Performance Volatility and Wage Elasticity: An Examination of Listed Chinese A-share Enterprises*

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Abstract

The management of future financial risk on the part of managers and changes in firm finances are two of the fundamental reasons for upward and downward rigidity of wages. The proxy variable for firm financial risk is volatility, the past performance of which is among the principal indicators of wage rigidity. In firms whose current performance is on the upswing, the greater the volatility in past performance, the smaller the elasticity ratio and the more acute the upward rigidity; the more stable past performance, the larger the elasticity ratio and the more acute the upward elasticity. In firms in which current performance is declining, greater past performance volatility leads to a larger elasticity ratio and more acute downward rigidity, whereas more stable such performance leads to a smaller elasticity ratio and more acute downward rigidity.

JEL classification: E24; G32

Keywords: Wage rigidity; Performance volatility; Financial risk

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1. Introduction

Economic theory is often used to explain financial phenomena. We are interested in this study whether certain economic phenomena can be explained by financial theory. We explore the causes of microenterprise-level wage rigidity and attempt to explain it from the financial point of view. Chen, Shen and Zhou (2009) found that wages in non-listed companies exhibit downward rigidity (firm performance in a particular year shows a growth trend, but not wages), and also characteristics of upward rigidity (firm performance declines in a particular year, but wages remain unchanged). We too find that the wages of A-share listed companies in China exhibit both upward and downward rigidity. There is a significant body of research within the economics literature that explores downward wage rigidity,[1] but not from the financial point of view. We have not found any published research that describes or explains upward wage rigidity. One reason may be that the existing research on wage rigidity in the labor economics field concentrates on the individual level. Hence it draws on the incentive point of view to investigate the impact of changes in individual wages on staff effort. This makes it very difficult to observe the impact of wages on an enterprise's cash flow and financial risk. The majority of this research focuses on an interpretation of downward wage rigidity. Our study, in contrast, addresses the enterprise level. It also draws on the cash flow perspective to investigate the impact of changes in wages on future financial risk. We focus on the relationship between changes in performance and wage movements to explain both upward and downward wage rigidity.

Workers' wages involve labor remuneration and incentives and are an important component of production costs. Although executive compensation is also part of an enterprise's expenses, executive compensation primarily manifests itself as incentives. Therefore, the relationship between remuneration changes and performance sensitivity inevitable differs between workers and executives. Normally, the total remuneration of workers is greater than that of senior executives. Changes in workers' remuneration have a bigger impact on cash flows and this may have a significant consequence on

[1] The economics literature provides a multi-dimensional explanation for downward wage rigidity, primarily drawing on the institutional and economic theory perspectives. The former considers that it is due to such institutional factors as government wage regulation, legislative protection, trade unions and collective bargaining, (Franz *et al.*, 2006; Agell and Bennmarker, 2002; Stiglitz, 2000). The economic theory perspective comprises contract theory (Fischer, 1977), implicit contract theory (Baily, 1974), the sabotage model of efficiency wage theory (Shapiro and Stiglitz, 1984), the gift exchange model (Akerlof, 1984), the adverse selection model (Weiss, 1990), the employee turnover model (Stiglitz, 1974), the fair wage-effort hypothesis (Akerlof and Yellen, 1990) and the insider-outsider hypothesis (Lindbeck and Snower, 1988).

future financing or investments, similarly to cash dividends.[2] Current financial research is concerned with cash dividends and stock repurchases, and thus studies of cash expenditures on wages, particularly the reasons for wage rigidity are infrequent. We explain upward and downward wage rigidity from the accounting and financial points of view.

This paper argues that senior managerial attempts to manage future risk are one of the root causes of wage rigidity. Fluctuations in performance, which are considered to be a proxy for corporate financial risk, are one of its indirect causes. The findings of this study are as follows. Among businesses experiencing improved performance, the probability of future financial risk is greater if their past reported earnings has fluctuated widely. To reduce possible future risk, managers may decide to reduce workers' wages: the greater the fluctuation in performance in previous years, the greater the decline in wages, the smaller the wage elasticity coefficient and the stronger is the upward rigidity. On the other hand, if reported earnings have been more stable in previous years, future financial risks are less likely. In this case, managers may choose to raise employee wages: the more stable the firm's performance, the greater the extent of this wage increase is likely to be, the larger the wage elasticity coefficient and the stronger the upward flexibility. Among businesses experiencing a decline in performance, the probability that managers will reduce wages is greater the more widely that performance has fluctuated in previous years. In addition, the wage elasticity coefficient is greater and the downward flexibility stronger. The more stable business performance has been in previous years, the greater the extent of the increase in wages, the smaller the wage elasticity coefficient and the stronger the downward rigidity.

This paper explains wage rigidity at the enterprise level from the financial point of view. Its main contributions are: (1) to expand the body of research about the effect of a company's finances on changes in employee wages, and (2) to enrich the literature on the impact of performance volatility and the significance of employee wage levels in enterprises from the financial accounting perspective.

The remainder of the paper is organized as follows. Part 2 presents a literature review; Part 3 discusses the institutional context, theoretical analysis and research assumptions; Part 4 covers the samples, variables and variable definitions; Part 5 presents the descriptive statistical analysis; Part 6 covers the empirical analysis and Part 7 the robustness tests; and, finally, Part 8 discusses the study's findings.

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[2] In terms of large cash outflows, we believe that changes in wage movements are very similar to dividends: first, because they lead to large changes in the amount of corporate cash available, which may affect future investments and financing and second, because dividends also exhibit rigid characteristics. The growth of enterprises with an increase in dividends is greater than that of enterprises with a decrease in dividends, and the extent of a dividend decrease is generally far greater than that of an increase (Skinner and Soltes, 2008). Lintner (1956), Benartzi *et al.* (1997), Howatt *et al.* (2009), Lu and Wang (1999), Li and Song (2007), Skinner and Soltes (2008), and Kormendi and Zarowin (1996) have all investigated changes in dividends. Research in China and other countries has concluded that changes in a company's wages policy signal the market that its level of corporate risk has altered, and performance persistence and volatility can proxy for changes in corporate risk. The findings and methodology of previous research on changes in cash dividends serve as a valuable reference for our study on changes in wages.

2. Literature Review

Drawing on the literature about interpretations of dividend changes, we employ performance volatility as a proxy for future business risk in order to explain the causes of wage rigidity from the financial point of view. This study links together aspects of the literature on wage rigidity, the impact of performance volatility and the significance of wages in enterprises.

2.1. Explanation of Wage Rigidity Provided by Economic Theory

Economic theory argues that wage rigidity differs by firm type. Downward wage rigidity has been explained at the institutional and economic theory levels. The institutional level considers the effects of wage legislation, trade unions and a collective consultation system. If a firm is subject to mandatory wage legislation, strong trade union power and robust collective bargaining mechanisms, then wages will display characteristics of downward rigidity. Only after a negotiated agreement with employees may wages be reduced (Holden, 1994). Economic theory includes contract theory (Fischer, 1977), implicit contract theory (Baily, 1974), the sabotage model of efficiency wage theory (Shapiro and Stiglitz, 1984), the gift exchange model (Akerlof, 1984), the adverse selection model (Weiss, 1990), the employee turnover model (Stiglitz, 1974), the fair wage-effort hypothesis (Akerlof and Yellen, 1990) and the insider-outsider hypothesis (Lindbeck and Snower, 1988).

Neither the institutional nor economic theory literature explains wage rigidity on the basis of an enterprise's financial situation. Nor is financial situation or financial risk management used to explain downward such rigidity. Although we adopt an enterprise-level definition of wage rigidity,[3] we believe that the definition and interpretation of such rigidity stems from the actual business situation of enterprises. Our approach differs from previous economic theory literature because our definition of wage rigidity covers both upward and downward rigidity. This two-pronged approach and our explanation of the two types of wage rigidity from the financial point of view are the main contributions of this study.

2.2. Information Content of Performance Volatility

A company's performance is to a large extent influenced by the risks that result from its operating and financial activities. Performance volatility is attributable to the inherent uncertainty of fluctuations in revenue and operating costs. It also results from the financial costs of the interest on debt financing, changes in workers' wages, and so on. Many studies show that performance volatility conveys information about a company's level of risk to the market (Howatt *et al.*, 2009) and that higher degrees of

[3] The definition of rigidity in economic theory is based on the individual.

volatility have a negative effect on firm value (Allayannis and Weston, 2003; Barnes, 2001). Other studies are concerned about the impact of performance volatility on forecasts of future performance (Minton *et al.*, 1999; Dichev and Tang, 2009; Petrovic *et al.*, 2009; Brennan and Hughes, 1991; Schipper, 1991). Financial analysts and institutional investors are generally reluctant to make predictions about the performance of enterprises with higher levels of volatility because doing so may increase their forecast error and result in negative surprises (Badrinath *et al.*, 1989). Enterprises that exhibit extreme performance volatility may reverse faster (Freeman, Ohlson and Penman, 1982), while high volatility may be due to the inclusion of temporary items, the sustainability of which is unlikely. Performance volatility may also have an impact on a company's future financing costs (Trueman and Titman, 1988), as it signals a higher likelihood of failure.

