Random Effects	OLS	Fixed Effects	Random Effects
AtRisk	-0.0688 (0.020)	-0.0634 (0.020)	-0.0638 (0.016)	-0.1479 (0.033)	-0.1031 (0.031)	-0.1204 (0.023)
Sex	-0.0117 (0.005)		-0.0218 (0.006)	0.0091 (0.003)		0.0031 (0.005)
Mar	0.0094 (0.009)	0.0052 (0.018)	0.0100 (0.011)	0.0126 (0.003)	-0.0050 (0.008)	0.0124 (0.004)
SEC	0.0145 (0.021)	-0.0279 (0.045)	-0.00003 (0.023)	0.0531 (0.014)	0.0215 (0.042)	0.0503 (0.015)
HIGH	0.0320 (0.022)	-0.0512 (0.047)	-0.0019 (0.024)	0.0913 (0.013)	0.0200 (0.043)	0.0804 (0.015)
PSE	-0.0261 (0.022)	-0.1102 (0.048)	-0.0663 (0.024)	0.0464 (0.014)	-0.0093 (0.045)	0.0306 (0.015)
DIP	0.0472 (0.023)	-0.0165 (0.054)	0.0055 (0.027)	0.1077 (0.014)	0.0704 (0.046)	0.1017 (0.015)
DEG	-0.0718 (0.055)	-0.1384 (0.094)	-0.1035 (0.051)	0.0973 (0.014)	0.1377 (0.051)	0.0978 (0.016)
TRD	0.0480 (0.027)	-0.0046 (0.058)	0.0205 (0.030)	0.1108 (0.015)	0.0445 (0.045)	0.0990 (0.017)
UnempGp	-0.0074 (0.002)	-0.0049 (0.002)	-0.0070 (0.002)	-0.0081 (0.002)	-0.0060 (0.001)	-0.0069 (0.001)
RGDP	-0.0001 (0.0001)	0.00005 (0.0001)	-0.00005 (0.0001)	-0.00003 (0.0001)	0.00003 (0.0001)	-0.000003 (0.0001)
NF	-0.4832 (0.250)	0.1568 (0.274)	-0.2563 (0.230)	-0.1779 (0.177)	0.1164 (0.183)	-0.1193 (0.165)
PEI	-0.3586 (0.257)	0.0822 (0.295)	-0.1889 (0.237)	-0.1359 (0.182)	0.0533 (0.194)	-0.0996 (0.169)
NS	-0.3277 (0.243)	0.0052 (0.263)	-0.1304 (0.224)	-0.0792 (0.172)	0.1745 (0.178)	-0.0243 (0.160)
NB	-0.3571 (0.246)	0.0113 (0.263)	-0.1712 (0.226)	-0.1144 (0.174)	0.0463 (0.181)	-0.0643 (0.162)
Man	-0.2804 (0.237)	-0.1742 (0.281)	-0.1007 (0.218)	-0.0478 (0.168)	0.1067 (0.179)	-0.0059 (0.156)
Alb	-0.2374 (0.192)	0.1097 (0.204)	-0.0842 (0.177)	-0.0488 (0.136)	0.0294 (0.150)	-0.0079 (0.127)
BC	-0.2401 (0.185)	0.0459 (0.196)	-0.0945 (0.170)	-0.0590 (0.131)	0.0570 (0.149)	-0.0178 (0.122)
Que	-0.1500 (0.113)	0.1948 (0.139)	-0.0540 (0.104)	-0.0450 (0.080)	0.1311 (0.095)	-0.0201 (0.074)
Sas	-0.2736 (0.240)	0.1046 (0.250)	-0.0825 (0.220)	-0.0716 (0.170)	0.0186 (0.180)	-0.0205 (0.158)

Notes: Data are from the LMAS 1985 - 1990 Job File. Empirical specification includes the variables reported plus the quarter and year effects. "AtRisk" is a dummy variable that takes the value 1 if the individual is 'at risk', 0 otherwise. All other control variables are defined in Table 4.3. Standard errors in the OLS and FE models are corrected by White (1980) procedure.

