

The Extent and Nature of Downward Nominal Wage Flexibility: An Analysis of Longitudinal Worker/Establishment Data from Korea*

Seonyoung Park[†] Donggyun Shin[‡]

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Abstract

Analysis of a special dataset constructed from the Survey on Labor Conditions by Type of Employment finds evidence that does not support the downward nominal wage rigidity hypothesis during the 2008–2009 through 2012–2013 period, which was a period of low inflation and low economic growth. Our analysis finds at least one in every four job stayers experienced nominal wage cuts from one year to the next, and few experienced nominal wage freezes. The extent of downward nominal wage flexibility is somewhat greater in Korea than in Great Britain and the United States, which have the most flexible labor markets among OECD countries. Our analysis at the establishment level uncovers the nature of this downward nominal wage flexibility. The observed downward flexibility does not result from a fraction of employers cutting most of their workers' wages, but from a majority of employers cutting a fraction of their workers' wages fairly routinely. The size of nominal wage reductions is substantial. In addition, employers tend to 'choose' high wage earners for wage cuts.

JEL Codes: E24, E32, J3, J64

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[†]Corresponding author. Department of Economics, Alfred Lerner College of Business & Economics, University of Delaware, 413 Purnell Hall, Newark, DE 19716, U.S.A. Email: ypark@udel.edu.

[‡]School of Economics and Finance, Victoria University of Wellington, Wellington, New Zealand. Email: don.shin@vuw.ac.nz.

1 Introduction

It has been commonly believed by macroeconomists that nominal wages are downwardly rigid. When combined with low inflation, this downward nominal wage rigidity (DNWR) has often been cited as a major cause of sluggish real wage adjustment and, therefore, high unemployment during a recession (e.g., [Daly et al., 2012](#)). Contrary to this belief, many recent longitudinal microdata-based studies have observed frequent nominal wage reductions among job stayers (see, among others, [Doris et al., 2015](#); [Elsby et al., 2016](#); [Kurmann and McEntarfer, 2017](#); [Nickell and Quintini, 2003](#); [Smith, 2000](#)).¹ Much of the existing evidence focuses on the labor markets in Europe or North America, predominantly Great Britain and the United States. The latter countries are often cited as having the most flexible labor markets among developed countries.

This paper contributes to the literature in several ways. First, it provides additional evidence on nominal wage flexibility/inflexibility in South Korea, which is a developed Asian economy. The case of Korea is interesting in that, compared to Great Britain and the US, Korea is believed to have a more rigid labor market with a prevailing seniority-based pay system and stronger union activities, among other differences.²

¹One exception is the study by [Carneiro et al. \(2014\)](#) who report virtually no nominal wage cuts for job stayers in Portugal where nominal cuts are explicitly outlawed. All of the studies listed deal with the issue of measurement errors featured in survey-based wage data by using either payroll-based wage data, or special information collected from the survey ([Smith, 2000](#)). Several studies also examine survey-based longitudinal microdata to assess the prevalence of nominal wage stickiness in the United State (e.g., [McLaughlin, 1994](#); [Card and Hyslop, 1996](#); [Kahn, 1997](#); [Altonji and Devereux, 1999](#); [Dickens et al., 2007](#); [Daly et al., 2012](#)). A study by [Kuroda and Yamamoto \(2003\)](#) also investigates this issue using survey-based wage data in Japan. Like other studies that use survey-based wages, they find evidence of nominal wage stickiness. [Elsby et al. \(2016\)](#) demonstrate that the observed nominal wage stickiness in these studies is mostly attributed to rounding errors inherent in survey-based wages.

²A few recent papers addressed a similar issue of downward wage flexibility/inflexibility using individual wages in Korea. For example, [Lee and Ma \(2015\)](#) analyse longitudinal wage data received from the Korea Labor and Income Panel Surveys (KLIPS) and conclude that downward nominal wage rigidity is prevalent in the Korean labor market. [Park and Shin \(2014\)](#) analyse the same KLIPS data and produce the same observed pattern of nominal wage changes among job stayers as [Lee and Ma \(2015\)](#). [Park and Shin \(2014\)](#), however, conjecture that the spike at zero wage change in the distribution of nominal wage changes could be driven by measurement errors (rounding errors, in particular) plaguing household-survey-based wage data. Unlike these studies, the current study is based on more accurate wage information received from payroll records.

Second, and more importantly, while existing studies examine the degree of nominal wage flexibility experienced by individual workers, this paper investigates the issue at the establishment level as well. This is important for at least two reasons. First, in Korea, wage and employment decisions are made at the establishment level, and therefore, it is more appropriate to address the issue of nominal wage adjustment at both the worker and establishment (employer) levels. Second, by doing so, our results help us understand the underlying causes of the nominal wage flexibility observed in recent studies. In particular, how observed wage flexibility is connected to employers' choice about wages. Does the observed downward flexibility in nominal wages come from only a group of employers cutting all of their employees' wages or from most employers cutting a fraction of their employees' wages? If the latter is the case, how do employers 'select' workers whose wages are to be reduced? This type of investigation leads us to understand the nature of nominal wage changes effectively.³

Third, while existing studies focus on the incidence of nominal wage reductions, we analyze the size of the nominal wage cuts as well. Obviously, this is a major concern of cost-minimizing employers. Lastly, this paper studies heterogeneity in nominal wage flexibility not only by worker characteristics (e.g., gender, age, education, tenure, union status, employment type, occupation, wage level), but also by employer characteristics (establishment size, industry) and across different wage measures (from a base pay to a more comprehensive measure of average hourly earnings). The current results will be helpful for designing effective wage policies as well as understanding the nature of nominal wage flexibility/rigidity and thereby, deriving unemployment implications.

Following a recent trend in the literature, we analyze payroll-based wage data, which

³Prominent research by [Kurmann and McEntarfer \(2017\)](#) also investigates wage/earnings flexibility/inflexibility at the firm level. Using the linked employer-employee data received from the Longitudinal Employer Household Dynamics (LEHD) program for Washington State, [Kurmann and McEntarfer](#) find that larger firms are more likely to show a symmetric distribution of nominal wage changes. More importantly, firms with indicators of DNWR had systematically higher job destruction and separation rates and lower creation and hiring rates. While [Kurmann and McEntarfer \(2017\)](#) thoroughly investigate the employment and unemployment consequences of DNWR at both the the extensive and intensive margins, we focus on the nature and causes of downward wage flexibility.

effectively reduces, although not entirely, bias in the results associated with error-ridden household-survey-based wages. Analysis of the employer-worker linked longitudinal dataset constructed from the Survey on Labor Conditions by Type of Employment (SLCTE) reveals that the nominal average hourly wage rate (ratio of the actual monthly pay without overtime or incentive to actual monthly regular work hours) is downwardly flexible in Korea. From 2008–2009 to 2012–2013, which was a period of low inflation and low economic growth, at least one in every four job stayers experienced nominal wage cuts from one year to the next. This estimate is generally consistent with those found in recent studies for the European and North American labor markets that are based on relatively accurate wage information from either payroll or administrative records. Like these recent studies, we find little evidence of nominal wage freezes. The findings of frequent nominal wage reductions and infrequent nominal wage freezes are quite robust with respect to different wage definitions and different sample restrictions. Little heterogeneity is detected in the measured degree of flexibility across different demographic/economic groups, except for the pay level: Higher, relative to lower, wage earners are more likely to experience nominal wage reductions.

Analysis at the establishment level reveals that a majority of employers cut nominal wages for a fraction of their employees fairly routinely. When an employer cuts nominal wages for some workers (not others), she/he cuts their wages by about 11 to 12 percent on average. Some employers (about 13 to 16 percent of the establishments in the sample) do so by more than 20 percent. All of these results defy the prediction that DNWR is prevalent in a period of low inflation and low economic growth. A detailed analysis of the wage behavior at the establishment level shows that employers tend to ‘select’ higher wage workers for wage cut, but not others.

Organization of the paper is as follows. Section 2 explains characteristics of the current sample, focusing on its analytical advantages/drawbacks. Section 3 presents evidence on nominal wage flexibility/inflexibility at the individual level, and compares the results with existing studies. Section 4 analyzes nominal wage flexibility at the establishment level. In

Section 5, we conduct various tests to check the robustness of the current results. Section 6 concludes with a brief economic implication.

2 Data and Methodological Issues

Following existing studies (e.g., [Kahn, 1997](#); [Smith, 2000](#); [Elsby et al., 2016](#)), we measure the degree of nominal wage flexibility and inflexibility by the proportion of wage reductions and freezes, respectively, in the distribution of year-to-year nominal wage changes experienced by those who stay in the same job (job stayers).⁴ A better measure of nominal wage rigidity would be the fraction of desired nominal wage cuts that were not pursued, not only among surviving matches, but also on matches that were destroyed. To the best of our knowledge, however, such measure is still understudied. Instead, the implicit assumption in this literature is that, if DNWR is sufficiently common to cause a number of job losses, it should also be commonly observed among job stayers.⁵

As discussed by [Elsby et al. \(2016\)](#), among others, a measured degree of wage rigidity/flexibility is often overstated by measurement errors plaguing household-survey-based reported wages. Specifically, the extent of nominal wage rigidity measured by the proportion of job stayers who receive the same wage between the two adjacent years tends to be exaggerated by the nature of rounding errors that appear in survey-based wage data. At the

⁴The current study defines job stayers more strictly compared to existing studies. To be in the sample of job stayers, individual workers stay in the same establishment from June of one year to June of the next, work in the same occupation category at the 4-digit level with the same industry code at the 3-digit level, maintain the same employment type (permanent vs. temporary worker), the same work type (full-time, part-time, work at home, shift work, etc.), and even the same union status. In contrast, most existing studies (aforementioned) analyze wage changes among employer (or firm) stayers. [Elsby et al. \(2016\)](#) focus on those who stay in the same job with the same employer.

⁵In this sense, the current results should be interpreted with caution. The literature often uses asymmetry of the wage change distribution as a measure of downward wage rigidity. In particular, excess mass at zero wage change and missing mass to the left of zero (compared to what a symmetric distribution would imply) are interpreted as evidence of downward nominal wage rigidity. [Elsby \(2009\)](#), however, calibrates a simple dynamic model and finds that firms have an incentive to compress wage increases as well as wage cuts when downward wage rigidity is binding. In addition, as demonstrated by [Kurmann and McEntarfer \(2017\)](#), an analysis of job stayers in regards to downward wage rigidity may be subject to a sample selection bias, as firms tend to disproportionately layoff those workers who are constrained by downward wage rigidity. Consequently, evidence based on the current measure of nominal wage flexibility/inflexibility and/or asymmetry may not be used by itself to reject or accept the downward rigidity hypothesis.

same time, existence of classical measurement errors in reported wages tends to understate the degree of nominal wage rigidity. Which one dominates is an empirical matter. [Elsby et al. \(2016\)](#) conclude that the effects of rounding errors dominate, and therefore, analysis based on survey-based reported wages tends to overstate the extent of nominal wage rigidity. Although not reported for brevity, it can be shown that, even though reported wages are subject to classical measurement errors, the estimated proportion of job stayers who experience nominal wage cuts also overstates the true proportion, as long as wages grow over the course of the lifecycle. Consequently, when it comes to measuring the degree of wage flexibility/rigidity, access to more accurate wage information from payroll or administrative records is a top priority, as shown by a series of efforts made by aforementioned recent studies.