Another line of research has examined the impact of cash flow volatility on firm performance. For example, Minton and Schrand (1999) reported that cash flow volatility is positively correlated with average levels of capital expenditure, research and advertising costs, and significantly and negatively correlated with the cost of external financing. Allayannis and Weston (2003) reported that cash flow volatility has a significantly negative correlation with firm value. Moreover, the negative impact on firm value from fluctuations in accounting profits is of greater statistical and economic significance. These findings are entrenched in the financial and accounting literature (Petrovic *et al.*, 2009).

As performance volatility conveys information to the market about firm value, future performance and future financing costs, we are interested in determining whether management is aware of the inherent informational value of earnings volatility and quality and that it subsequently takes action to control risks.

3. Institutional Background: Theoretical Analysis and Hypotheses

Since the time of the socialist transformation of production in China in the mid-1950s, the wages in state-owned enterprises have been subject to planned control, with graded salaries being the norm. This has resulted in a fairly low degree of production efficiency in state-owned enterprises. To promote initiative at both the firm and employee levels, the Chinese government began in the 1980s to issue a series of macro-control measures on the distribution of national income, such as linking pay to performance and instituting flexible pay plans, thereby changing the original wage system pattern. After nearly two decades of reform, both urban and rural incomes have increased, and individuals have realized significant improvements in their quality of life. At the same time, however, the income gap has widened over the years (Lin, 2007) and now exceeds reasonable limits (Chen, 2007). To prevent income polarization among employees and to ensure that the principle of equity is met, towards the end of the 1900s the State implemented macro-control measures about wage allocation, including

labor market and wage guidelines and minimum wage regulations. These measures have been primarily administrative in nature and lack rigid enforcement,[4] and no mechanism is yet in place to monitor their implementation or verify their results[5] (Yang, 2008).

To ensure continued improvement in living standards and to overcome defects and irregularities in the wage distribution system within enterprises, the central and local governments now require companies to establish a mechanism for the normal growth of wages of full-time employees. The 52nd administrative paper from the bureau of the People's Government of Shandong Province (2007) states that all enterprises should ensure appropriate growth in wages and that a reasonable reduction in wages is allowed only if there is a decline in profits and a democratic process is followed. The government also regulates the wages of corporate executives, ruling that they cannot claim a wage increase if the average wages of their employees have experienced annual increases. This macro-level wage control may contribute to the downward rigidity of wages.

Labor unions play a key role in the decision-making process of firms in many Western countries with regard to wage changes. By 2000 China promulgated 'the Interim Measures on collective wage negotiations,' and these have had some positive effects (Zhou, 2008; Guan, 2008). Because of status inequality, power imbalance and information asymmetry between employees and employers, employees often do not know how, or dare not negotiate with their employers, thus making the negotiation system meaningless (Zhou, 2008). The government has failed to enforce the wage guidelines it has issued, so that executives usually play the leading role in wage decisions and ultimately they have the freedom to allocate higher wages to themselves[6] (Zeng and Chen, 2006; Li, 2006).

As the agents of shareholders, executive managers will likely consider the company's future financial risk when it deliberates about wage changes. This is due in part to firm value being affected by financial risk (Allayannis and Weston, 2003; Barnes, 2001). Financial risk includes fluctuations in foreign exchange rates, interest rates and product prices. Moreover, because of the imperfection of capital markets, the corporate risks related to agency costs, transaction costs and the costs of external financing are important factors in determining a company's future financial condition. The management of such risks may be one way of improving firm value and benefiting shareholders (Bartram, 2000). In addition, increased volatility in a company's performance in previous years

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[4] The government has both economic and political goals for wage and employment regulations. However, it retains stricter control over the number of employees than their wages, which may ultimately lead to excess employment in state-owned enterprises (Zeng and Chen, 2006).

[5] Dong Keyong, director of the School of Public Administration at China Renmin University, holds the view that wages are like weather forecasts, which work as reference frames. Under market economy conditions, wages, or the price of labor, should be determined on the basis of the supply of labor and the demand of employers. Government wage guidelines work as macro-level guidance and reference, but should not be relied upon to increase wages (Yang, 2008).

[6] For more detailed information, please refer to Li (2006). Managerial compensation and wages are far higher than the average wage level in China Ping An and other listed companies in the insurance and banking industries, a good example of the corporate right to freely allocate higher wages to executives.

adds to the unpredictability of its future performance, thus increasing the possibility of future financial risks. Fixed costs such as wages, dividends, and interest may reduce firm liquidity.

Either explanation increases financial distress, which can propel the company into a vicious circle: if its past performance fluctuated significantly, this indicates the uncertainty of its future performance (cash flows), which might indicate the possibility that its liquidity will be insufficient to meet the aforementioned fixed costs. Hence, we can expect a decline in the company's earning ability or solvency and a negative impact on its future investments (Minton and Schrand, 1999). If there is any doubt about a company's ability to fulfill its payment obligations in full and on time, its transaction costs increase significantly. The costs resulting from financial distress or insufficient liquidity are determined by the degree or likelihood of decreased liquidity (Bartram, 2000).

The fluctuation of firm performance may be the best signal of firm risk (Howatt *et al.*, 2009). Research has shown that the more volatile its previous performance, the harder it is to predict its future performance accurately (Minton *et al.*, 2002), the quicker the change in its mean reversal (Freeman, Ohlson and Penman, 1982), and the more likely its expected earnings will be negative (Badrinath *et al.*, 1989). These factors may be accompanied by an increase in future financing costs (Minton and Schrand, 1999) and the possibility of financial distress. By observing fluctuations in performance, management may be able to measure the direct or indirect costs arising from financial distress or poor liquidity. These costs include the visible costs related to clients, suppliers, employees and creditors, as well as such recessive costs as direct contract costs and the indirect costs resulting from the transfer of employees and executives to competitors in response to financial distress (Bartram, 2000). Executives may seek to pre-empt these potential risks by engaging in risk management promptly. Although risk management cannot lower the direct and indirect costs of financial distress, it can reduce the likelihood of that distress and of liquidity shortfalls (Bartram, 2000).

Increasing the firm's cash reserves is an important objective of executive risk management. Firms require significant reserves of cash for such outlays as loan interest, cash dividends and wages. The interest on loans affords little flexibility, and cash dividends are decided by general shareholders meetings. However, the cash paid to employees is under managerial control, particularly in China, where labor unions are weak and collective wage negotiation is merely a formality (Zhou, 2008).

Our goal in this paper is to use the financial perspective to explain why firm wages exhibit rigid characteristics. We are particularly interested in the following questions. Why do the wages in certain firms decline instead of increasing and why do they exhibit upward rigidity rather than upward flexibility when annual performance is on the upswing? Why do the wages in some firms increase rather than decline, and exhibit downward rigidity rather than downward flexibility when annual performance is on the decline? One reason for such wage rigidity may be the executive-level management of potential financial risks in the face of performance fluctuation.

How should a firm's past performance fluctuation be viewed when investigating wage rigidity? We agree that prior performance fluctuation contains information about a company's level of risk (Minton *et al.*, 1999; Dichev and Tang, 2009; Petrovic *et al.*, 2009; Brennan and Hughes, 1991; Schipper, 1991). The more volatile a firm's performance has been in the past, the less stable and predictable its future performance is likely to be. Analysts and investors cannot predict future performance on the basis of the company's historical fluctuation or changes in current performance. It is the contention of this paper that to a large extent, the more volatile a company's historical performance, the greater the likelihood that it needs to manage financial risks.

Management needs to consider whether and how to change workers' wages in the face of either an improvement or deterioration in firm performance. Wage changes differ from changes in managerial salaries because they involve significantly larger absolute amounts of money. This in turn may affect future corporate financing, investments and sustainability, as well as future labor costs and productivity of the workforce. Thus, wage decisions involve a trade-off between costs and benefits.