Table 4.5
Estimates of the Effects of Minimum Wages
on the Employment Continuation Probability for the "At Risk" Group
Low-wage Individuals
(standard errors in parentheses)

Variable	Teens: Ages 16-19			Young Adults: Ages 20-24		
	OLS All	Fixed N ≥ 3	OLS N ≥ 3	OLS All	Fixed N ≥ 3	OLS N ≥ 3
AtRisk	-0.0007 (0.024)	-0.0987 (0.031)	-0.0729 (0.030)	-0.0528 (0.041)	-0.1122 (0.040)	-0.0966 (0.048)
Sex	0.0018 (0.014)		0.0063 (0.015)	0.0261 (0.023)		0.0368 (0.023)
Mar	-0.0520 (0.034)	-0.0031 (0.093)	-0.0427 (0.037)	-0.0229 (0.025)	-0.0321 (0.097)	0.0120 (0.025)
SEC	0.1248 (0.076)	-0.0709 (0.100)	-0.0388 (0.051)	0.1197 (0.076)	-0.0034 (0.095)	0.1070 (0.089)
HIGH	0.1292 (0.076)	-0.0941 (0.113)	-0.0590 (0.053)	0.2122 (0.071)	-0.0125 (0.059)	0.1359 (0.084)
PSE	0.0744 (0.077)	-0.2014 (0.121)	-0.0885 (0.054)	0.1361 (0.072)	-0.0343 (0.087)	0.0709 (0.086)
DIP	0.0495 (0.087)	-0.3988 (0.151)	-0.1663 (0.076)	0.1228 (0.077)	0.1687 (0.136)	0.0887 (0.089)
DEG	-0.0297 (0.162)	-0.4649 (0.249)	-0.2463 (0.156)	0.2223 (0.078)	0.1576 (0.119)	0.2330 (0.083)
TRD	0.1297 (0.096)	-0.2162 (0.171)	-0.0472 (0.077)	0.2196 (0.086)		0.1420 (0.104)
UnempGp	0.0003 (0.006)	-0.0029 (0.007)	-0.0027 (0.007)	-0.0076 (0.009)	-0.0233 (0.011)	-0.0195 (0.009)
RGDP	-0.0001 (0.0003)	-0.0005 (0.0004)	-0.0003 (0.0004)	-0.00006 (0.001)	0.0008 (0.001)	0.0001 (0.001)
NF	-0.4738 (0.790)	-1.0626 (0.996)	-0.7814 (0.930)	-0.2724 (1.267)	1.9377 (1.220)	0.1382 (1.150)
PEI	-0.3063 (0.811)	-0.8572 (1.102)	-0.7686 (0.956)	-0.2419 (1.301)	-0.0031 (0.185)	0.1819 (1.190)
NS	-0.2668 (0.768)	-0.7259 (1.056)	-0.7392 (0.902)	-0.1361 (1.230)		0.1636 (1.117)
NB	-0.3237 (0.777)	-1.3589 (0.979)	-0.7647 (0.912)	-0.1849 (1.242)		0.2397 (1.128)
Man	-0.2006 (0.750)		-0.6833 (0.879)	-0.1214 (1.200)	0.2564 (0.250)	0.2330 (1.089)
Alb	-0.2347 (0.607)	-0.9697 (0.855)	-0.5842 (0.713)	-0.1051 (0.971)	-0.0394 (0.318)	0.1632 (0.881)
BC	-0.2094 (0.582)		-0.5720 (0.684)	-0.1851 (0.932)	-0.0464 (0.353)	0.1260 (0.849)
Que	-0.1696 (0.355)		-0.3475 (0.416)	-0.0689 (0.570)		0.1036 (0.520)
Sas	-0.2151 (0.757)	-0.9887 (0.979)	-0.6977 (0.889)	-0.1763 (1.211)		0.2034 (1.101)

Notes: See notes in Table 4.4. "AtRisk" is a dummy variable that takes the value 1 if the individual is "at risk"; 0 if the individual is considered as low-wage control. N = Number of low-wage employment periods. All standard errors are corrected by White (1980) procedure.