We analyze payroll-based wage data received from the Survey on Labor Conditions by Type of Employment (SLCTE), which is a survey administered by the South Korean Ministry of Employment and Labor. The survey is intended to collect information on working conditions (e.g., hours, wages) of permanent and temporary workers and thereby, develop effective employment policies such as working standards and labor and management policy. As sampled employers (establishments) are required by law to report to the survey, attrition/non-response is a small issue or a nonissue.

This dataset suits the current research purposes for the following reasons. First, since our main research objective is to study the incidence of nominal wage reductions at the establishment level, it is desirable to have many establishments in the sample. Since 2008, the SLCTE has been selecting about 3 percent of all establishments. Focusing on establishments with 5 or more employees, about 17,000 establishments are sampled annually from 2008 through 2014. The large sample size at the establishment level makes it possible to examine various distributions of incidence of nominal wage reductions at the establishment level.

For the purpose of investigating underlying causes of nominal wage flexibility/inflexibility, especially in regards to what employers do about wages, we require that each establishment has a sufficient number of individual workers included in the sample. For example, to examine

whose wages are cut and whose wages are not, we need to have, for each establishment, multiple employees who experience nominal wage cuts, multiple employees who experience nominal wage increases or freezes, and compare the two groups in the sample. As explained in Appendix A, the SLCTE tends to sample proportionally more employees for smaller establishments. For those establishments with 29 employees or less, all workers are included in the sample.

The information on earnings and work hours elicited from the employers pertains to payroll information for a reference month (June 1 through June 30). Because the earnings and hours data come from payroll records, they are thought to be more accurate than similar data gathered from household surveys. More importantly, the SLCTE releases the actual amount of wages paid by employers and the actual labor hours during the reference month, which makes the hourly wage measure closer to the actual hourly cost of labor.⁶

Lastly, the survey delivers detailed information on individual and job-related characteristics, such as each person's employment type (permanent or temporary workers), work type (shift work, the degree of work attachment), industry codes (3 digits), occupation codes (4-digit), the timing of entry into the current job, as well as various economic and socio-demographic characteristics, which enables us to investigate the incidence of nominal wage reductions in various dimensions.

The SLCTE also has some limitations. Although the survey releases employer identifiers, it does not contain individual identifiers. As an alternative, we use various individual and job characteristics to match individual workers in an establishment from June of one year to June of the next. To be included in the final sample of job stayers, an employee should have the same employer identifier between two adjacent survey years, the same gender status, and the same starting date of employment at the current establishment. In addition, as the survey collects information during the same reference month (June) every year, ages

⁶When analyzing wage stickiness/flexibility with a view to deriving implications on the quantity side, a more appropriate measure would be the actual hourly cost of employing a unit of labor, including all kinds of non-wage costs.

should grow by one year between two neighboring surveys. To further reduce the probability of matching two different individuals with the same characteristics, we also require that longitudinally matched individuals should have the same characteristics in the following variables: education, occupation (4-digit), industry (3-digit), employment type (permanent vs. temporary), work type (full-time, part-time, work at home, etc.), and union status. Due to the strong restrictions we imposed in the matching process, we lost a large number of establishments as well as individuals in the final sample.⁷ The good news is that, despite the great loss in the sample size, we still end up with a large longitudinally matched employer-employee linked sample. For an average matched year from 2008–2009 through 2012–2013, almost 9,000 establishments and approximately 100,000 individuals are in the final sample, and about 11 job stayers are linked to an establishment (in the dataset). In addition, as explained in Appendix A, the excluded and included samples are not much different in terms of various individual and establishment characteristics. (See Appendix A for details of the current sample.) More importantly, as will be evaluated in Section 5, the probability of matching two different workers incorrectly by the current matching scheme is quite low, and the current results from the longitudinally matched sample also survive various robustness tests.

Since 2008, the SLCTE has been re-sampling establishments every three years instead of annually which means they were re-sampled in 2011 and 2014. Therefore, year-to-year matches are not available for 2010–2011 and 2013–2014. The final sample consists of four matched years, 2008–2009, 2009–2010, 2011–2012, and 2012–2013. This sample period is characterized by low inflation and low economic growth. As shown in Figure 1, Korea had enjoyed high economic growth rates before the 1997 exchange rate crisis, with an average growth rate of 9.3 percent from 1973 to 1996. The period after the exchange rate crisis and before the Great Recession is characterized by a period of moderate economic growth, with the average growth rate being 4.7 percent for the 2000 to 2007 period. The average growth

⁷We also focus on prime wage workers (those between the ages of 25 and 59 in both matched years), and exclude the top 1% and bottom 1% of individuals in each year's wage distribution.

rate dropped further to 2.4 percent for the 2008 to 2015 period. The average inflation rate for our sample period, 2008–2009, 2009–2010, 2011–2012, and 2012–2013, was 0.72 percent (PPI-based) or 1.62 percent (CPI-based). These statistics generally imply that, for the last half century, the downward pressure in nominal wages was probably the greatest during our sample period (from the late 2000s to the early 2010s). Whether nominal wages were downwardly adjusted, or frozen or even increased depends on, among other things, how workers resisted against nominal wage cuts.⁸

3 Analysis of Nominal Wage Changes at the Individual Level

Figure 2 displays histograms of year-to-year nominal wage changes among job stayers for 2008–2009, 2009–2010, 2011–2012, and 2012–2013. The hourly wage rate is defined as the ratio of actual monthly regular pay to actual monthly regular hours, excluding overtime and incentive pay and overtime hours. The bin to the right of zero shows the percentage of workers whose change in log nominal wage was positive but less than or equal to 0.02. The next bin contains those whose change in log nominal wage was greater than 0.02 and less than or equal to 0.04, and so on. The bins to the left of zero are constructed symmetrically. To limit the histograms to a readable scale, we pile up workers with a change in log nominal wage greater than 0.6 in the rightmost bin and those with change less than -0.4 in the

⁸As shown in Figure 1, the Korean economy underwent three major recessions since the mid-1970s. Judging by the real growth rate, the most severe recession is associated with the 1997 exchange rate crisis. The negative growth rate of 5.6 percent (observed in the 1997 recession) is the lowest growth rate since the mid-1970s. The next most severe recession followed the second oil shock and the political instability of the 1979 to 1980 period, when the Korean economy showed another negative growth rate of 1.7 percent. It is known that the recent financial crisis (Great Recession) had a relatively minor impact on the Korean economy, compared to the United States and European economies. Still, the Korean economy showed an almost zero growth rate (0.7 percent) in 2009. The order of severity among these three recessions is generally preserved in the unemployment rate. The unemployment rate was as high as 7 percent and 5.2 percent in 1998 and 1980, respectively. The adverse impact of the Great Recession on the unemployment rate, relative to that of the previous severe recessions, appears smaller than what is implied by the comparison of growth rates. It is often cited that, in Korea, the unemployment rate is a relatively poor indicator of labor market conditions (e.g., [Hwang \(2010\)](#)).

leftmost bin. Table 1 contains some summary statistics for the four empirical distributions.

Most importantly, even when the regular hourly pay is analyzed, many job stayers are found to experience nominal wage reductions from one year to the next. As shown in Table 1, when a wage freeze is defined by ‘receiving the same wage rate between two time points,’ the fraction of stayers with nominal wage freezes is at most 0.2 percent. In contrast, the share of stayers with nominal wage cuts is at least 25 percent. Changing the definition of a nominal wage freeze from ‘exact zero changes’ to ‘approximate zero changes’ makes little, if any, difference in the results. When the approximate zero wage change is defined by the change in the logarithm of the wage rate between -0.005 and 0.005 , the fraction of nominal wage freezes (reductions) appears at most (least) 3.2 (24) percent. The evidence of frequent nominal wage reductions and infrequent nominal wage freezes is altogether consistent with those found in aforementioned recent studies.⁹ For example, for a similar sample period, the measured degree of downward nominal wage flexibility is somewhat greater for Korea than for Great Britain (Elsby et al., 2016; Nickell and Quintini, 2003) or the US (Kurmann and McEntarfer, 2017), but smaller for Korea compared to that of Ireland (Doris et al., 2015).¹⁰

Figure 2 also reveals the following interesting patterns. First, none of the distributions show a dip in the bins for $(0, 0.02]$ or $[-0.02, 0)$. That is, stayers’ nominal wages are adjusted even by a very small amount in both directions, which is evidence against the existence of a menu cost. Second, the empirical distributions are approximately symmetric around their central tendencies, and missing mass is hardly observed to the left of zero. This is particularly true for 2008–2009 when the economy shows an almost zero growth rate and low inflation,

⁹It is believed that the Korean labor market stays quite stable in June, compared to other months, as both the job market and the year’s wage setting process are mostly closed. Nevertheless, the possibility cannot be ruled out that comparison of wages between two time points leads to spuriously large wage cuts and increases. This is so, because wages collected at a point in time reflect firm-specific shocks that occur at that time point. In fact, the same issue is featured in many recent studies cited in the introduction. Vice versa, if performance-based pay and/or bonuses are more variable than regular wages and paid out around the end of the year, then comparison of wages from June of one year to June of the next would produce artificially small changes. Given the structure of the current data set, this issue cannot be properly addressed in the current study.

¹⁰During the Great Recession, the Ireland labor market experienced extraordinarily severe negative demand shocks with deflation in prices, and a majority of job stayers experienced nominal wage reductions.

suggesting another feature of nominal wage flexibility.¹¹ Third, the empirical distributions are quite dispersed, implying that rigidity of entry wages, if any, would be less consequential as a driving force of high unemployment. Finally, although the sample period is not long enough to investigate business cycle aspects of nominal wage flexibility/inflexibility thoroughly, the current results are consistent with the view that nominal wages are procyclical. For 2008–2009, when the GDP growth rate reached its lowest level during our sample period at 0.7 percent, more than 50 percent of job stayers experienced nominal wage cuts. These results do not support the common view that DNWR is prevalent in a period of low inflation and weak demand, but suggests that nominal wages are, in fact, quite downwardly flexible.