Labor costs and the level of effort expended by the workforce are not affected by fluctuations in performance, but rather performance volatility affects the costs of financial distress. Relative to a stable company, the financial distress costs of a volatile company are larger. These costs include those that arise from managerial risks and from failing to take measures to reduce potential future financial risks. A sense of fairness is deeply rooted in Chinese culture, and workers' perceptions of fairness are an important determinant of the level of effort they exert. The perception of fairness has a positive effect on workers' level of effort and productivity and on corporate profits. If wages are reduced and workers feel unfairly treated, then they are less likely to work hard, which will impact negatively on the corporation. If management ignores this the net effect may be that financial distress costs become much larger than the costs of adjusting the current wage level. Therefore, management is more likely to actively manage risk. The cost of increasing wages (or the benefit of decreasing them) would thus be larger, which reduces the likelihood of increasing wages when the corporation performs better (upward rigidity), but increases the likelihood of doing so when performance declines (downward elasticity). The situation is asymmetrical.

In enterprises in which performance has improved in the current year, but where performance has fluctuated widely in previous years, management is still likely to reduce wages to manage future financial risk. The greater the fluctuation, the greater the likelihood of such a reduction. If the improved performance is expected to last, then the lower the degree of elasticity, the stronger the upward rigidity. If a company's past performance was relatively stable, then the likelihood of future financial risk is low, and management may raise workers' wages to motivate them to work harder.[7] The more stable the company's former performance, the larger the extent of the workers' pay rise

[7] In addition to encouraging workers to work harder, government policy establish a normal wage increase mechanism may be another reason that companies increase wages.

and the stronger the upward wage elasticity.

Based on the foregoing discussion, we propose the following hypothesis.

H1: *In corporations whose performance has improved in the current year, the coefficient of wage elasticity is negatively correlated with former performance volatility.*

In corporations in which performance has deteriorated in the current year, and where the fluctuation in performance in former years has been large, management will tend to reduce workers' wages to manage future financial risk. The greater the fluctuation, the greater the likelihood of such a reduction. If the deterioration in performance does not ease, then the larger the coefficient of wage elasticity, the stronger the downward elasticity.

If a corporation exhibited relatively stable former performance, the low degree of fluctuation would signal to the market that the company has a low likelihood of future financial risk. If the company's performance remains stable, even though it has deteriorated in the current year, management may still raise employees' wages. The more stable the former performance and the larger the extent of improvement in the current year's performance, the smaller the coefficient of wage elasticity and the stronger the downward wage rigidity. This discussion leads us to posit our second hypothesis.

H2: *In corporations whose performance deteriorated in the current year, the coefficient of wage elasticity is positively correlated with former performance volatility.*

4. Sample, Data and Definition of the Variables

4.1. Sample

Our research sample comprises companies listed as A-shares on the Shenzhen and Shanghai Stock Exchanges. Companies included have been listed since 1999, they pay annual wages ranging from 8,000 to 200,000 Yuan, and they have been in continuous existence for at least five years.[8] After eliminating companies in the finance industry and those with missing data, 7,347 observations of 933 companies are detailed in Table 1.

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[8] We required the companies in our sample to have existed for five or more years to ensure that we could compute increased wages and performance. Companies with data missing for a certain year were eliminated. Companies that delisted before 2007 were included, as long as they met the five-year survival requirement, which reduces the problem of survival bias.

Table 1. Sample Distribution

Panel A: Sample Distribution by Length of Existence

Years of continuous existence	*5 years*	*6 years*	*7 years*	*8 years*	*9 years*	*Total*
Number of companies	87	90	117	198	441	993
Number of samples	435	540	819	1584	3969	7347

Panel B: Sample Distribution by Industry and Year

Industry	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*Total*
Agriculture, forestry, livestock farming, fishery	7	9	19	17	19	19	19	19	19	147
Mining	3	6	8	8	9	9	9	6	6	64
Manufacturing	303	423	482	525	565	559	555	540	497	4449
Utilities	19	25	30	34	37	36	36	36	33	286
Construction	8	10	11	11	15	15	15	14	14	113
Transportation	19	28	33	39	44	44	44	43	41	335
IT	22	28	34	41	49	48	48	46	41	357
Wholesale and retail trade	52	62	60	67	66	65	65	65	61	563
Real estate	16	17	26	30	34	32	30	29	28	242
Social services	20	29	29	29	29	29	28	27	25	245
Communication and cultural industry	6	6	7	8	8	8	8	8	7	66
Comprehensive	40	49	58	59	58	58	55	55	48	480
Total	515	692	797	868	933	922	912	888	820	7347

Panel A of Table 1 displays the distribution of the sample companies by their period of existence. Panel B of Table 1 displays the sample distribution by industry and year.

4.2. Data

Our research data were obtained from the WIND and CCER databases. Data on the number of workers at the end of each year from 2002 to 2007 were collected manually from the websites of the Shenzhen and Shanghai Stock Exchanges. Market data for all provinces from 2001 to 2005 were obtained from the 'Market Index of China' (Fan, Wang and Zhu, 2007). The market data for 2006 and 2007 are assumed to be the same as for 2005.

4.3. Definition of the Variables

The names and definitions of the dependent variables, main independent variables and control variables used in this research are displayed in Table 2.

Table 2. Variable Names, Codes and Definitions

Variable Name	*Variable Code*	*Variable Definition*
Average Wage	W_t	Cash paid to and on behalf of employees in T period[9]/number of employees at the end of T period
Growth Rate of Wage	PW_t	(Wages in T period minus wages in T-1 period) x100/wages in T-1 period, $(W_t\text{-}W_{t-1}) \times 100/W_{t-1}$
Growth Rate of Performance	PP_t	(Performance in T period minus performance in T-1 period) x 100/ performance in T-1 period, $(P_t\text{-}P_{t-1}) \times 100/P_{t-1}$,
Wage Elasticity Coefficient	ELA_t	Growth rate of wages in T period/Growth rate of performance in T period, PW_t/PP_t
Standard Deviation of Performance[10]	$VP_{(t-4,\ t-1)}$	Standard deviation of performance from T-4 period to T-1 period
Quality of Profit	QP_{t-1}	Ratio of operating profit contributed to total profit in T-1 period
Continued Performance Improvement Dummy Variable	CI_t	CI is 1 if performance continues to improve from T-4 period to T-1 period, and 0 otherwise
Continued Performance Deterioration Dummy Variable	CD_t	CD is 1 if performance continues to deteriorate from T-4 period to T-1 period, and 0 otherwise
Change in Number of Employees	PNE_t	(Number of employees at the end of T period minus number of employee at the end of T-1 period) x 100/number of employees at the end of T-1 period
Level of Wages	LW_{t-1}	Common logarithm of average wages in T-1 period, LOG10(W)
Leverage	LEV_t	Debt at the end of T period x 100/assets at the end of T period
Size	SIZE	Common logarithm of assets at the end of the year
Investment Expenditure	INV	Ratio of net cash flows from investing activities to total assets
Cash Dividends	DIV	Cash dividends per share
Actual Controller	$STAT_t$	STAT is 1 if company is state-owned, and 0 otherwise
Trading Status	ST_t	ST is 1 if company stock has a special trading status, and 0 otherwise
Market Index	MI_t	From 'Market Index of China' (Fan, Wang and Zhu, 2007)
Consumer Price Index	CPI_t	Consumer Price Index taken from the China Statistical Information website
Unemployment Rate	UEM_t	Unemployment rate in the area in which the company operates, taken from the China Statistical Information website
GDP Growth	GDP_t	GDP growth in the area in which the company operates, taken from the China Statistical Information website
Industry Dummy Variable	IND1-IND11	12 major industry categories based on CSRC industry classification standards

[9] For companies listed on the Chinese mainland, we were able to obtain information on the cash paid to and on behalf of employees from companies' cash flow statements. This index is obviously less exact than the cash paid to employees (Chen, Shen and Zhou, 2009), which is primarily mandatory. Part of the cash paid on behalf of employees is voluntary for the company and accords with its exact operating conditions, a situation that agrees with our research objectives. This index includes the narrow dimension of cash payments such as wages, bonuses and allowances. Wages remain stable, whereas bonus amounts fluctuate and are easily controlled by management.

[10] We use ROA, ROE and OROA to represent performance. Each return index is adjusted by adding the cash paid to and on behalf of employees.

We use per capita cash flow, which includes basic wages, bonuses and allowances, as a substitute for wages. Bonuses may vary depending on current performance, but may not adjust to changes in that performance in a timely fashion, a problem we address in our robustness tests.

We define the *coefficient of wage elasticity* as the ratio of the current year's wage increase rate and current year's performance increase rate (PW/PP). We claim that the wage is flexible if this variable is positive. The larger is this variable, the greater the elasticity of the wage and the greater the positive relativity between wages and performance. The wage is considered rigid if this variable is negative.[11] The smaller is the variable, the more rigid the wage and the larger the negative relativity between wages and performance. Similar to Chen, Shen and Zhou (2009), we differentiate between upward and downward elasticity and upward and downward rigidity.