Figure 4.1 Distribution of Total Employment Periods by Age

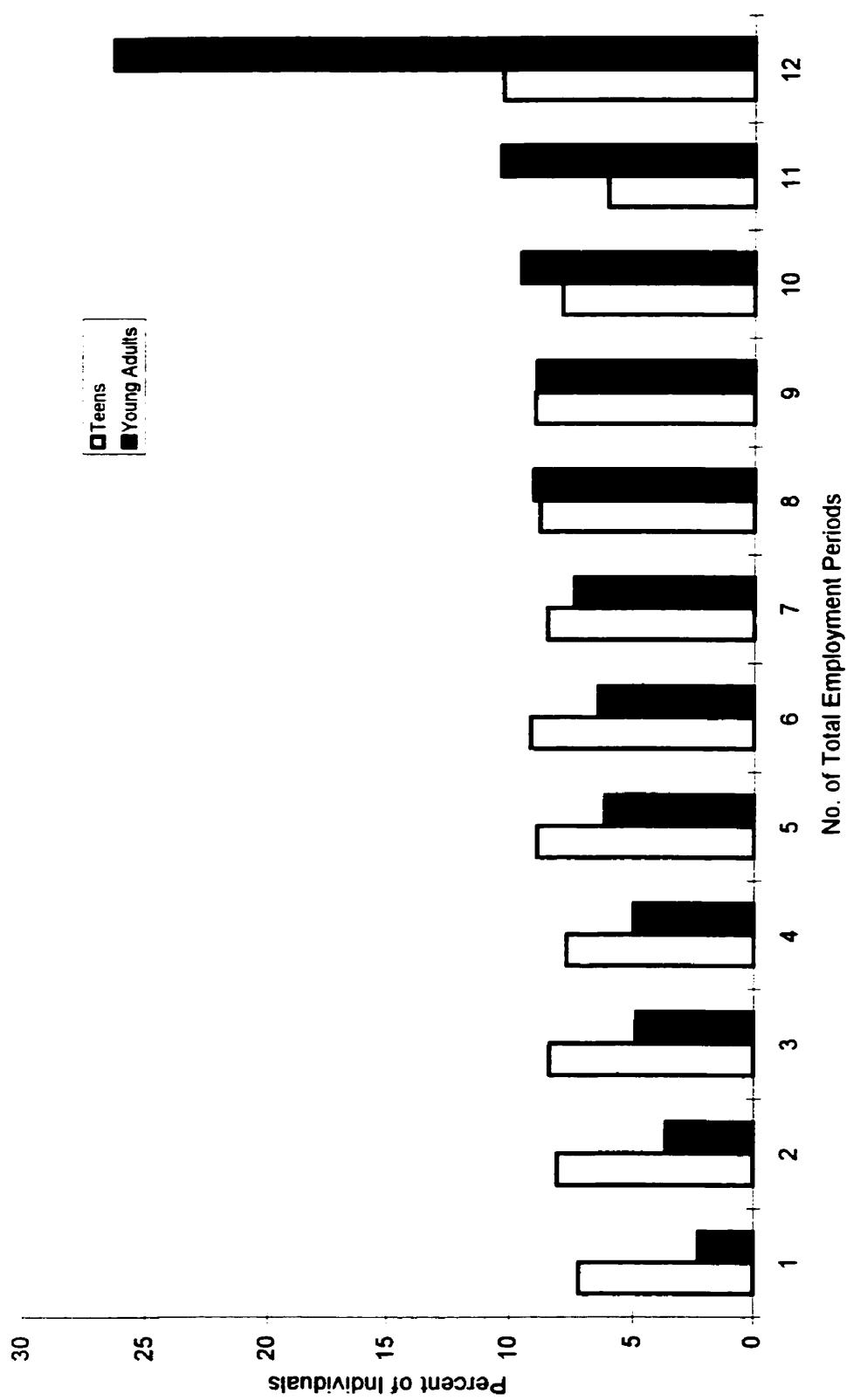


Figure 4.2 Minimum Wages by Province