Estimates in Table 1 are based average hourly earnings, computed as the ratio of monthly earnings to monthly hours. To examine how hours changes affect the estimates, Table 2 recomputes the estimates using monthly earnings. It is found that the fraction of stayers with nominal reductions (or freezes) remains similar even when monthly earnings, instead of average hourly earnings, is used in the analysis.¹² For 2008–2009 when the economy shows an almost zero growth rate and low inflation, the fraction of stayers with reductions in average hourly earnings is, in fact, somewhat greater than the fraction of stayers experiencing a decrease in monthly pay, suggesting that hours actually increased during the period of economic hardship.¹³ Little change is made to the fraction of nominal wage freezes whether hourly wages or monthly earnings are used in the analysis.

To check the robustness of the results, we redo the analysis in Table 1 using the hourly wage rate of hourly workers, a more transparent measure of the wage rate. Although hourly workers account for only a small portion (about 7 percent) of all the employees in Korea,

¹¹An earlier study by [Dickens et al. \(2007\)](#) measures the degree of DNWR by computing $\frac{f_n}{f_n+f_c}$, where f_n and f_c are, respectively, the fraction of workers experiencing the same wage rate between two time points and the fraction of workers experiencing wage reductions.

¹²This finding seems at odds with [Kurmann and McEntarfer \(2017\)](#) who find that about three quarters of the earnings cut observed in their sample period is accounted for by a decrease in hours in the US. The discrepant results are attributed to different measurement units of the earnings variable, among other factors, adopted by the two studies. While [Kurmann and McEntarfer \(2017\)](#) use annual earnings, we analyze monthly earnings. Obviously, annual hours are more variable than monthly hours.

¹³Although not reported for brevity, the fraction of stayers with hours reductions appears much smaller for 2008–2009 compared to those for 2011–2012 or 2012–2013.

thanks to the nature of the large data set of the SLCTE, we still end up with a large number of hourly workers in the sample. Estimates in Table 3 are quite similar to those in Table 1, re-confirming that the current finding of frequent nominal wage reductions and infrequent nominal wage freezes has little to do with hours variation.

Our analysis so far excludes overtime and incentive pay from the wage measure. In principle, they should be included when analyzing adjustments of the firm's labor cost. Table 4 re-computes the fraction of nominal wage reductions using various wage definitions. As the final estimates are similar between the two definitions of a wage freeze, the analysis is based on the definition of 'exact zero'. The estimates show that the measured extent of downward nominal wage flexibility is robust with respect to different wage measures. With little difference in the final estimates, the rest of the analysis reverts to the average hourly regular pay.

The frequent nominal wage reductions and infrequent nominal wage freezes may surprise some readers who have the conventional belief that the Korean labor market is more rigid compared to the labor markets of Great Britain and the US. While seniority-based pay is still prevalent in Korea, and strong union activities and some restrictive employment laws are still in place in some sectors (the export sector in particular), Korea underwent structural changes in the labor market in the process of overcoming the 1997 exchange rate crisis. Various measures (e.g., dismissal for managerial reasons, a flexible work hour system) were introduced to make the labor market more flexible. Another factor to consider is that the current analysis is based on the actual pay and actual work hours, instead of wages and hours on the contract. Contract-based wage rates cannot be entirely flexible, as they cannot be adjusted in every nanosecond. As evidenced by [Shin and Shin \(2008\)](#), among others, even stayers' wages could be revised depending on labor market conditions, which necessitates adoption of actual wages for effective investigation of wage adjustments. It is interesting to note that real wages are also somewhat more procyclical in Korea than in European countries

(e.g., Germany, Great Britain, and Portugal) and the US (Shin, 2012).¹⁴

Table 5 investigates the extent of heterogeneity in nominal wage flexibility across various economic/demographic groups. To derive the estimates in Table 5, we first compute the fraction of workers who experience wage cuts in each sub-group of workers for each matched year, and then average the estimates across the four matched years.¹⁵ The estimates show that, except for wage groups, nominal wage cuts are pervasive across all sub-groups. The last panel of Table 5 presents estimates by the wage group. To obtain the estimates, each year, we first assign each worker to a wage percentile from the entire cross-sectional distribution of individual wages. Then we classify all workers into five wage groups: those whose wage rates are less than or equal to the 20 percentile, those whose wages are above the 20 percentile but less than or equal to the 40 percentile, etc. Then, we compute the fraction of stayers who experience nominal wage cuts among those whose wages at $t - 1$ belong to each wage group. Additionally, the first and last columns compare the top 10 percentile and bottom 10 percentile of workers in the measured extent of wage flexibility. Estimates show a systematic pattern: Higher, compared to lower, wage earners are more likely to experience nominal wage cuts. For example, the fraction of nominal wage reductions among the top 10 percentile is approximately 2.5 times greater than that among the bottom 10 percentile. A later discussion is devoted to whether this result holds even at the establishment level, (i.e., whether employers tend to ‘choose’ high wage earners for wage cuts).¹⁶

Table 6 presents how the probability of a nominal wage cut is related to individual and job

¹⁴According to the Ministry of Employment and Labor (MOEL), the average nominal monthly pay among workers in establishments with 300 employees or more decreased by 0.7% in June 2016 relative to June 2015. The next most recent episode of reduction in the average nominal monthly pay was from June 2008 to June 2009 (MOEL annual report based on the Labor Force Survey at Establishments, July 2016). Anecdotal evidence also suggests that nominal salaries of CEOs and managers, in the financial sector in particular, were subject to large reductions during the Great Recession and its aftermath (Edaily, January 14, 2014; Digital Times, January 15, 2014; Korean Economy (Hankyung), December 29, 2013).

¹⁵Appendix Tables B1 through B4 provide separate results for 2008–2009, 2009–2010, 2011–2012, and 2012–2013, respectively.

¹⁶Estimates in Table 5 also suggest that wage reductions are more likely among managers than other occupation groups. According to Appendix Tables B1 through B4, this result is entirely based on the episodes in 2008–2009 and 2009–2010 (not in other periods), when at least 70 percent of managers experienced nominal wage reductions. The tendency of cutting wages of managers during the recession is consistent with the evidence suggested in footnote 14.

characteristics. The dependent variable is a dummy variable which equals one for nominal wage reductions, and zero otherwise. With the sample pooled across the four matched years, we include year dummies for 2009–2010, 2011–2012, and 2012–2013.¹⁷ Unlike the estimates in Table 5, those in Table 6 are obtained with correlates controlled for. The results generally confirm our previous observations from Table 5. In particular, other things being held constant, higher-wage earners are more likely to experience nominal wage reductions, compared to lower-wage workers.

4 Analysis At the Establishment Level

Now we turn to the analysis of nominal wage adjustments at the establishment level.¹⁸ In Table 7, we examine the distribution of the fraction of employees in an establishment who experience nominal wage reductions. Figure 3 visualizes the distributions using histograms. The central research question at this stage is whether the frequent nominal wage cuts observed at the individual level are the result of a fraction of employers cutting all of their employees’ wages or the result of most employers cutting wages for a fraction of their employees. (Of course, in the current discussion, employees refer to those who stay in the same job within an establishment, as job changes are precluded from the sample.)

Estimates in panel A of Table 7 are based on all the establishments that generate the entire individual sample in Table 1. As shown in Appendix Table A2, a substantial portion of the establishments have only one employee in the final sample. Practically, this means that the distribution of the fraction of employees in an establishment reporting a nominal wage cut will be particularly dominated by zeros and ones, unless we zoom in on larger

¹⁷In the Probit equation, we include more detailed education groups: less-than high school, high school, some college, four-year university, and graduate school education. Omitted groups: The less-than high school group in education, managers in occupation, wage percentile [0, 20] in the wage distribution at $t - 1$, and 2008–2009 among year dummy variables.

¹⁸The idea and approach for exploring co-workers’ wage changes were developed in collaboration with Michael Elsby and Gary Solon, who are pursuing similar research with British data. We are also grateful to Eleanor Jawon Choi and Harold Cuffe for invaluable comments on construction of statistics at the establishment level.

establishments. This is verified by the large fraction of establishments that did not cut any of their employees' wages or cut all of their employees' wages in Table 7A (or Figure 3A). When we focus on those establishments with 10 employees or more in the dataset (Table 7B or Figure 3B), the fractions of employers who cut none of their employees' wages or cut all of their workers shrink to some degree. In fact, as we successively raise the minimum number of stayers in the sample from A) no restriction, to B) 10 or more, to C) 20 or more, to D) 30 or more, those estimates are further reduced.

The general impression is that there exists great heterogeneity across establishments in the fraction of employees in an establishment that experience a nominal wage cut. For example, focusing on establishments with 20 or more stayers in the sample, for 2008–2009 when the growth rate of per capita GDP hit a local trough with virtually zero inflation, the fraction is approximately uniformly distributed over the entire range. While the distribution is skewed to the right for the other three matched years, the share of establishments that cut nominal wages for more than 50 percent of their stayers ranges from about 18 percent to 33 percent. More importantly, employers (establishments) indeed cut nominal wages for a fraction of their employees fairly routinely. Again, focusing on establishments with 20 or more stayers in the sample, the share of those establishments that cut nominal wages for more than 10, but less than or equal to 90 percent of their stayers ranges from 47 percent (2012–2013) to 66 percent (2008–2009). These estimates remain quite similar when the required number of stayers in an establishment in the sample is extended to 30 or more (from 48 percent to 68 percent) or when it is reduced to 10 or more (from 44 percent to 64 percent). In fact, when all establishments are considered, the share ranges from 32 percent to 44 percent depending on the year.¹⁹

Table 8 reports the size of nominal wage reductions at the establishment level. We first compute the mean wage reductions among those who experience wage cuts for each establish-

¹⁹We reproduced Table 7 focusing on larger establishments (those establishments with 100 employees or more). For brevity, Appendix C reports only the case of 'at least 10 stayers in the sample.' Comparison of Appendix C and panel B of Table 7 reveals that the results are quite robust whether or not smaller establishments are excluded.

ment, and then calculate the simple average (or median) of the means among establishments. To reduce sensitivity of the final estimates, we restrict the sample to those establishments with 20 employees or more in the sample and further require that each establishment has at least three stayers in the sample who experience nominal wage cuts. The latter requirement reduces the number of establishments in the sample, as shown by a comparison of the last rows of Table 7C and Table 8.²⁰ In Table 7, we find that a majority of employers cut nominal wages for a fraction of their employees fairly routinely. Estimates in Table 8 reveal that, when they do, they cut nominal wages by well over 11 percent. Smaller estimates for the median (about 9 percent) than the mean nominal wage cuts suggest that the distribution is skewed to the right. On the basis of the same sample, Figure 4 presents the full distribution of the size of nominal wage reductions at the establishment level. The impression is that each distribution does have a long, and more or less, thick right tail. Statistics show that a non-negligible portion (about 17 to 21 percent) of the establishments that decide to cut some of their workers' wages do so by more than 20 percent on average. All these estimates suggest that the size of the nominal wage cut was substantial during the period of low inflation and low growth from the late 2000s to the early 2010s. Interestingly, despite the fact that the proportion of nominal wage cuts was much greater in 2008–2009 than in the other matched years, the size of the nominal wage cut was not much different across the four matched years, suggesting that employers respond to changes in demand and price conditions by adjusting the number of employees receiving wage cuts rather than changing the size of wage cuts.