With reference to the research carried out by Howatt *et al*. (2009), Jayaraman (2008), Dichev *et al*. (2009) and Petrovic *et al*. (2009), we use the standard deviation of the performance in the last three years of period T as our proxy index of performance volatility. If an observation was missing data for the last three years of period T, then it was eliminated from the regression. In addition, to determine the influence of average performance on the coefficient of wage elasticity and to ensure the robustness of our conclusions, we also regressed CV and variance as the proxy variables of performance fluctuation in our robustness tests, in which we also analyzed ROE and different performance indexes, including ROA and OROA.[12] Following Petrovic *et al*. (2009), we also included operating profit in our research, mainly because it does not include non-operating profit, thus helping to alleviate the influence of earnings management on performance fluctuation.

To control the direction of performance fluctuations, we set continued performance improvement and deterioration dummy variables. We then cross-multiplied the continued performance improvement dummy variable (CI) and continued performance deterioration dummy variable (CD) by the continued performance fluctuation variable.

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[11] Refer to the definition of downward rigidity in the labor economics field, which states that workers' wages may increase even when company performance deteriorates. We define upward wage rigidity as a decrease in wages even when company performance improves. According to this definition, if the coefficient of wage elasticity is negative, then wages appear to be rigid; if this coefficient is positive, then wages appear to be elastic.

[12] Although cash can be viewed as a performance index, we focus on accounting performance. Numerous accounting studies have demonstrated that accounting profit is more reflective of companies' true performance, for example Dechow (1994), Dechow, Kothari and Watts (1998), and Ball and Shivakumar (2006). The research carried out by Allayannis and Weston (2003) also showed that companies' cash flow fluctuations had no obvious influence on firm value, whereas fluctuations in accounting profit were remarkably negatively correlated with that value.

We also controlled for earnings quality, initially using the contribution of operating profit to total profit (QP_{t-1}) in period T-1. In the robustness test, we then employed the average proportion of operating profit in total profit for periods T-4 to T-1. We used this index to measure earnings quality because operating profit does not contain such temporal influences as non-operating income/expenses that would reduce the continuity of performance (Dichev *et al.*, 2009).

If the change[13] in the number of workers in the current term (PNEt) and the wage level in the last term (LW_{t-1}) are abnormally high or low, then current wages and current performance may change inversely. Thus we also controlled for this possibility. The existence of wage rigidity may result from companies' self-adjustment according to their financial status and may arise from government intervention in companies' market-oriented decisions. Thus, we controlled for the degree of marketization (MI) in the location in which the company operates. This index reflects the macro-environmental conditions in which companies make their market-oriented decisions, and includes such sub-indexes as the relationship between market and government, and the level of development in the input market. Because financing costs differ by company type (Petrovic *et al.*, 2009), we controlled for such firm-level characteristics as industry, scale and debt ratio. To investigate whether the performance fluctuations of companies in good (non-ST companies) and bad operating conditions (ST companies) have different effects on wage policy, we retained the latter in our sample,[14] but controlled for them by adding an ST dummy variable. As workers' wages constitute a substantial financial outlay for a company, we controlled for other substantial outlays such as capital investments, based on cash dividend research (Kormendi and Zarowin, 1996), to analyze whether the latter influence companies' wage policies. In addition, as the prevailing macro-economic conditions may have a significant influence on firm performance (Klein and Marquardt, 2006) and both labor and firm decisions (Shapiro and Stiglitz, 1984), we also included a macro-economic index, composed of GDP, the unemployment rate, of the district in which a company is located.

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[13] We conducted correlation analysis of the rate of wage change and the rate of change in the number of employees, and found them to be significantly negatively correlated at the 0.01 level. Hence, we controlled for the change in the number of employees when we analyzed the effect of performance volatility on the wage elasticity coefficient.

[14] The asset-liability ratio of individual companies is negative because the sample is partially comprised of ST enterprises.

5. Descriptive Statistics

5.1. Descriptive Statistics of Main Variables

Table 3 provides descriptive information on the sample.

Table 3. Descriptive Statistics[15]

Variables	N	MIN	P5	P25	MEDIAN	P75	P95	MAX	MEAN	V
W	6414	8023	11983	20502	31562	51758	105918	199154	41459	30834
PW	6414	-93.86	-32.98	-2.57	12.83	31.89	91.20	1196.76	21.01	56.99
ROA	6414	-50.55	-4.72	4.61	7.59	11.23	19.01	30.64	7.48	7.76
OROA	6414	-85.18	-4.09	3.82	6.97	10.58	18.20	32.99	7.01	7.09
PROA	6414	-28439.15	-153.25	-22.79	-0.48	23.81	156.47	97368.18	29.07	1740.25
POROA	6414	-22786.47	-153.29	-24.82	-0.49	27.80	192.73	150249.85	49.37	2257.61
ELA_ROA	6414	-28191.45	-6.28	-0.51	0.09	1.02	6.44	1748.66	-4.10	355.20
ELA_OROA	6414	-6678.31	-5.38	-0.47	0.08	0.90	5.94	946.67	-0.46	86.36
VROA	4966	0.00	0.32	0.93	1.81	3.61	10.48	33.67	3.12	3.87
VOROA	4966	0.01	0.33	0.96	1.75	3.28	7.90	31.28	2.65	2.79
QP	6414	-23726.64	23.81	84.03	96.79	100.66	111.82	25974.13	88.28	462.55
PNE	6414	-97.58	-29.6	-5.20	0.32	10.28	61.60	5145.82	11.02	100.46
SIZE	6414	18.61	19.95	20.66	21.18	21.84	22.91	25.96	21.28	0.93
LEV	6414	-30.21	17.66	35.89	48.87	61.33	77.99	354.20	48.74	19.45
UEM	6414	1.30	2.11	3.37	3.95	4.27	4.9	6.50	3.78	0.88
MI	6414	0.33	4	5.52	6.86	8.99	10.06	10.41	7.18	2.01
GDP	6414	8.10	9.6	11.50	12.80	14.50	15.2	23.80	12.83	1.94

Note: W= wages; PW= wage growth; ROA= total return on assets; OROA= operating profit margin of assets; PROA= growth rate of total return on assets; POROA= operating margin growth rate of assets; ELA_ROA= wage elasticity coefficient calculated by performance indicators' ROA; ELA_OROA= wage elasticity coefficient calculated by performance indicators' OROA; VROA= standard deviation of ROA; VOROA= standard deviation of OROA; QP= earnings quality; PNE= the rate of change in the number of employees; SIZE= firm size/logarithm of assets; LEV= firm financial leverage; UEM= unemployment rate in local of operation; MI= market-oriented index; and GDP= GDP growth rate in local of operation.

[15] The total sample is 7,347 firm-years and the sample from 1999 to 2002 is included because of the need to compute the performance variance of the last three years. The sample is 6,414 from 2002 to 2007. The actual sample is 4,966 firm-years in the regression for computing the firm volatility.

Table 3 also provides the distribution of the main variables. The median of wage (W) and wage growth (PW) are significantly lower than the mean, which indicates that the distribution of wages and wage growth is uneven. Although the number of enterprises with high levels of wages or wage growth is small, the wages and wage growth of these few enterprises are relatively large, which is basically consistent with the wage distribution of non-listed companies reported in previous research (Chen, Shen and Zhou, 2009). Performance and performance volatility are distributed more evenly and are similar to the median and mean. The median (QP 96.79) and mean (QP 88.28) of earnings quality are fairly evenly distributed. According to the coefficient of elasticity, the medians of ELA_ROA and ELA_OROA are 0.09 and 0.08, respectively, which indicates that the wage elasticity sample is larger than the wage rigidity sample.

Due to the dependent variable for wage elasticity being calculated from the ratio of the wage growth rate (PW) and the growth rate of the total return on assets (PROA), there are more outliers in the following multiple regression analysis, and thus the Winsorization process is adopted.

5.2. Distribution of Firm Characteristics

Table 4 provides descriptive statistics by year for the sample, which is divided into four categories based on firm characteristics.

Table 4. Distribution of Sample Characteristics by Year[16]

Year	Upward Elasticity		Upward Rigidity		Downward Elasticity		Downward Rigidity		CPI
	N	%	N	%	N	%	N	%	
1999	46	8.93	204	39.61	233	45.24	32	6.21	-1.4
2000	207	29.91	96	13.87	143	20.66	246	35.55	0.4
2001	214	26.85	68	8.53	190	23.84	325	40.78	0.7
2002	303	34.91	89	10.25	187	21.54	289	33.29	-0.8
2003	344	36.87	110	11.79	180	19.29	299	32.05	1.2
2004	352	38.18	99	10.74	176	19.09	295	32.00	3.9
2005	304	33.33	90	9.87	211	23.14	307	33.66	1.8
2006	394	44.37	135	15.20	134	15.09	225	25.34	1.5
2007	449	54.76	100	12.20	74	9.02	197	24.02	4.8

Note: The last column shows the Consumer Price Index (CPI) from 1999 to 2007.