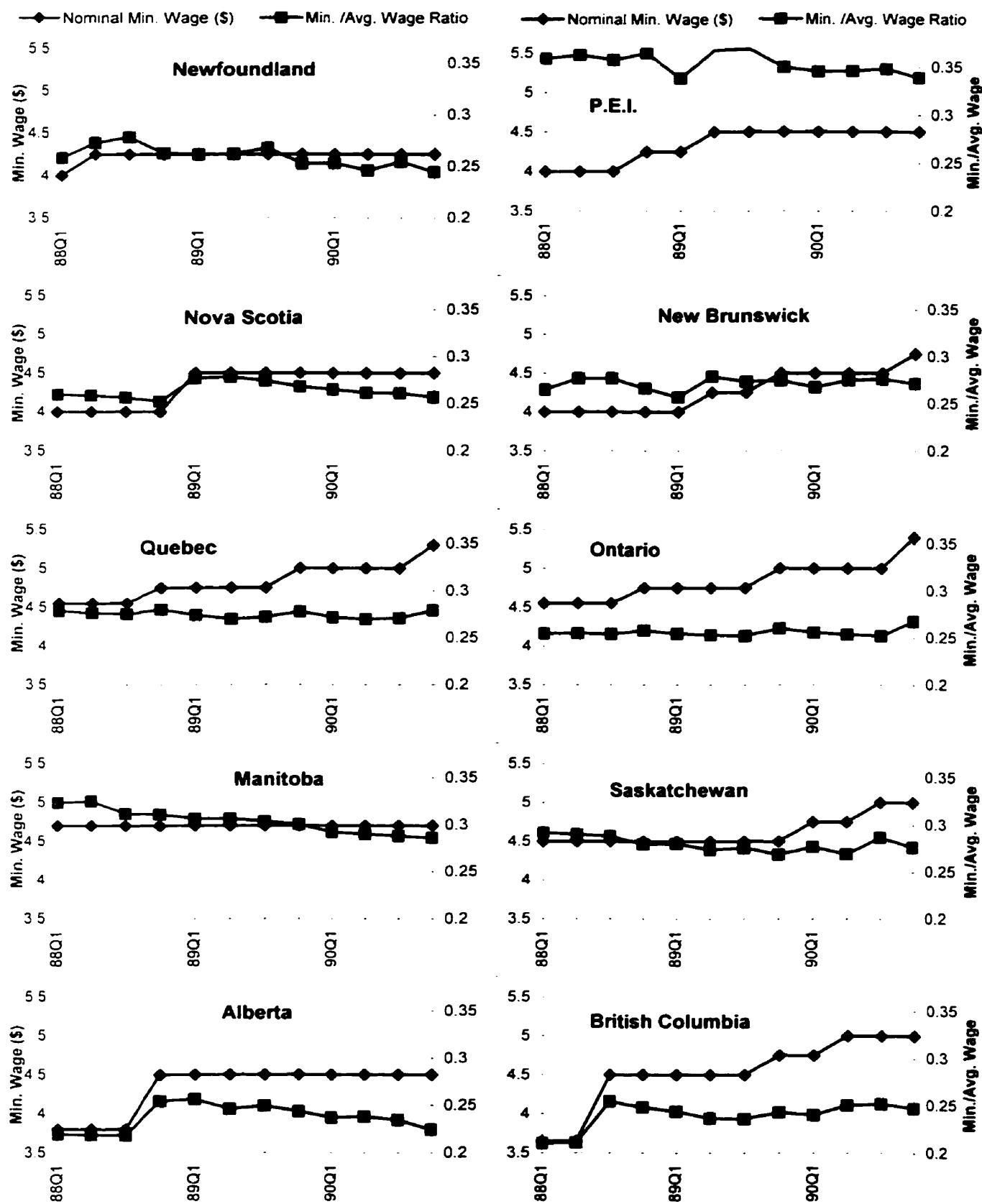
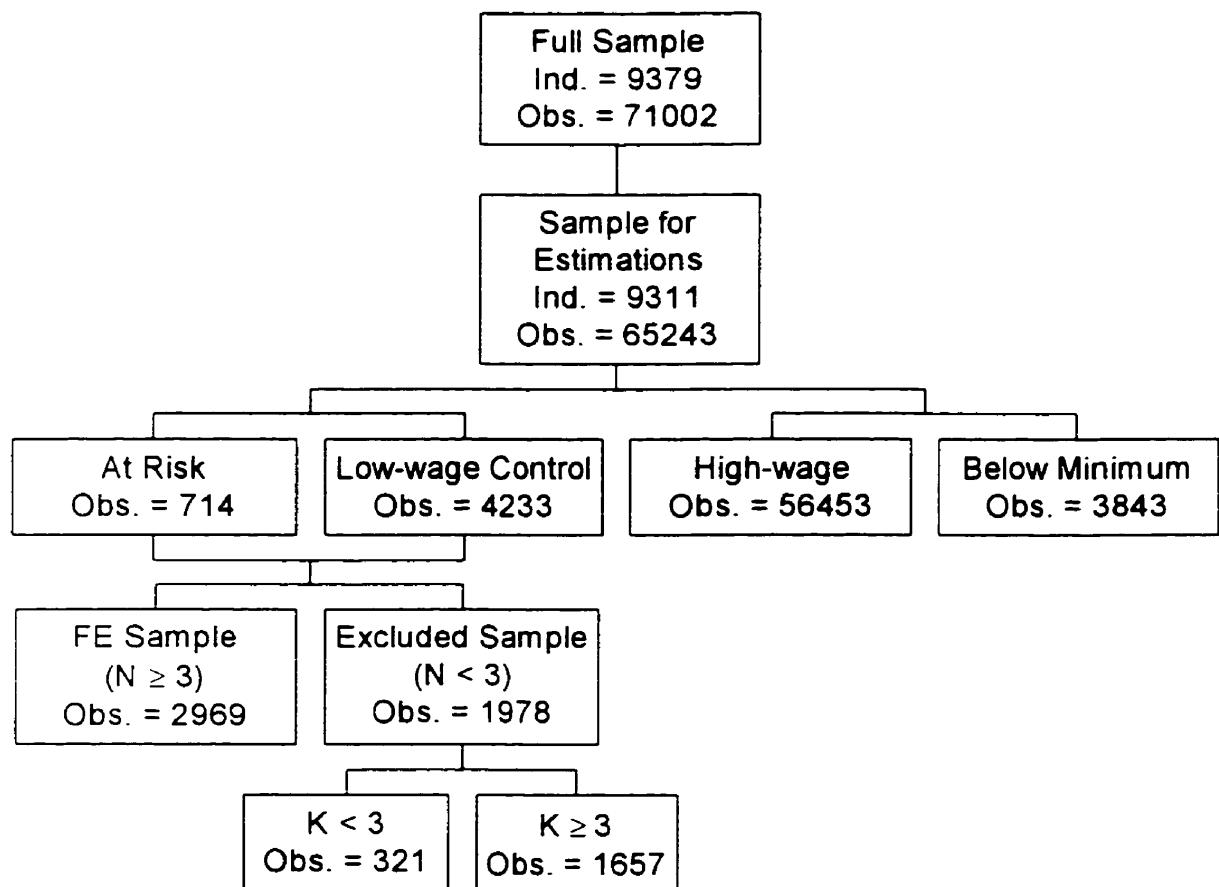