The evidence so far suggests that Korean employers often 'choose' a fraction of their employees for a wage cut, and the size of the wage cut is non-negligible. Whose wages are cut then? In Table 9, we conduct a similar analysis to that of Table 5, but at the establishment level. In particular, we find from Table 5 that high wage earners are more likely to experience nominal wage cuts than low wage workers are. Does it result from high-wage

²⁰Using the full sample of establishments with 20 or more employees in the dataset increases the size of the average nominal wage reduction only slightly. The results remain similar when we analyze establishments with 30 or more employees in the dataset or even when all establishments are included in the sample.

establishments cutting their employees’ wages more often than low-wage establishments do, or from most establishments cutting wages more often for higher-wage, relative to lower-wage, workers within establishments? Our basic strategy is to compare, for each establishment, those who experience nominal wage reductions and those who receive wage increases in various characteristics, and average those characteristics across establishments. To reduce sensitivity of the final estimates, we restrict our analysis to those establishments with at least 20 employees in the sample, and further require that each establishment has at least three employees who experience wage cuts and at least three who enjoy nominal wage increases.

The first two rows of Table 9 compare ‘wage winners’ and ‘wage losers’ within establishments in terms of their wages at $t - 1$. In determining the median wage level, we use all the wage observations in each establishment at $t - 1$, including non-stayers. † represents the fraction of the winners (or losers) within an establishment who have the characteristics under consideration. For example, for 2008–2009, 60 percent of the ‘wage losers’ in an establishment had above-median wages within the establishment they are employed in $t - 1$, while 36 percent of the ‘winners’ received above-median wages. Similar estimates are obtained for other matched years. Estimates in the second row also suggest that mean wages were higher for ‘wage losers’ than ‘winners’. As in Table 5, other than the pay level, little difference is observed between losers and winners in other characteristics.²¹ Due to lack of information, we are not able to investigate further why employers choose higher wage earners more frequently than lower wage earners for wage cuts. Although it is difficult to explain this employers’ wage practice theoretically, it is interesting to note that the current finding is not inconsistent with [Bewley](#)’s intensive interviews with employers/CEO’s in the US (1999, pp. 199–200). Although [Bewley](#) emphasized employers’ reluctance to cut wages, he did devote his chapter 12 to “Experiences with Pay Reduction.” On pages 199–200, he reported,

²¹Using the sample of Table 9, we estimate a similar Probit model as in Table 6. In addition to the variables in Table 6, we include a dummy variable which equals one if the worker’s wage rate at $t - 1$ was above the median wage in the establishment she/he worked for. The estimated coefficient of the dummy variable is 0.307 with its standard error estimate 0.007, implying that, with other things being held constant including the worker’s relative position in the entire wage distribution, higher wage earners within an establishment are more likely to experience a wage reduction compared to lower wage earners.

“Some companies did cut or freeze the pay of groups of employees whose pay was felt to be excessive.” Earlier research by [Blinder and Choi \(1990\)](#) conducted similar interviews with the manager of compensation or the personnel director of 19 firms in New Jersey and eastern Pennsylvania, and found that nominal wage cuts were surprisingly prevalent in the late 1980s when the economy was in a boom period. Regarding reasons for pay cuts, the paper writes, “Generally, wage reductions made to save the firm from failure or align wages with those of competitors are viewed as justifiable and fair while those made just to raise profits are not (p. 1008).”

5 Robustness Tests

Despite the strong matching conditions applied in the current analysis, there still remains a concern that the current analytical results may be affected by incorrect matches of two individuals with the same characteristics. This happens when an individual sampled in year $t - 1$ is not resampled in year t , and another individual with the same characteristics (including the employer identifier) who was not in the sample in year $t - 1$ newly enters the sample in year t . Even randomly mismatched wages tend to understate the measured degree of nominal wage inflexibility, and thereby exaggerate the degree of wage flexibility. They also tend to make higher wage earners at $t - 1$ ‘lose’ wages and lower wage workers ‘earn’ wages in the following year.

Various tests are conducted to check the robustness of the current results. First, we restrict our sample to those workers in relatively small establishments (5 to 29 workers). As noted in [Appendix A](#), the survey includes all the workers of these establishments in the ‘sample’. Then the same matching conditions adopted in the current analysis are applied to the subsample. In particular, whenever two or more individuals share a certain set of characteristics, all of them are deleted from the sample. This process guarantees only correct matches in the final analysis sample. This is so because, with all workers in an establishment being

included in the sample, the process rules out the possibility of an individual being replaced by another worker with the same characteristics (aforementioned) and leaves only those who have unique characteristics in the sample. Then we redo all our previous analyses using this subsample. The new results are remarkably similar to those from the full sample, including the analytical results at the establishment level. For brevity, however, Appendix D reports only the results comparable to Figure 2, Table 1, and some of Table 5.²² To repeat, at least one in every four job stayers experienced nominal wage reductions during our sample period, few experienced nominal wage freezes, and higher-wage workers are more likely to receive nominal wage reductions than lower-wage earners. Obviously, this transparent matching process is applicable only for the relatively small establishments. As already discussed in Table 5 (also in Tables B1 through B4), however, little difference is observed across different establishment sizes in the measured extent of nominal wage flexibility/inflexibility.²³

Second, using the entire sample, we directly assess the probability that a longitudinally matched job stayer under our matching conditions is actually a wrong match of two different workers with the same characteristics. Our previous discussion suggests that a wrong match is a possibility for relatively large establishments that sample a portion of workers from the entire payroll. An incorrect match could result from a joint occurrence of the following three events: (i) a person who is already in the sample in year $t - 1$ is excluded from the sample in year t , (ii) another person from the same establishment who is not sampled in year $t - 1$ is now included in the following year's sample, and (iii) the two people have identical characteristics considered in the current analysis. Because the probability of being in the sample of an establishment varies across different groups by the establishment size,

²²Full results are electronically available upon request.

²³ For this subsample of workers in relatively small establishments, we repeat the same analysis with less restrictive matching conditions. Precisely, to identify a job stayer, we require only four conditions: the same establishment identifier number between two adjacent survey years, the same month and year of entry into the current establishment, the same birth year, and gender. Because all workers in an establishment are included in the sample, and because 'duplicated' individuals are excluded from the sample, this process also leaves only correctly matched stayers in the sample. While this process generates a much greater sample size relative to the case of adopting the stronger restrictions previously mentioned, little difference is observed in the final result between the two cases. These results are also supplied upon request.

we assess the probability separately for each group. Data shows that the probability that a set of characteristics are shared by more than one person also varies across different size groups. For each group of establishments, we first compute each year’s probability of a worker being selected as a weighted-average of the selection probabilities for permanent workers and temporary workers, with the appropriate weights being their relative sample sizes. For each year-group cell, we then estimate the probability of a worker sharing a full set of her/his characteristics adopted in the current analysis with anyone in the sample (and therefore, is deleted from the sample) by finding the proportion of workers who have the same characteristics among the total workers in the sample. Data shows that the estimated probability of ‘duplication’ increases with the establishment size.²⁴ Then, for each cell, the probability of an incorrect match is computed as a product of the three marginal probabilities of the aforementioned three events.²⁵ Finally, the overall probability of an incorrect match is computed as a weighted average of the size-specific probabilities, with the share of each size group among all the sampled workers being the appropriate weight, which turns out to be 0.01567. A back-of-the-envelope calculation shows that the estimated probability has little impact on our final conclusion. For example, Table 1 reports that the proportion of nominal wage reductions ranges from 25.3% to 56% depending on the year. Assuming that all incorrect matches work in the direction of overstating the proportion of nominal wage reductions, our adjusted estimates range from 24.9% to 55.1%. Similarly, this adjustment factor makes little difference in the main finding of Table 5, which is that higher wage earners are more likely to experience nominal wage cuts.

²⁴Precisely, when averaged across years, the probability that a randomly selected individual has a duplicated identification number (made of a set of characteristics) with anyone in the sample is 2% for those employed in establishments with 5 to 29 employees, 4.83% for 30 to 99, 7% for 100 to 299, 9.5% for 300 to 499, 12.67% for 500 to 999, 18.17% for 1,000 to 4,999, and 30.33% for 5,000 or more.

²⁵Intuitively, focusing only on the probability of being in the sample, an incorrect match becomes most likely when the probability is 0.5. When averaged across years, the probability of being in the sample (as a weighted average of the two selection probabilities) for permanent and temporary workers is 100% for those employed in establishments with 5 to 29 employees, 81.99% for 30 to 99, 53.75% for 100 to 299, 39.27% for 300 to 499, 36.04% for 500 to 999, 22.93% for 1,000 to 4,999, and 10% for 5,000 or more.

6 Conclusion

Since [Keynes \(1936\)](#), macroeconomists have firmly believed that workers’ resistance to nominal wage reductions can constrain real wage adjustments to negative demand shocks, and this nominal wage stickiness might exacerbate rising unemployment during recessions. Obviously the downward wage pressure, and therefore the chance of observing DNWR, becomes greater in a period of lower inflation, as employers can reduce real wages while granting nominal wage increases in the period of high inflation. The cost of low inflation was previously emphasized by [Tobin \(1972\)](#), who argued that moderate levels of inflations may “grease the wheels of the labor market” by making the DNWR constraint less binding and therefore making a unit of labor less costly than it would otherwise be under low inflation. As noted in [Figure 1](#), the Korean economy experienced a combination of low economic growth and low inflation from the late 2000s to the early 2010s. Whether DNWR was prevalent or not depends on, among other things, how both workers and employers reacted to the economic environments.

Analysis of a special dataset constructed from the Survey on Labor Conditions by Type of Employment finds evidence that does not support the downward nominal wage rigidity hypothesis in this period. At least one in every four job stayers experienced nominal wage cuts, and few experienced nominal wage freezes. In fact, the measured degree of downward nominal wage flexibility is somewhat greater in Korea than in Great Britain and the US, which are believed to have the most flexible labor markets among OECD countries. Furthermore, the empirical distributions of year-to-year individual nominal wage changes are approximately symmetric around their central tendencies, and missing mass is hardly observed to the left of zero. This is particularly true for 2008–2009 when the economy shows an almost zero growth rate and low inflation, suggesting that even nominal wages were procyclical in Korea during the Great Recession and the ungreased wheels of the Korean labor market were working. This in turn may be responsible (at least partly) for the fact that,

during the Great Recession, the unemployment rate did not rise much in Korea despite the zero growth rate.