[16] We also describe the sample by industry, areas (market) and property of the firms, but we do not find any obvious rule.

Table 4 shows that between 1999 and 2007, the proportion of the sample exhibiting upward elasticity increased year on year from 8.93% to 54.76% and that the proportion exhibiting downward elasticity decreased from 45.24% to 9.02%. The ratio of upward and downward elasticity samples increased from 54.17% in 1999 to 63.78% in 2007. The proportion of the sample exhibiting downward rigidity over this period increased from 6.21% to 24.02%, whereas the proportion exhibiting upward rigidity declined. From the perspective of wage changes, the number of enterprises that increased wages (exhibiting upward elasticity and downward rigidity) increased year on year, from 15.14% in 1999 to 78.78% in 2007.

5.3. Sub-Portfolio Analysis of Business Performance Improvement and Deterioration

We divided 4,966 observations of the business performance improvement and decline samples into 10 portfolios in accordance with the standard deviation of performance. Table 5 provides the median of wage elasticity, wage characteristics and elasticity coefficient of each portfolio.

Table 5.

Panel A: Distribution of Wage Characteristics of Different Performance Volatility Portfolios of Companies with Improved Performance

Portfolio	Wage Characteristics	Frequency (F)	Median of Wage Elasticity	Ratio: F1/F2
1	Upward elasticity	209	1.02	4.10
	Upward rigidity	51	-0.68	
2	Upward elasticity	206	1.16	3.81
	Upward rigidity	54	-0.66	
3	Upward elasticity	204	1.38	3.64
	Upward rigidity	56	-0.43	
4	Upward elasticity	222	1.17	5.84
	Upward rigidity	38	-0.63	
5	Upward elasticity	228	1.11	7.13
	Upward rigidity	32	-0.84	
6	Upward elasticity	214	1.17	4.65
	Upward rigidity	46	-0.34	
7	Upward elasticity	195	0.99	3.00
	Upward rigidity	65	-0.31	
8	Upward elasticity	193	0.78	2.88
	Upward rigidity	67	-0.17	
9	Upward elasticity	191	0.48	2.77
	Upward rigidity	69	-0.10	
10	Upward elasticity	175	0.32	2.06
	Upward rigidity	85	-0.21	

Note: The fifth column is the ratio of the number of the two types of enterprises.

In Panel A of Table 5, in accordance with the standard deviation of performance, the sample is divided into 10 combinations. The proportion of observations in the first (upward elasticity) and second quadrants (upward rigidity) declines as performance volatility increases. The distribution of the number of enterprises is consistent with our expectations. According to the median of each portfolio's standard deviation of performance, wage elasticity is gradually reduced from 1.02 to 0.32, whereas the standard deviation of performance in the upward elasticity sample increases with volatility. Wage elasticity increases from -0.68 to -0.21, whereas, in line with our expectations, the wage elasticity of the upward rigidity sample increases with volatility.

Table 5.

Panel B: Distribution of Wage Characteristics of Different Performance Volatility Portfolios of Companies with Deteriorating Performance

Portfolio	Wage Characteristics	Frequency (F)	Median of Wage Elasticity	Ratio: F1/F2
1	Downward elasticity	64	0.55	0.37
	Downward rigidity	172	-1.10	
2	Downward elasticity	89	0.52	0.60
	Downward rigidity	148	-0.95	
3	Downward elasticity	92	0.47	0.63
	Downward rigidity	145	-1.04	
4	Downward elasticity	79	0.43	0.50
	Downward rigidity	157	-1.17	
5	Downward elasticity	96	0.52	0.68
	Downward rigidity	141	-0.64	
6	Downward elasticity	83	0.55	0.54
	Downward rigidity	154	-1.23	
7	Downward elasticity	90	0.55	0.62
	Downward rigidity	146	-0.90	
8	Downward elasticity	90	0.35	0.61
	Downward rigidity	147	-0.73	
9	Downward elasticity	85	0.40	0.56
	Downward rigidity	152	-0.57	
10	Downward elasticity	90	0.49	0.62
	Downward rigidity	146	-0.48	

Note: The fifth column is the ratio of the number of two types of enterprises.

Panel B of Table 5 shows that among firms with deteriorating performance, higher levels of performance volatility lead to the ratio of the two types of firms exhibiting a weak increasing trend. The ratio of the smallest volatility portfolio is 0.37 and that of the largest is 0.68, which, to a certain extent, shows that the percentage of firms exhibiting downward elasticity gradually increases with an increase in performance volatility. This outcome is in line with our expectations. The median of wage elasticity for each portfolio as well as the median of downward elasticity for the firms changed little with an increase in performance volatility. However, the median of downward rigidity for the firms increased gradually, from -1.10 to -0.48 with such an increase. This indicates that, contrary to our expectations, performance declined by 1%, the median wage of Portfolio one increased by 1.1% and that of portfolio ten by only 0.48%.

Table 5 indicates that the wage elasticity of the upward elasticity and downward rigidity samples exhibits significantly decreasing or increasing trends with increased performance volatility. Wages in these two types of businesses have increased, which suggests that, relative to their counterparts that have decreased wages, the managers of these firms are more concerned about past performance volatility.

5.4. Time-Series Characteristics of Wage Elasticity

In order to investigate whether wage elasticity is self-relevant, we analyze the time-series characteristics of wage elasticity and examine the following regression model.

$$ELA\_P_t = \alpha + ßELA\_P_{t-1} + \varepsilon.$$

We conduct separate regressions of the two types of wage elasticity coefficients calculated by two types of variables (ROA and OROA) and find no correlation between any of the coefficients in periods t and t+1. The ß in the two regressions are -0.0001 and 0.00001, respectively, which do not pass the statistical significance test and are thus of no economic significance. We therefore infer that there is no continuity of elasticity; rather, managers adjust wages largely based on possible future changes in financial risk.

6. Empirical Tests

6.1. Univariate Tests

To explain why wages exhibit upward and downward rigidity, we carried out mean and median tests of performance volatility and earnings quality respectively, for firms undergoing performance improvement and decline by using wages as a single-factor explanatory variable (see Table 6).

Table 6.

Panel A: Results of Mean and Median Tests of Performance Volatility in Enterprises with Improved Performance

Variables	Character	Sample Number	Mean	T-value	Median	Z-value
VROA	Upward Elasticity	2037	3.23	3.68***	1.80	4.80***
	Upward Rigidity	563	4.38		2.53	
VOROA	Upward Elasticity	2037	2.71	4.08***	1.75	2.61***
	Upward Rigidity	563	3.30		2.17	

Panel A of Table 6 shows that the mean and median of the standard deviation of the return on assets (VROA) are 4.38 and 2.53, respectively, in the upward elasticity sample, which are both higher than those in the upward rigidity sample. After excluding the effects of nonrecurring gains and loss, the standard deviation of the operating return on assets (VOROA) exhibits the same result. Both the mean and median of VOROA in the upward elasticity sample are significantly higher than those in the upward rigidity sample at the 0.01 level.

Table 6.

Panel B: Results of Mean and Median Tests of Performance Volatility in Enterprises with Deteriorating Performance

Variables	Character	Sample Number	Mean	T-value	Median	Z-value
VROA	Downward Elasticity	858	2.81	1.05	1.75	0.79
	Downward Rigidity	1508	2.67		1.69	
VOROA	Downward Elasticity	858	2.47	0.60	1.71	0.42
	Downward Rigidity	1508	2.41		1.68	

In line with our expectations, the mean and median of VROA (VOROA) are 2.67 (2.41) and 1.69 (1.68), respectively, in the downward elasticity sample, which are both lower, but insignificantly so, than those in the downward elasticity sample: 2.81 (2.47) and 1.75 (1.71).