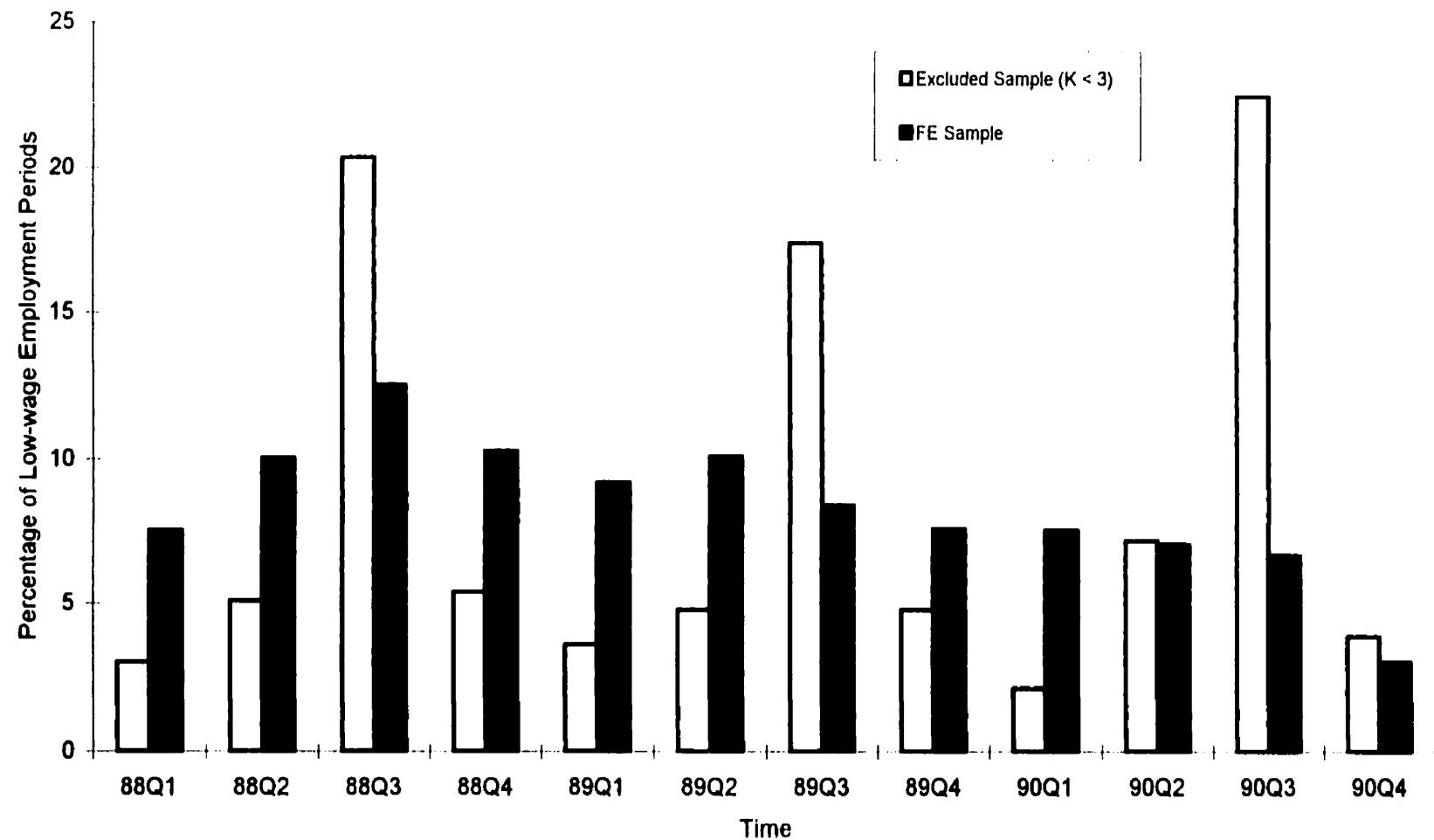
Figure 4.3 Detailed Breakdown of the Sample