More importantly, our analysis at the establishment level uncovers the nature of this downward nominal wage flexibility. The observed downward flexibility does not result from a fraction of employers cutting most of their workers' wages, but from a majority of employers cutting a fraction of their workers' wages fairly routinely. It is also found that the size of nominal wage reductions is substantial, and employers tend to choose high wage earners for wage cuts.

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Tables

Table 1: Extent of Nominal Wage Flexibility/Inflexibility: Average Hourly Earnings

Definition of Wage Freeze		2008-2009	2009-2010	2011-2012	2012-2013
$\Delta \log W = 0$	Reductions	49,627 (56.03%)	38,859 (35.62%)	26,354 (25.97%)	28,593 (25.26%)
	Freezes	3 (0.00%)	229 (0.21%)	19 (0.02%)	42 (0.04%)
$-0.005 < \Delta \log W < 0.005$	Reductions	48,408 (54.65%)	37,556 (34.43%)	25,585 (25.21%)	27,432 (24.23%)
	Freezes	2,405 (2.72%)	3,520 (3.23%)	1,618 (1.59%)	2,326 (2.05%)
Total job stayers		88,575	109,085	101,490	113,211

Notes: The hourly wage rate is defined as the ratio of actual monthly regular pay to actual monthly regular hours, excluding overtime/incentive pay and overtime hours. Numbers in parentheses represent the percentage of the frequency of each case among the total number of job stayers in each matched year.

Table 2: Extent of Nominal Wage Flexibility/Inflexibility: Monthly Earnings

Definition of Wage Freeze		2008-2009	2009-2010	2011-2012	2012-2013
$\Delta \log W = 0$	Reductions	34,440 (40.26%)	36,412 (34.58%)	28,358 (28.83%)	34,403 (32.15%)
	Freezes	155 (0.17%)	581 (0.53%)	91 (0.09%)	157 (0.14%)
$-0.005 < \Delta \log W < 0.005$	Reductions	35,657 (38.88%)	37,719 (33.38%)	29,255 (27.94%)	36,399 (30.39%)
	Freezes	2,401 (2.72%)	4,861 (4.46%)	2,085 (2.05%)	4,215 (3.72%)
Total job stayers		88,575	109,085	101,490	113,211

Notes: Actual monthly regular pay, excluding overtime/incentive pay. Numbers in parentheses represent the percentage of the frequency of each case among the total number of job stayers in each matched year.

Table 3: Extent of Nominal Wage Flexibility/Inflexibility: Hourly Wage Rate of Hourly Workers

Definition of Wage Freeze		2008-2009	2009-2010	2011-2012	2012-2013
$\Delta \log W = 0$	Reductions	3,182 (56.94%)	2,715 (38.07%)	1,890 (26.54%)	1,782 (22.52%)
	Freezes	0 (0%)	25 (0.35%)	2 (0.03%)	4 (0.05%)
$-0.005 < \Delta \log W < 0.005$	Reductions	3,122 (55.87%)	2,626 (36.82%)	1,829 (25.68%)	1,691 (21.37%)
	Freezes	162 (2.90%)	238 (3.34%)	115 (1.61%)	162 (2.05%)
Total job stayers		5,588	7,131	7,122	7,914

Notes: The hourly wage rate of hourly workers, excluding overtime/incentive pay. Numbers in parentheses represent the percentage of the frequency of each case among the total number of job stayers in each matched year.

Table 4: Fraction of Nominal Wage Reductions by Wage Definition

	2008-2009	2009-2010	2011-2012	2012-2013
Regular pay	49,627 (56.03%)	38,859 (35.62%)	26,354 (25.97%)	28,593 (25.26%)
Overtime included	48,920 (55.23%)	38,429 (35.23%)	27,451 (27.05%)	29,803 (26.33%)
Incentives included	47,991 (54.18%)	39,846 (36.53%)	30,253 (29.81%)	29,810 (26.33%)
Total job stayers	88,575	109,085	101,490	113,211

Notes: Numbers in parentheses represent the percentage of the frequency of each case among the total number of job stayers in each matched year.

Table 5: Who Experiences Nominal Wage Reductions? Average of 2008–2009 through 2012–2013

	Education		Establishment Size			
	High school/less	Some college	5 to 29	30 to 99	100 to 499	500 or more
Wage reductions	17,105 (36.80%)	18,754 (33.12%)	6,580 (32.70%)	9,410 (32.95%)	13,817 (37.34%)	6,052 (34.76%)
N	46,476	56,615	20,123	28,554	37,004	17,409

	Gender		Occupation (One Digit)			
	Men	Women	Managers	Professionals	Clerks	Service workers
Wage reductions	25,260 (35.08%)	10,598 (34.09%)	501 (50.64%)	10,369 (34.02%)	7,194 (30.95%)	1,484 (41.53%)
N	71,999	31,091	989	30,481	23,243	3,574

	Tenure		Occupation (One Digit)				
	Less than 3 years	3 years or more	Sales workers	SAFF	Craftsman	PMOA	Laborers
Wage reductions	8,186 (34.39%)	27,672 (34.90%)	1,599 (33.95%)	139 (36.46%)	2,642 (37.26%)	10,089 (37.39%)	1,841 (32.64%)
N	23,803	79,288	4,711	381	7,091	26,981	5,640

	Union status		Employment type	
	Union workers	Non-union	Permanent	Temporary
Wage reductions	11,522 (37.23%)	24,337 (33.73%)	32,929 (34.55%)	2,929 (37.65%)
N	30,948	72,143	95,309	7,781

	Wage percentile at $t - 1$						
	[0, 10]	[0, 20]	(20, 40]	(40, 60]	(60, 80]	(80,100]	[90, 100]
Wage reductions	2,245 (21.35%)	5,557 (26.89%)	7,009 (32.26%)	7,858 (35.97%)	7,483 (37.30%)	7,951 (42.32%)	4,156 (46.72%)
N	10,515	20,668	21,725	21,847	20,061	18,789	8,896

Notes: Professionals: Professionals & related workers; SAFF: Skilled agricultural, forestry and fishery workers; Craftsman: Craft and related trades workers; PMOA: Plant, machine operators and assemblers. Appendix Table B reports the results by matched year.

Table 6: Who Experiences Nominal Wage Reductions? Probit Model

Covariate	Coefficients (standard error)	Covariate	Coefficients (standard error)
Tenure	-0.017*** (0.001)	Size: 30–99	(-0.021***) (0.006)
Tenure Square	0.000** (0.000)	Size: 100–499	0.027*** (0.006)
High School	-0.039*** (0.009)	Size: More than 500	-0.024** (0.008)
College	-0.137*** (0.011)	Female	0.150*** (0.005)
University	-0.316*** (0.011)	Union	0.029*** (0.006)
Graduate School	-0.405*** (0.014)	Regular Worker	-0.195*** (0.009)
Professionals	-0.387*** (0.021)	Wage Pctile (20,40] at $t - 1$	0.315*** (0.007)
Clerks	-0.457*** (0.022)	Wage Pctile (40,60] at $t - 1$	0.528*** (0.007)
Service Workers	-0.054* (0.024)	Wage Pctile (60,80] at $t - 1$	0.699*** (0.008)
Sales Workers	-0.326*** (0.023)	Wage Pctile (80,100] at $t - 1$	1.007*** (0.009)
SAFF Workers	-0.182*** (0.040)	Year 2009–2010	-0.541*** (0.006)
Craftsman	-0.258*** (0.023)	Year 2011–2012	-0.827*** (0.006)
Laborers	-0.267*** (0.024)	Constant	0.386*** (0.026)
	Observations	412,361	
	Log likelihood	-246,258.668	
	Chi-squared	40,331.598	

Notes: See notes to table 5. Education groups: less than high school, high school, some college, four-year university, and graduate school education. Omitted groups: The less-than high school group in education, managers in occupation, wage percentile [0, 20] in the wage distribution at $t - 1$, and 2008–2009 among year dummy variables.

Table 7: Distribution of the Percentage of Employees in an Establishment that Experience a Nominal Wage Cut by Year

(A) All Establishments

Percentage of nominal wage reductions	2008–2009	2009-2010	2011–2012	2012–2013
$x = 0$	23.9	37.4	49.28	48.35
$0 < x \leq 10$	2.53	5.79	6.75	6.48
$10 < x \leq 20$	4.92	8.07	7.76	7.62
$20 < x \leq 30$	4.26	5.53	4.76	4.88
$30 < x \leq 40$	5.76	6.06	5.15	5.42
$40 < x \leq 50$	8.29	7.06	5.53	5.12
$50 < x \leq 60$	3.72	3.09	1.68	2.05
$60 < x \leq 70$	5.48	3.95	2.45	2.80
$70 < x \leq 80$	6.43	3.96	2.60	2.52
$80 < x \leq 90$	5.26	2.86	2.07	2.14
$90 < x < 100$	3.63	1.81	0.86	0.94
$x = 100$	25.82	14.41	11.12	11.69
Total	100	100	100	100
N	7,950	9,287	8,588	9,898

Notes: Employees refer to those who stay in the same job within an establishment.

(B) Establishments with 10 employees or more in the sample

Percentage of nominal wage reductions	2008–2009	2009-2010	2011–2012	2012–2013
$x = 0$	7.89	17.39	28.19	30.84
$0 < x \leq 10$	7.59	16.50	20.36	18.90
$10 < x \leq 20$	7.06	12.30	13.58	12.35
$20 < x \leq 30$	6.80	8.59	8.00	8.23
$30 < x \leq 40$	6.72	7.33	6.42	5.96
$40 < x \leq 50$	8.01	6.44	4.60	3.89
$50 < x \leq 60$	6.46	6.26	2.84	3.66
$60 < x \leq 70$	8.46	5.12	2.67	3.66
$70 < x \leq 80$	9.82	5.21	3.19	2.98
$80 < x \leq 90$	10.23	4.94	3.76	3.18
$90 < x < 100$	10.88	5.16	2.60	2.74
$x = 100$	10.08	4.78	3.79	3.63
Total	100	100	100	100
N	2,648	3,261	2,849	3,392

Notes: Employees refer to those who stay in the same job within an establishment.