6.2. Multiple Regression Tests

Considering that outliers will affect our research conclusions, we winsorized the top and bottom 1% of the outliers of the wage elasticity coefficient (ELA), performance volatility and earnings quality. To gain a more comprehensive understanding of how the other variables affect the relationship between performance volatility and the ELA, we conducted separate OLS multiple regression tests for H1 and H2 by building the following multiple regression model.

$$\begin{aligned}ELA\_(O)ROA_t = {} & \alpha + ß_1 V(O)ROA_{(t-4,t-1)} + ß_2 QP_{t-1} + ß_3 PNE_t + ß_4 LW_{t-1} + ß_5 V(O)\\ & ROA_{(t-4,\,t-1)} \times LW_{t-1} + ß_6 CD_t + ß_7 CI_t + ß_8 CD_t \times V(O)ROA_{(t-4,t-1)} +\\ & ß_9 CI_t \times V(O)ROA_{(t-4,t-1)} + ß_{10} SIZE_t + ß_{11} LEV_t + ß_{12} INV_t + ß_{13} DIV_t\\ & + ß_{14} STAT + ß_{15} ST + ß_{16} MI + ß_{17} UEM + ß_{18} GDP + ß_{19\text{-}29} IND_{1\text{-}11} +\\ & ß_{30\text{-}34} Y_{2003\text{-}2007} + \varepsilon.\end{aligned}$$

6.2.1. Tests of H1

To test H1, we ran a multiple regression for the samples with an increase in ROA, with the results reported in Table 7.

Table 7.
Panel A: OLS Multiple Regression for Samples with an Increase in ROA

		Regression (1)		Regression (2)	
Variable Name	Variable Code	Coefficient	T-value	Coefficient	T-value
Constant	INT	2.22***	16.51	4.62	1.51
Standard deviation of return on assets	VROA	-0.10***	-4.09	-0.05*	-1.80
Quality of profit	QP			0.003	1.02
Change in number of employees	PNE			-0.003***	-4.08
Wage level	LW			-1.02***	-5.30
Continuing deterioration	CD			-0.49	-0.69
Continuing improvement	CI			-0.78	-1.19
Interactive options	CD × VROA			-0.03	-0.29
Interactive options	CI × VROA			0.20**	1.98
Control variables	Controlled				
N		2600		2600	
$ADJR^2$		0.006		0.033	
F		16.73***		3.97***	

*Note: This regression was run for the samples that had shown an increase in ROA. The dependent variable is the wage elasticity coefficient (ELA_ROA), and the main independent variable (VROA) is the standard deviation of ROA from the t-4 period to the t-1 period. In this model, we controlled for the following variables: QP (the ratio contributed by operating profit to total profit) in the t-1 period, PNE (the change in the number of employees) in the t period, LW (wage level) in the t-1 period, the CD (continuing deterioration) and CI (continuing improvement) dummy variables, and two interactive options (CD×VROA and CI×VROA). Other variables were controlled, including SIZE, LEV (leverage), the STAT dummy variable, the ST dummy variable and a number of macroeconomic variables (market index, unemployment rate, GDP, industry, year, etc.). ***, ** and * indicate that the empirical results are significant at the 0.01, 0.05 and 0.1 levels, respectively.*

Regression (1) in panel A of Table 7 provides evidence to show that without controlling the other variables, VROA and ELA_ROA are significantly negatively correlated at the 0.01 level, which is consistent with our expectations. After controlling the other related variables, the results of regression (2) remain consistent with our expectations, but with higher explanatory power, increasing from 0.006 to 0.035. The significantly negative correlation of VROA and ELA_ROA at the 0.01 level suggests that the higher the volatile performance, the more that wages will be reduced relative to that performance and, as a result, the lower the wage elasticity coefficient. This regression result also indicates that managers carried out corresponding risk management to address the large degree of performance volatility. Although the current performance of their firms had improved, because of the large degree of performance volatility in previous years, the managers still restricted the amount of cash paid to and on behalf of employees, and hence wages exhibited upward rigidity. In firms whose performance had remained stable over the past few years and whose financial situation was healthy, in contrast, it was possible for managers to increase the wages of their employees. As their current performance had also improved, wages exhibited upward elasticity. This finding is not only consistent with risk management theory, but also supports H1. The coefficient of interactive options (CI×VROA) is 0.20, which is significantly positive at the 0.05 level, indicating that the more that performance continues to improve, the greater the growth rate and the more upwardly flexible are wages.

Given that nonrecurring gains and losses may be due to wage changes, we carried out further regression analysis on the wage elasticity coefficient and performance volatility. This was calculated on the basis of operating return on assets (OROA) excluding the effect of nonrecurring gains and losses (see Panel B, Table 7).

Table 7.

Panel B: OLS Multiple Regression for Samples in Which OROA Had Increased

		Regression (1)		Regression (2)	
Variable Name	Variable Code	Coefficient	T-value	Coefficient	T-value
Constant	INT	2.09***	13.75	3.60	1.13
Standard deviation of operating return on assets	VOROA	-0.10***	-2.70	-0.05	-1.29
Quality of profit	QP			0.01***	4.26
Change in number of employees	PNE			-0.003***	-4.06
Wage level	LW			-0.81***	-4.05
Continuing deterioration	CD			-0.73	-0.97
Continuing improvement	CI			0.79	1.00
Interactive options	CD×VOROA			-0.01	-0.07
Interactive options	CI×VOROA			-0.09	-0.04
Control variables	Controlled				
N		2573		2573	
$ADJR^2$		0.01		0.03	
F		7.30***		3.79***	

*Note: This regression is run for the samples that had shown an increase in OROA. The dependent variable is the wage elasticity coefficient (ELA_ROA), and the main independent variable (VOROA) is the standard deviation of OROA from the t-4 period to the t-1 period. In this model, we controlled for the following variables: PNE (change in the number of employees) in the t period, LW (wage level) in the t-1 period, the CD (continuing deterioration) and CI (continuing improvement) dummy variables, and two interactive options (CD×VROA and CI×VROA). The other variables that were controlled include SIZE, LEV (leverage), the STAT dummy variable, the ST dummy variable and a number of macroeconomic variables (market index, unemployment rate, GDP, industry, year, etc.). ***, ** and * indicate that the empirical results are significant at the 0.01, 0.05 and 0.1 levels, respectively.*

Regression (1) in panel B of Table 7 provides evidence to show that without controlling the other variables, VOROA and ELA_ROA are significantly negatively correlated, which is consistent with our expectations. After controlling the other related variables, the coefficient of VOROA in regression (2) is -0.05, which is consistent in sign with our expectations, but not significant.

The following conclusions can be drawn from Table 7. Regardless of whether a firm's current performance had improved, the more its performance had fluctuated in previous years, the greater the possibility that it would face financial risks in future, and hence the greater the possibility that wages would be cut to reduce the probability of future financial risk and a shortfall in liquidity. As a result, wages exhibit upward rigidity. The more volatile is firms' performance, the lower the wage elasticity coefficient and the stronger the upward wage rigidity. In companies whose performance had realized improvements in the current year and had been stable in previous years, the probability of future financial risk was smaller. Thus, their managers may have decided to increase staff wages to comply with government macro-control measures and to further their own economic interests. Salaries are therefore seen to manifest upward elasticity. The more stable performance had been in previous years, the higher the wage elasticity coefficient and the stronger the upward wage elasticity.

6.2.2. Tests of H2

To test H2, we ran a multiple regression for the samples in which ROA had decreased, with the results presented in Table 8.

Regression (1) in panel A of Table 8 provides evidence to show that VROA and ELA_ROA are significantly positively correlated at the 0.01 level, which to a certain extent supports H2. After controlling the other related variables, the significance level of the VROA coefficient remained the same (whereas the T-value changed from 3.36 to 3.10) and the goodness of fit reached 0.03, which means that VROA's power to explain the wage elasticity coefficient is partly replaced by the other variables. Although the performance of these firms declined in the current year, the more stable was their performance in previous years, the fewer financial risks they were likely to face in future, and the more likely that they would increase wages. Wages in these firms thus exhibited downward rigidity. In those companies in which performance had both deteriorated in the current year and fluctuated in previous years, wages were likely to be reduced and exhibited downward elasticity. We also carried out further regression analysis after excluding the effect of nonrecurring gains and losses (see Panel B of Table 8).

Table 8.