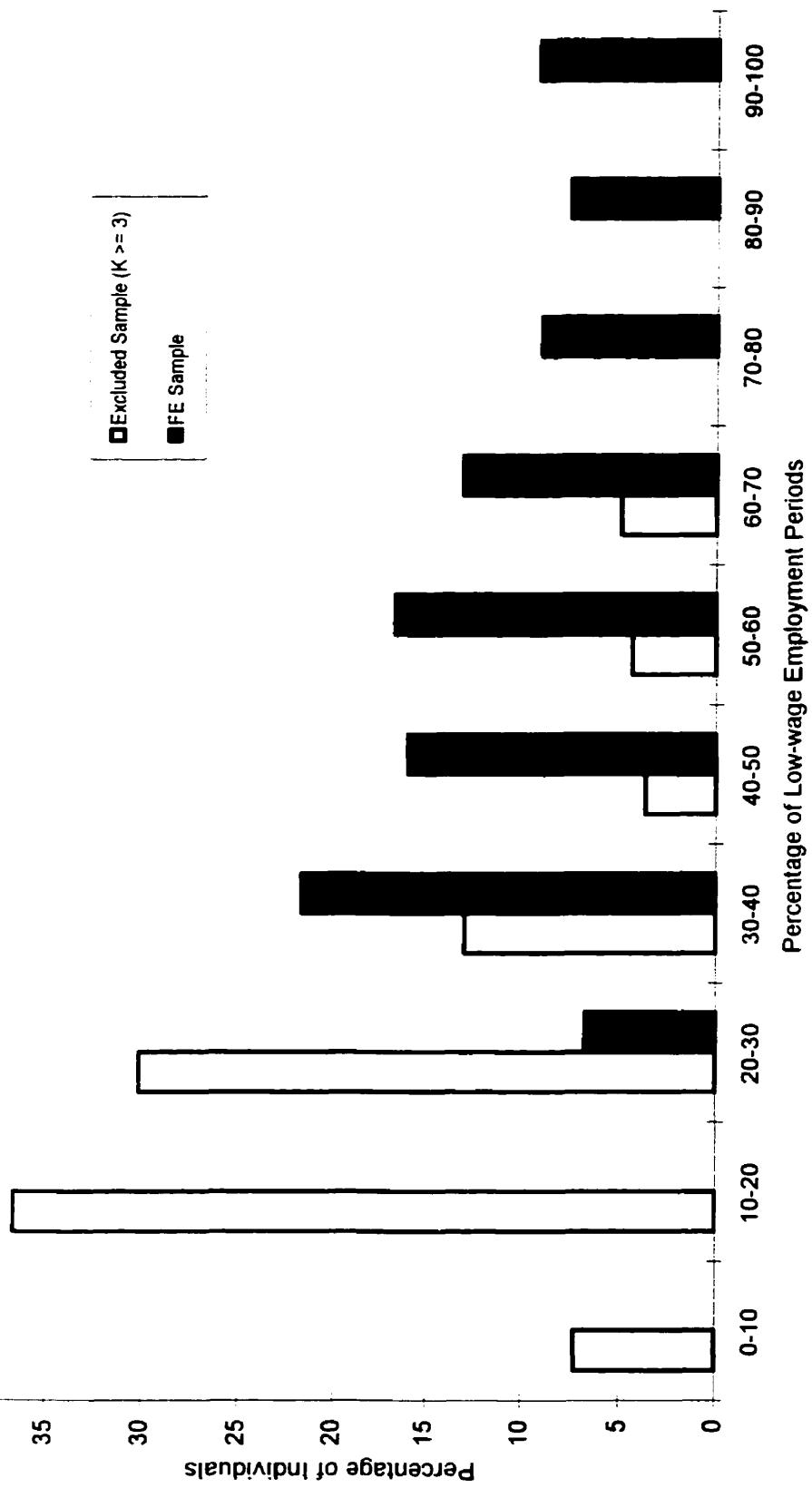
K = Total periods of employment between 1988 - 90

N = Number of low-wage employments between 1988 - 90

Figure 4.4 Distribution of Low-wage Employment Periods across Time



Notes: K = Total periods of employment between 1988 – 90. The samples are defined in the notes to Figure 4.3.

Figure 4.5 Distribution of Percentage of Individuals with Low-wage Employments

Notes: See notes in Figure 4.4.

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