Table 7: Distribution of the Percentage of Employees in an Establishment That Experience Nominal Wage Cut By Year (Cont'd)

(C) Establishments with 20 employees or more in the sample

Percentage of nominal wage reductions	2008–2009	2009-2010	2011–2012	2012–2013
$x = 0$	5.52	11.62	21.10	22.55
$0 < x \leq 10$	7.69	18.1	25.93	25.49
$10 < x \leq 20$	7.16	13.38	15.23	13.42
$20 < x \leq 30$	7.24	9.14	8.67	9.07
$30 < x \leq 40$	6.87	7.32	6.78	6.00
$40 < x \leq 50$	8.51	7.02	4.33	3.98
$50 < x \leq 60$	7.24	6.17	3.07	4.04
$60 < x \leq 70$	8.06	6.30	3.07	4.29
$70 < x \leq 80$	10.22	5.87	2.94	2.76
$80 < x \leq 90$	11.12	5.39	3.77	3.06
$90 < x < 100$	13.73	6.18	3.00	3.00
$x = 100$	6.64	3.51	2.10	2.33
Total	100	100	100	100
N	1,340	1,652	1,431	1,632

Notes: Employees refer to those who stay in the same job within an establishment.

(D) Establishments with 30 employees or more in the sample

Percentage of nominal wage reductions	2008–2009	2009-2010	2011–2012	2012–2013
$x = 0$	3.86	9.46	13.59	18.49
$0 < x \leq 10$	6.26	19.13	29.55	28.62
$10 < x \leq 20$	7.59	14.35	16.83	13.25
$20 < x \leq 30$	6.52	9.04	9.60	10.36
$30 < x \leq 40$	6.13	7.17	7.36	7.02
$40 < x \leq 50$	8.92	7.28	3.87	4.12
$50 < x \leq 60$	7.19	6.13	2.62	4.01
$60 < x \leq 70$	8.52	6.55	3.24	4.12
$70 < x \leq 80$	11.98	5.82	2.74	2.78
$80 < x \leq 90$	11.58	5.30	4.74	2.67
$90 < x < 100$	15.45	6.76	3.86	3.23
$x = 100$	5.99	3.01	2.00	1.34
Total	100	100	100	100
N	751	962	802	898

Notes: Employees refer to those who stay in the same job within an establishment.

Table 8: Average Nominal Wage Reduction among Those Who Experience a Nominal Wage Cut in an Establishment

	2008-2009	2009-2010	2011-2012	2012-2013
Mean	12.15%	11.22%	12.15%	11.57%
Median	9.85%	8.72%	9.60%	8.59%
Inflation, CPI/PPI	2.76/-0.21	2.96/3.81	2.19/0.69	1.31/-1.60
Growth rate	0.7	6.5	2.3	2.9
<i>N</i>	1,187	1,236	864	953

Notes: The results are based on the sample of establishments that have at least 20 employees in the dataset and at least three employees who experience nominal wage cuts. (Employees refer to those who stay in the same job within an establishment.) The results remain similar whether those establishments with one or two wage reductions are included in the sample, and/or whether establishments with between 20 and 29 employees are excluded from the sample.

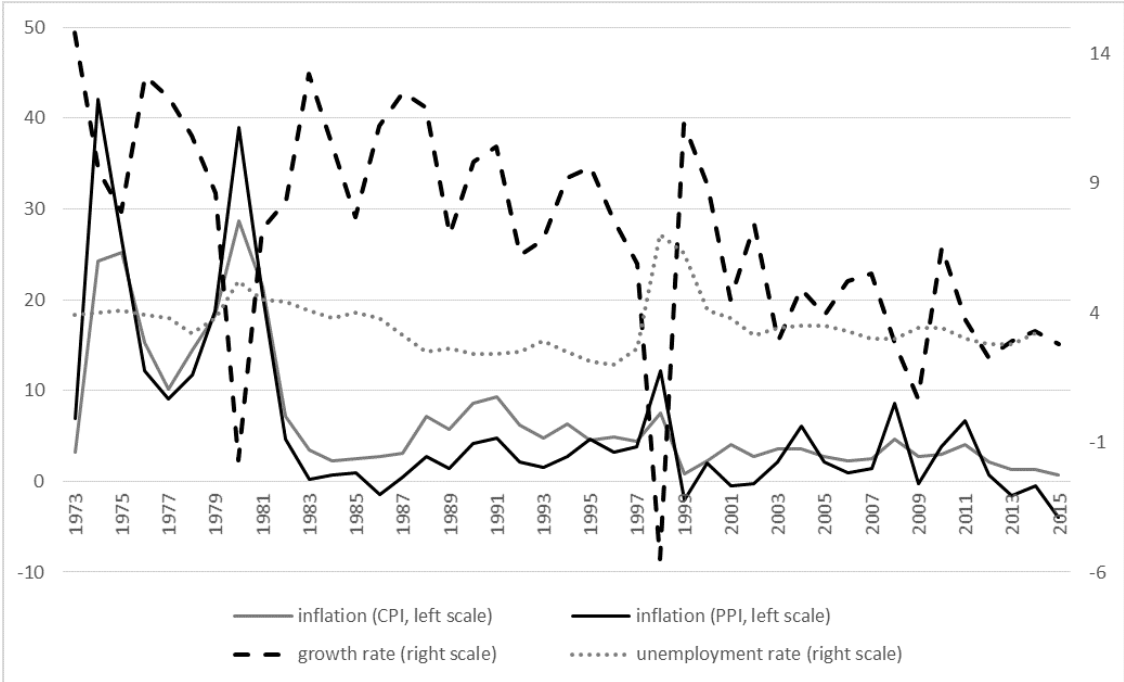
Table 9: Whose Wages Are Cut Within Establishments?

	2008–2009		2000–2010		2011–2012		2012–2013	
	Reduction	Increase	Reduction	Increase	Reduction	Increase	Reduction	Increase
Above median wage [†]	0.60	0.36	0.60	0.38	0.61	0.42	0.61	0.42
Mean wage	14.00	11.71	13.90	11.78	16.07	14.25	17.47	15.36
Mean age	40.28	40.23	41.50	40.13	40.77	40.36	41.13	40.47
Mean tenure	8.61	7.95	9.07	8.36	8.27	8.69	8.85	8.47
Female [†]	0.32	0.27	0.27	0.31	0.29	0.31	0.32	0.32
Union [†]	0.37	0.40	0.37	0.36	0.31	0.31	0.32	0.31
Regular workers [†]	0.90	0.90	0.91	0.89	0.80	0.89	0.89	0.89
College [†]	0.53	0.49	0.52	0.53	0.55	0.58	0.57	0.59
Managers	0.02	0.00	0.03	0.00	0.01	0.01	0.00	0.01
Professionals	0.32	0.28	0.34	0.32	0.33	0.32	0.31	0.32
Clerks	0.20	0.19	0.14	0.21	0.16	0.23	0.21	0.20
Service workers	0.03	0.03	0.02	0.03	0.04	0.03	0.05	0.04
Sales workers	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.04
SAFF	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Craftsman	0.08	0.05	0.06	0.06	0.07	0.07	0.08	0.08
PMOA	0.29	0.35	0.34	0.30	0.26	0.24	0.24	0.24
Laborers	0.04	0.08	0.05	0.06	0.09	0.06	0.07	0.07
<i>N</i>	960		1,106		808		875	

Notes: [†] represents the ratio of employees with each characteristic among those who experience nominal wage reductions or increases. Professionals: Professionals & related workers; SAFF: Skilled agricultural, forestry and fishery workers; Craftsman: Craft and related trades workers; PMOA: Plant, machine operators and assemblers. The results are based on the sample of establishments that have at least 20 employees in the dataset, at least three employees who experience nominal wage cuts, and at least three employees who experience nominal wage increases. The results remain similar whether establishments with between 20 and 29 employees are excluded from the sample.