Panel A: OLS Multiple Regression for Samples in which ROA had Decreased

		Regression (1)		Regression (2)	
Variable Name	Variable Code	Coefficient	T-value	Coefficient	T-value
Constant	INT	-6.90***	-4.54	-4.35	-0.92
Standard deviation of return on assets	VROA	18.24***	3.36	16.75***	3.10
Quality of profit	QP			-0.007	-1.13
Change in number of employees	PNE			0.01***	5.00
Wage level	LW			1.35***	4.88
Continuing deterioration	CD			-1.92	-1.24
Continuing improvement	CI			-3.42**	-2.41
Interactive options	CD×VROA			0.31	1.05
Interactive options	CI×VROA			0.60**	2.44
Control variables	Controlled				
N		2366		2366	
$ADJR^2$		0.01		0.03	
F		11.29***		3.56***	

*Note: This regression was run for the samples where ROA had decreased. The dependent variable is the wage elasticity coefficient (ELA_ROA), and the main independent variable (VROA) is the standard deviation of ROA from the t-4 period to the t-1 period. In this model, we controlled the following variables: QP (that ratio of operating profit contributed to total profit) in the t-1 period, PNE (change in the number of employees) in the t period, LW (wage level) in the t-1 period, the CD (continuing deterioration) and CI (continuing improvement) dummy variables, and two interactive options (CD×VROA and CI×VROA). The other variables controlled include SIZE, LEV (leverage), the STAT dummy variable, the ST dummy variable and a number of macroeconomic variables (market index, unemployment rate, GDP, industry, year, etc.). ***, **and * indicate that the empirical results are significant at the 0.01, 0.05 and 0.1 levels, respectively.*

Regression (2) in panel B of Table 8 provides evidence to show that VOROA and ELA_ROA are significantly positively correlated at the 0.01 level, which to a certain extent supports H2. After controlling the other related variables, the significance level of the VROA coefficient changed from 0.01 to 0.05.

Table 8 indicates that despite a current decline in performance, if (a) a company's performance had exhibited stability in recent years, (b) the financial situation is good and (c) the likelihood of future financial risk is small, then managers may still raise staff wages to comply with government macro-control measure and to further their own economic interests. Therefore, salaries in such firms manifest downward rigidity. The more stable the performance in previous years, the lower the wage elasticity coefficient and the stronger the downward wage rigidity. In those companies in which performance both decreased in the current year and fluctuated in previous years, however, managers are likely to cut staff wages to reduce the probability of future financial risk. Downward elasticity thus manifests itself in the wages of these firms. The more volatile is the performance in previous years, the higher the wage elasticity coefficient and the stronger the downward wage elasticity.

Table 8.
Panel B: OLS Multiple Regression for Samples in which OROA had Decreased

		Regression (1)		Regression (2)	
Variable Name	Variable Code	Coefficient	T-value	Coefficient	T-value
Constant	INT	-2.06	-10.11	-7.43*	-1.76
Standard deviation of operating return on assets	VOROA	0.18***	2.94	0.18**	2.77
Quality of profit	QP			-0.01**	-2.26
Change in number of employees	PNE			0.01***	4.75
Wage level	LW			1.28***	4.99
Continuing deterioration	CD			2.10	1.45
Continuing improvement	CI			1.13	0.84
Interactive options	CD×VOROA			-0.53**	-1.97
Interactive options	CI×VOROA			-0.37	-1.31
Control variables	Controlled				
N		2393		2393	
$ADJR^2$		0.003		0.028	
F		8.62***		3.29***	

*Note: This regression was run for the samples in which OROA decreased. The dependent variable is the wage elasticity coefficient (ELA_ROA), and the main independent variable (VOROA) is the standard deviation of OROA from the t-4 period to the t-1 period. In this model we controlled the following variables: PNE (change in the number of employees) in the t period, LW (wage level) in the t-1 period, the CD (continuing deterioration) and CI (continuing improvement) dummy variables, and two interactive options (CD×VROA and CI×VROA). The other variables controlled include SIZE, LEV (leverage), the STAT dummy variable, the ST dummy variable and a number of macroeconomic variables (market index, unemployment rate, GDP, industry, year, etc.). ***, ** and * indicate that the empirical results are significant at the 0.01, 0.05 and 0.1 levels, respectively.*

7. Robustness Checks

To further test the stability of our results, we conducted the following robustness checks.

7.1. Replacement of Key Indicators

We used the standard deviation of the return on total assets (ROA) and the operating return on total assets (OROA) as an alternative indicator of performance volatility. In this robustness check, we used the profit growth rates when calculating wage flexibility and the wage elasticity coefficients. The regression results are presented in Table 9. The use of variance and the coefficient of performance variation as alternative indicators of performance volatility did not change the regression results substantially.

Table 9.

Panel A: OLS Multiple Regression of the Sample with Increased Profits

	Regression (1)		Regression (2)	
Variable Code	Coefficient	T-value	Coefficient	T-value
INT	1.48	19.63	7.80***	4.13
VP	-0.08***	-4.71	-0.03*	-1.75
QP			0.004*	1.90*
PN			-0.003***	-5.33
LW			-0.65***	-5.48
CD			-0.03	-0.09
CI			0.16	0.46
CD×VP			0.0013	0.32
CI×VP			0.005	0.19
Control variables	Controlled			
N	2600		2600	
$ADJR^2$	0.005		0.028	
F	22.19***		3.29***	

*Note: This regression was run on the sample with increased profits. The dependent variable is the wage elasticity coefficient (ELA_e), and the main independent variable (VP) is the standard deviation of the return on total assets from the t-4 to t-1 periods. We controlled the change in the number of workers (PNE), the wage level (LW) in period t-1, the sustained reduction in performance (CD) and sustained growth (CI) dummy variables, and the performance fluctuations in the interaction items CD×VP and CI× VP. Other variables, including firm size (SIZE), financial leverage (LEV), the actual controller dummy variables STAT and ST, and such macroeconomic variables as the market index (MI), the unemployment rate (UEM), GDP, and industry and year dummy variables, were also controlled. ***, ** and * indicate significance at the 0.01, 0.05 and 0.1 levels, respectively.*

Table 9.

Panel B: OLS Multiple Regression of Sample with Decreased Profits

	Regression (1)		Regression (2)	
Variable Code	Coefficient	T-value	Coefficient	T-value
INT	-1.54***	-9.11	-10.3***	-2.13
VP	0.14***	2.89	0.12**	2.22
QP			0.003	0.64
PN			0.02***	6.92
LW			0.94***	3.27
CD			-0.09	-0.07
CI			0.82	0.54
CD×VP			0.002	0.06
CI× VP			-0.002	-0.01
Control variables	Controlled			
N	2366		2366	
$ADJR^2$	0.003		0.05	
F	8.33***		3.75***	

*Note: This regression was run on the sample with decreased profits. The dependent variable is the wage elasticity coefficient (ELA_e), and the main independent variable (VP) is the standard deviation of the return on total assets from the t-4 to t-1 periods. We controlled the change in the number of workers (PNE), the wage level (LW) in period t-1, the sustained reduction in performance (CD) and sustained growth (CI) dummy variables, and the performance fluctuations in the interaction items CD×VP and CI×VP. Other variables, including firm size (SIZE), financial leverage (LEV), the actual controller dummy variables STAT and ST, and such macroeconomic variables as the market index (MI), the unemployment rate (UEM), GDP, and industry and year dummy variables, were also controlled. ***, ** and * indicate significance at the 0.01, 0.05 and 0.1 levels, respectively.*

It can be seen from Table 9 that the regression results on the wage elasticity coefficient that we obtained by employing the profit growth rate are similar to those obtained by using the return on total assets.

7.2. Adjustment of Nominal Wage Growth Rate to Real Wage Growth Rate

In this paper, we consider only the growth rate of nominal wages, which equals the wage difference between two adjacent periods divided by the wage level of the former period. By taking into account the impact of the CPI in different years on wage adjustments, we adjusted the nominal wage in accordance with the following formula.

Real wage growth rate in period t = nominal wage growth rate in period t minus the CPI in period t.

Formula (1)

Using the adjusted real wage growth rate to redefine the rigidity and elasticity coefficients, we obtained the regression results presented in Table 10.

Table 10.

Panel A: OLS Multiple Regression of Sample with Increased ROA

	Regression (1)		Regression (2)	
Variable Code	Coefficient	T-value	Coefficient	T-value
INT	-0.86***	-5.85	6.44**	2.06
VROA	0.23***	7.68	-0.05*	-1.72
QP			0.003	0.39
PN			-0.003***	-4.10
LW			-1.17***	-5.98
CD			-0.42	-0.58
CI			-0.86	1.30
CD×VROA			0.02	-0.19
CI×VROA			0.19*	1.93
Control variables	Controlled			
N	2600		2600	
$ADJR^2$	0.018		0.037	
F	58.92***		4.20***	

*Note: This regression was run on a sample with an ascending rate of return on total assets. The dependent variable is the wage elasticity coefficient adjusted by the CPI, and the main independent variable (VROA) is the standard deviation of the rate of return on total assets in the t-4 to t-1 periods. We controlled the change in the number of workers (PNE), the wage level (LW) in period t-1, the sustained reduction in performance (CD) and sustained growth (CI) dummy variables, and the performance fluctuations in the interaction items CD×VP and CI×VP. Other variables, including firm size (SIZE), financial leverage (LEV), the actual controller dummy variables STAT and ST, and such macroeconomic variables as the market index (MI), the unemployment rate (UEM), GDP, and industry and year dummy variables, were also controlled. ***, ** and * indicate significance at the 0.01, 0.05 and 0.1 levels, respectively.*

Table 10.
Panel B: OLS Multiple Regression of Sample with Decreased ROA

	Regression (1)		Regression (2)	
Variable Code	Coefficient	T-value	Coefficient	T-value
INT	-19.30***	-42.50	-12.93***	-4.22
VROA	3.09***	23.37	0.14**	2.49
QP			-0.007	-1.28
PN			0.009***	4.75
LW			1.14***	4.37
CD			-1.81	-1.22
CI			-2.29	1.69
CD×VROA			0.22	0.77
CI×VROA			0.35	1.46
Control variables	Controlled			
N	2366		2366	
$ADJR^2$	0.14		0.024	
F	546.08***		2.90***	

*Note: This regression was run on a sample with a descending rate of return on total assets. The dependent variable is the wage elasticity coefficient adjusted by the CPI, and the main independent variable (VROA) is the standard deviation of the rate of return on total assets in the t-4 to t-1 periods. We controlled the change in the number of workers (PNE), the wage level (LW) in period t-1, the sustained reduction in performance (CD) and sustained growth (CI) dummy variables, and the performance fluctuations in the interaction items CD×VP and CI×VP. Other variables, including firm size (SIZE), financial leverage (LEV), the actual controller dummy variables STAT and ST, and such macroeconomic variables as the market index (MI), the unemployment rate (UEM), GDP, and industry and year dummy variables, were also controlled. ***, ** and * indicate significance at the 0.01, 0.05 and 0.1 levels, respectively.*

The regression results remained basically unchanged when price changes were taken into account.

7.3. Adjustment of the Wage Elasticity Coefficient Definition

We define the wage elasticity coefficient as the ratio of the wage growth rate in period t divided by the performance growth rate in period t-1. Taking into account that in reality wage adjustments may take place after performance changes, we adjusted our definition of the wage elasticity coefficient according to the following formula.

Elasticity coefficient = wage growth rate in period t divided by
performance growth rate in period t-1.

Formula (2)

The results of the regression run after redefining the wage elasticity coefficient are presented in Table 11.

Table 11.

Panel A: OLS Multiple Regression of Sample with Increased ROA

	Regression (1)		Regression (2)	
Variable Code	Coefficient	T-value	Coefficient	T-value
INT	0.22***	1.64	-0.11	-0.05
VROA	-0.03	-1.27	-0.04	-1.25
QP			-0.002	-0.58
PN			-0.006	-0.77
LW			-0.029	-0.15
CD			-3.73***	-5.05
CI			1.89***	2.77
CD×VROA			0.258**	2.19
CI×VROA			-0.109	-1.04
Controlled				
N	2245		2245	
$ADJR^2$	0.002		0.02	
F	1.62		2.90***	

*Note: This regression was run on a sample with an ascending rate of return on total assets. The dependent variable is the redefined wage elasticity coefficient, and the main independent variable (VROA) is the standard deviation of the rate of return on total assets in the t-4 to t-1 periods. We controlled the change in the number of workers (PNE), the wage level (LW) in period t-1, the sustained reduction in performance (CD) and sustained growth (CI) dummy variables, and the performance fluctuations in the interaction items CD×VP and CI×VP. Other variables, including firm size (SIZE), financial leverage (LEV), the actual controller dummy variables STAT and ST, and such macroeconomic variables as the market index (MI), the unemployment rate (UEM), GDP, and industry and year dummy variables, were also controlled. ***, ** and * indicate significance at the 0.01, 0.05 and 0.1 levels, respectively.*

Table 11.

Panel B: OLS Multiple Regression of Sample with Decreased ROA

	Regression (1)		Regression (2)	
Variable Code	Coefficient	T-value	Coefficient	T-value
INT	-0.378**	-2.39	-4.87*	-1.78
VROA	0.027	0.62	-0.027	-0.54
QP			-0.002	-0.33
PN			0.002	0.94
LW			0.25	1.1
CD			-3.85***	-2.90
CI			1.71	1.41
CD×VROA			0.17	0.69
CI×VROA			-0.05	-0.24
Controlled				
N	2036		2036	
$ADJR^2$	-0.002		0.007	
F	0.38		1.55**	

*Note: This regression was run on a sample with a decreased rate of return on total assets. The dependent variable is the wage elasticity coefficient redefined by Formula (2), and the main independent variable (VROA) is the standard deviation of the rate of return on total assets in the t-4 to t-1 periods. We controlled the change in the number of workers (PNE), the wage level (LW) in period t-1, the sustained reduction in performance (CD) and sustained growth (CI) dummy variables, and the performance fluctuations in the interaction items CD×VP and CI×VP. Other variables, including firm size (SIZE), financial leverage (LEV), the actual controller dummy variables STAT and ST, and such macroeconomic variables as the market index (MI), the unemployment rate (UEM), GDP, and industry and year dummy variables, were also controlled. ***, ** and * indicate significance at the 0.01, 0.05 and 0.1 levels, respectively.*

It can be seen from Table 11 that when we lag the wage growth rate by one period, the sign of the one independent variable regression is contrary to our expectations. Although the sign of the multiple independent variable regression on performance fluctuation is in accordance with our expectations, it does not pass the significance test.

7.4. Regression on State-Owned and Private Enterprises

To determine whether the nature of firms' property rights has an impact on the relationship between performance fluctuation and the wage elasticity coefficient, we employed state-owned and private enterprises as our regression samples. The results of the former sample are basically consistent with those of the full sample. In the private enterprise sample, however, the direction of the performance fluctuation impact on the wage elasticity coefficient is in line with our expectations, but does not pass the significance test.

7.5. Regression with the Compensation and Number of Executives, Directors and Supervisors Excluded

When we removed the compensation paid to executives, directors and supervisors from that paid to employees and their numbers from the total number of employees, the regression results changed little and are basically in accordance with our expectations.

7.6. Performance Volatility over Four Years, Including Current Year Performance

Given that senior management takes into account the current year's performance as well as the performance volatility of previous years, we also took it into account in our calculation of performance volatility. Thus, when calculating the indicators of performance fluctuation, we used performance data for the current year as well as those for the past three years. The regression results using this revised calculation were still in line with our expectations and support our hypotheses.

7.7. Stability Test of Heteroscedasticity

To overcome the possible impact of heteroscedasticity and ensure the stability of inference, we used robust OLS estimates. The regression results were largely unaffected by heteroscedasticity and were in accordance with our expectations.

7.8. Excluding Abnormal Samples

We removed the outliers of the elasticity coefficient, performance, volatility and earnings quality from the top and bottom 1%, and the results remained basically unchanged.

8. Research Conclusions and Limitations

Taking A-share listed companies in China from 1999 to 2007 as our research sample, this article analyzes the causes of wage rigidity from the financial perspective. We demonstrate that firms whose current performance has improved, but whose performance in previous years has fluctuated, face a greater likelihood of future financial risks, and thus their management may reduce employees' wages to avoid those risks. The greater the fluctuation in a firm's former performance, the greater the decrease in employees' wages, the smaller the wage elasticity coefficient and the stronger the upward rigidity. If the firm's performance in previous years was less volatile, then it is less likely to face financial risks in future and management is more likely to increase staff wages both in the interests of the company and to manage potential risk. The more stable the former performance, the greater the increase in wages, the larger the wage elasticity coefficient and the stronger the upward elasticity. In firms whose performance is deteriorating, the greater the fluctuation in its former performance, the more it decreases employee wages, the larger the wage elasticity coefficient and the stronger the downward elasticity. The more stable that former performance, the more wages are increased, the smaller the wage elasticity coefficient and the stronger the downward rigidity.

A limitation of this paper lies in its definition of wage elasticity. Such elasticity is defined as the current wage growth rate divided by the current performance growth rate. There are two issues of concern regarding this definition. First, if the elasticity coefficient is less than zero, then it is considered that wages exhibit rigidities. The definition exaggerates the downward flexibility and upward rigidity samples to some extent because a drop in the average wage does not necessarily mean a decrease in the wage level, but may also result from a change in employee numbers or a firm's internal structure. Even if we had controlled the variable for the change in employee numbers, this substantial deviation could not have been avoided. Second, our definition involves the assumption that wage adjustment is a short-term concept. In practice, however, wages (except for bonuses) may be adjusted every two or more years. We adjusted the definition of the wage elasticity coefficient by employing the ratio of the wage growth rate over two years divided by the performance growth rate over two years, but the results were contrary to our expectations. Furthermore, a company's operating leverage, cost structure, and ability to bargain with clients and suppliers may also affect the flexibility of wage adjustments. However, given the limited data available, we were unable to control such variables, which may have had an impact on the reliability of our conclusions.

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