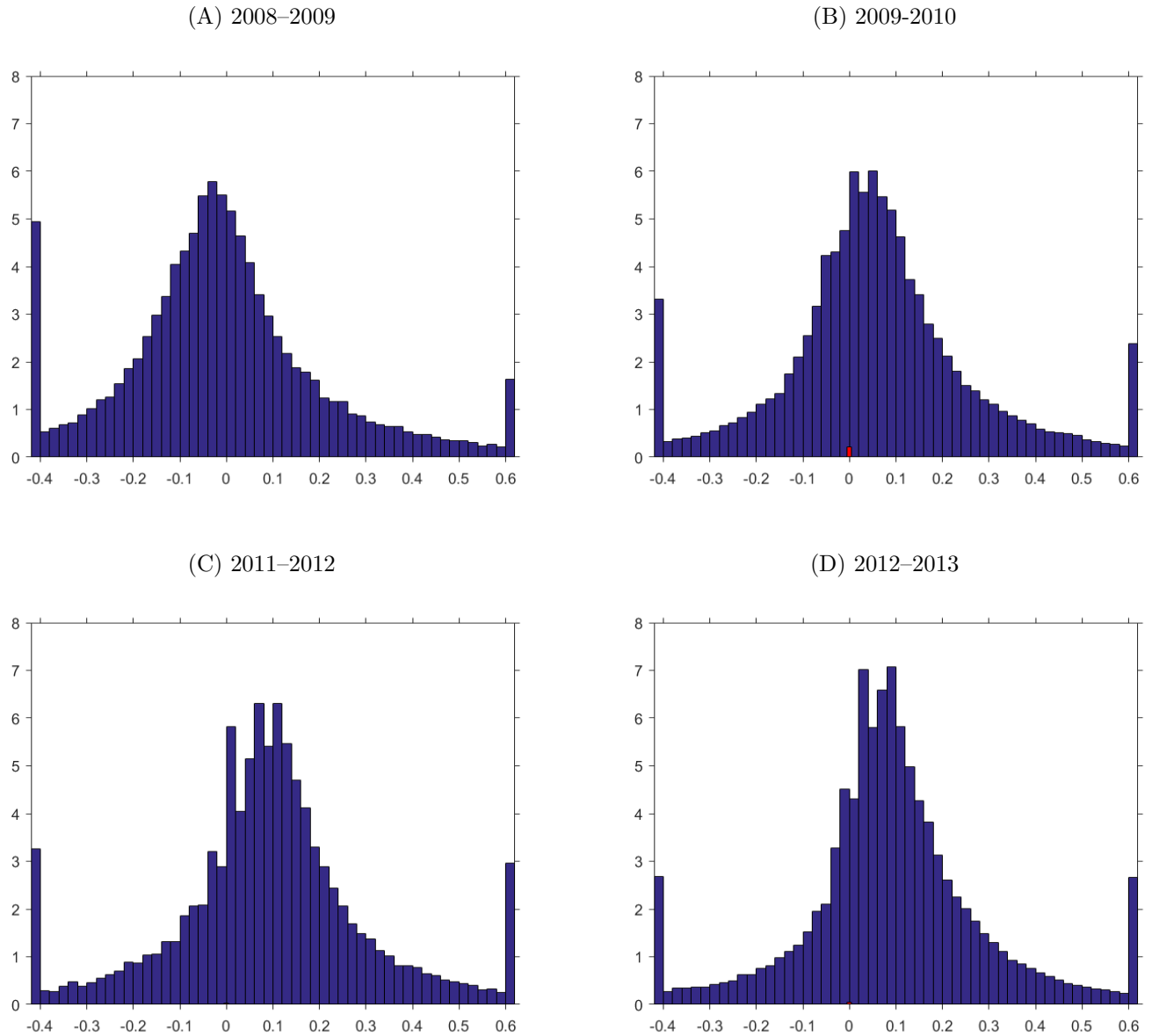
Figures

Figure 1: Inflation and Growth



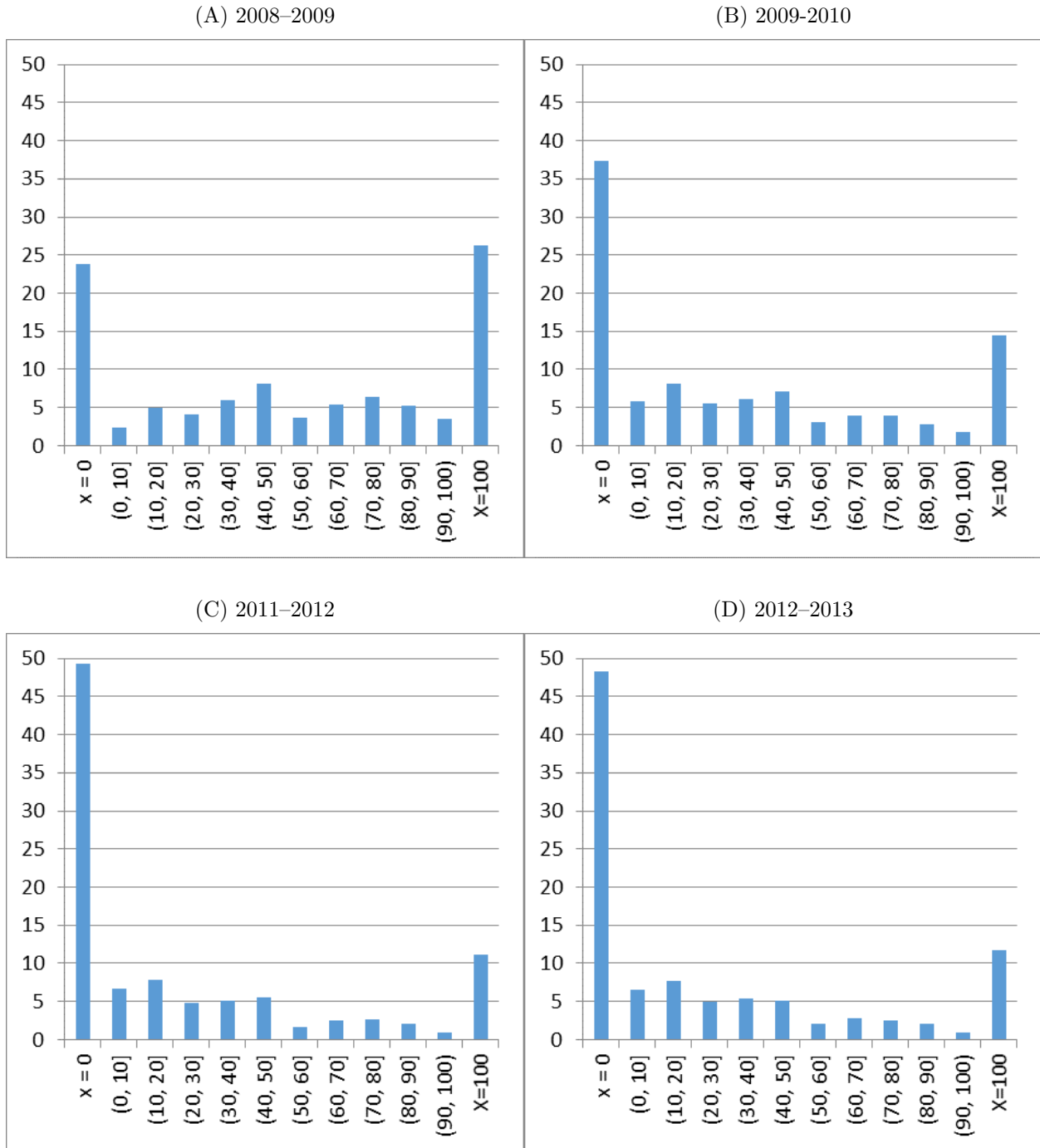
Notes: Source: Bank of Korea. PPI: Producer Price Index. CPI: Consumer Price Index.

Figure 2: Distribution of Nominal Wage Changes among Job Stayers



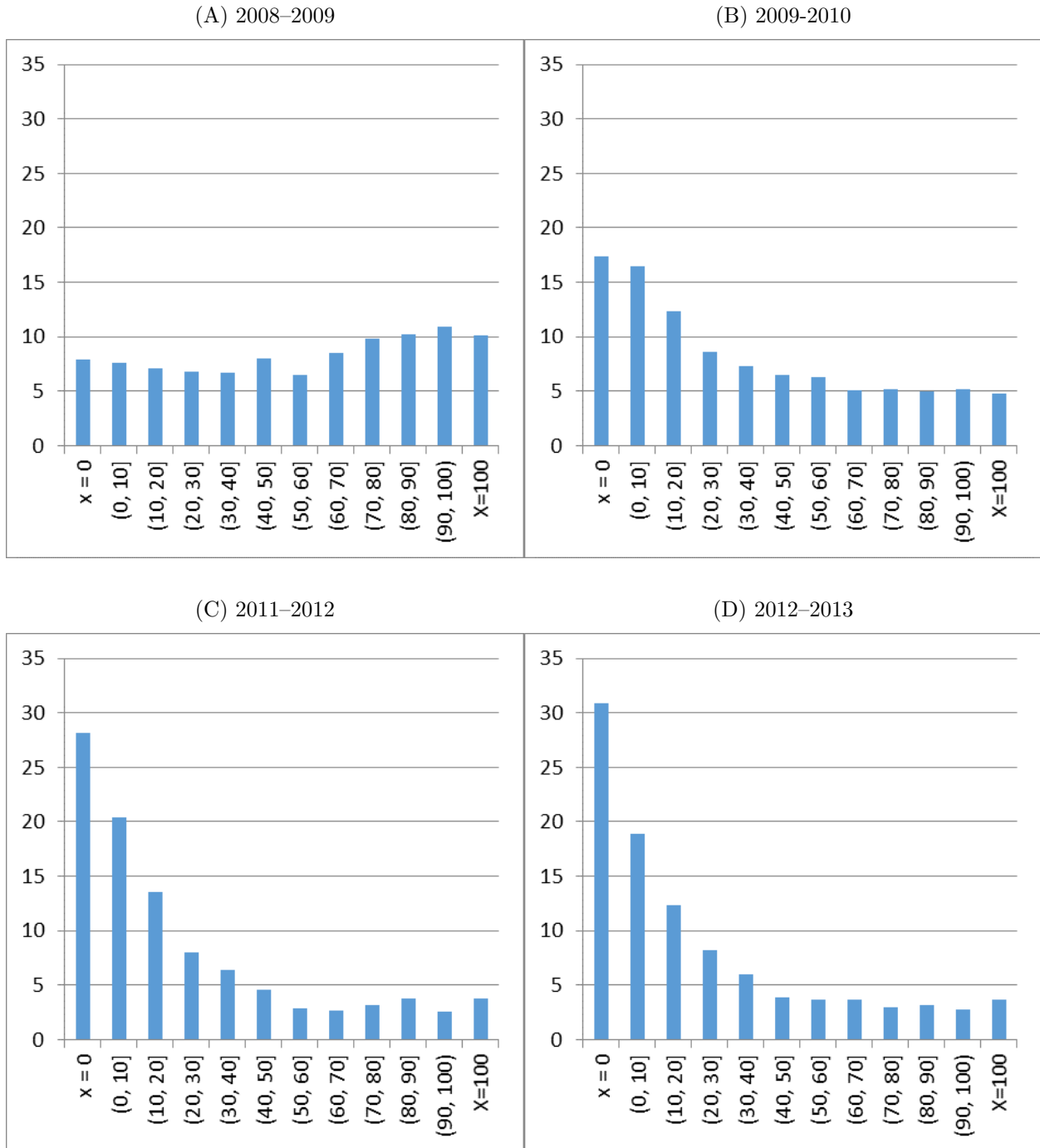
Notes: Source: Authors' calculation based on the SLCTE data. The hourly wage rate is defined as the ratio of actual monthly regular pay to actual monthly regular hours, excluding overtime/incentive pay and overtime hours. The bin to the right of zero shows the percentage of workers whose change in log nominal wage was positive, but less than or equal to 0.02. The next bin contains those whose change in log nominal wage was greater than 0.02 and less than or equal to 0.04, and so on. The bins to the left of zero are constructed symmetrically.

Figure 3A: Histograms of the Percentage of Employees in an Establishment that Experience a Nominal Wage Cut by Year (All Establishments)



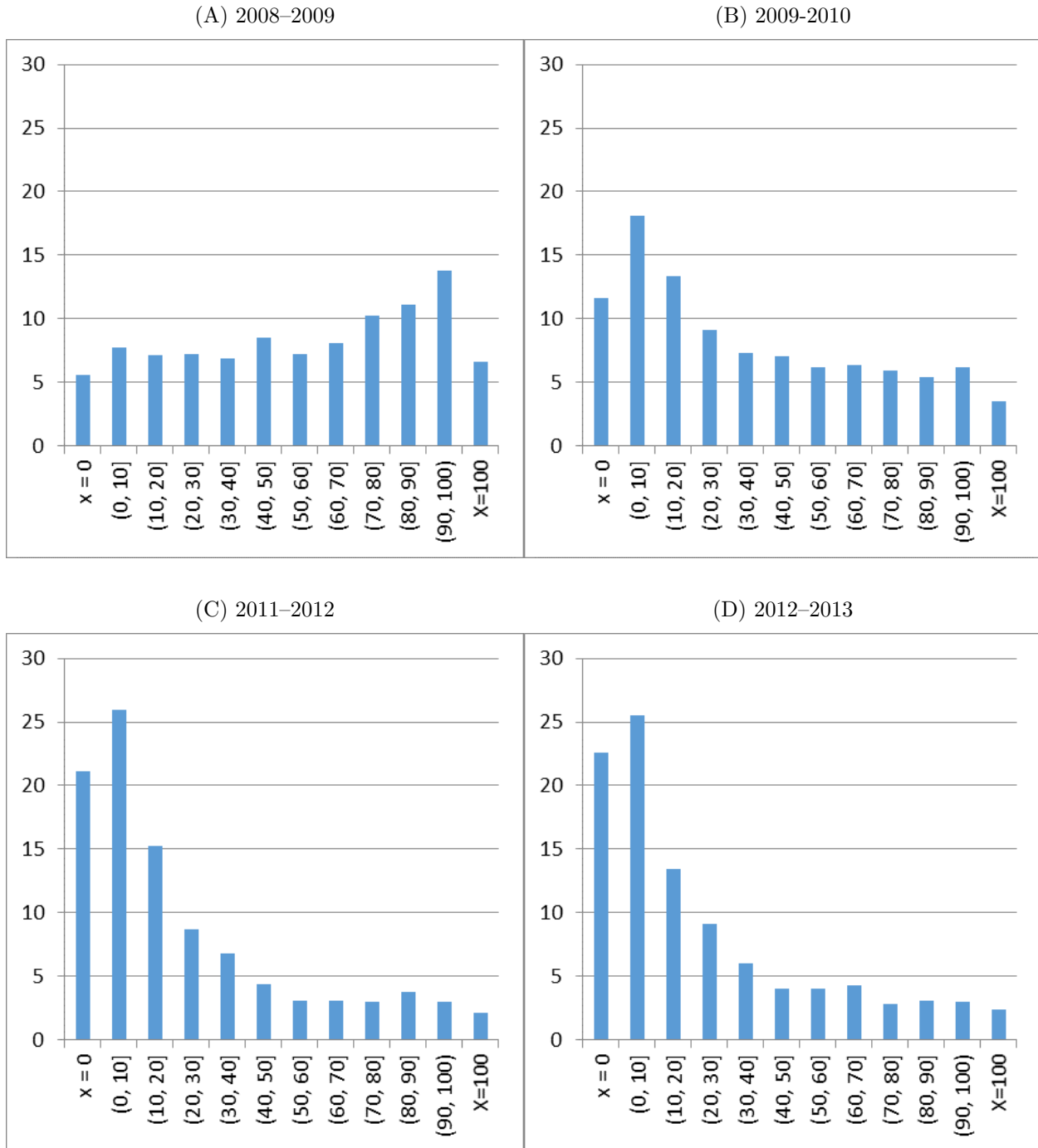
Notes: Employees refer to those who stay in the same job within an establishment.

Figure 3B: Histograms of the Percentage of Employees in an Establishment that Experience a Nominal Wage Cut by Year (Establishments with 10 Employees or More in the Sample)



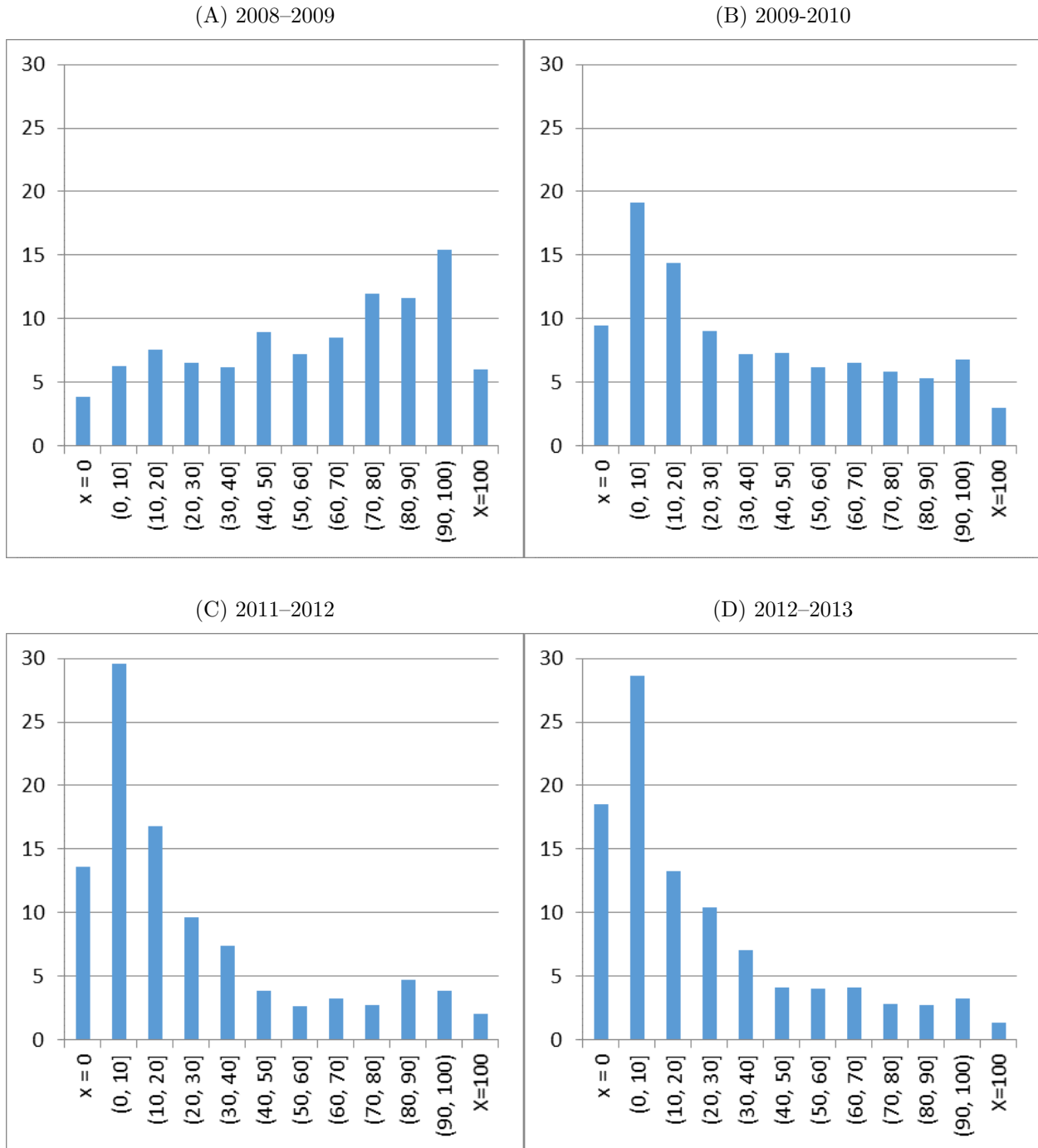
Notes: Employees refer to those who stay in the same job within an establishment.

Figure 3C: Histograms of the Percentage of Employees in an Establishment that Experience a Nominal Wage Cut by Year (Establishments with 20 Employees or More in the Sample)



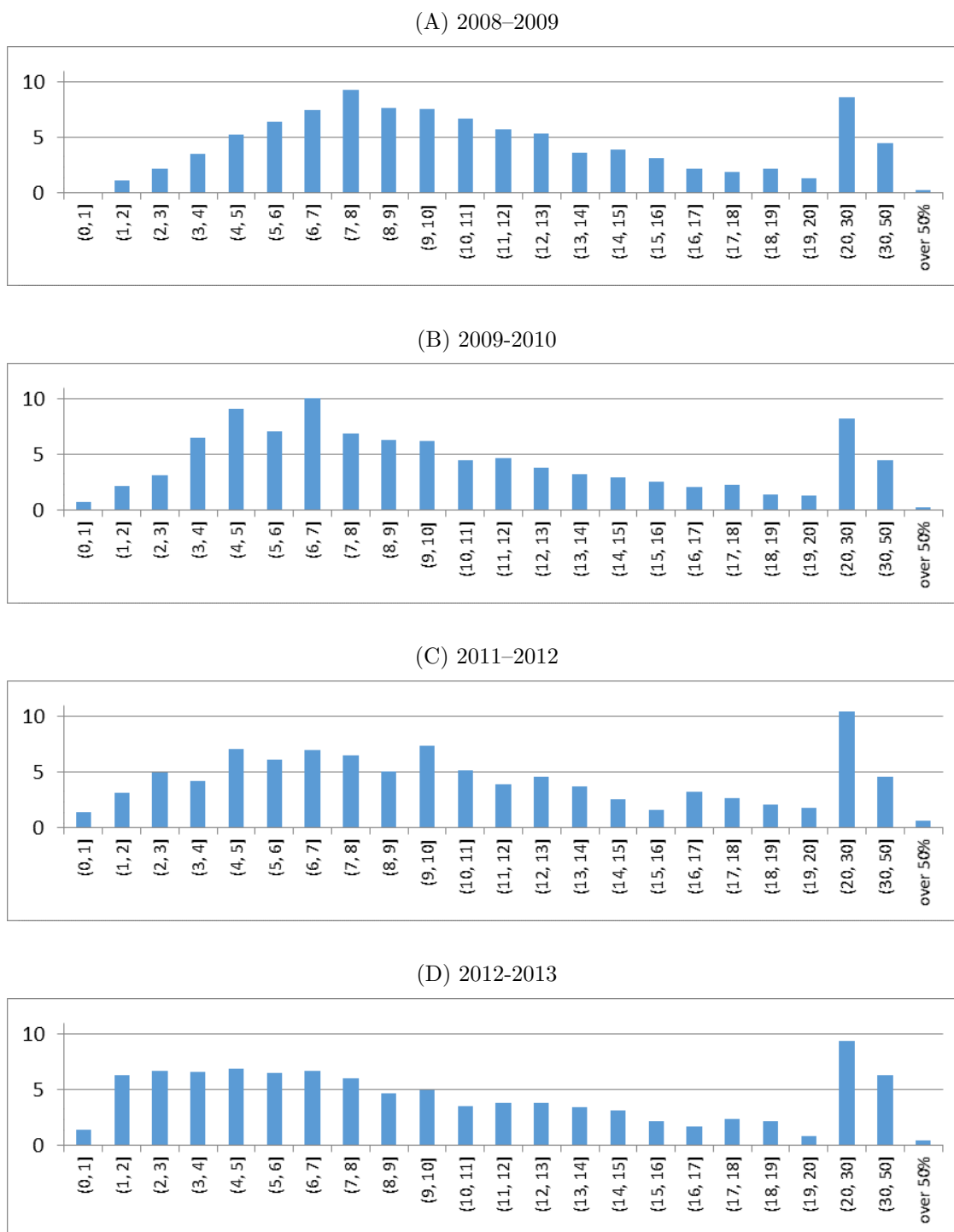
Notes: Employees refer to those who stay in the same job within an establishment.

Figure 3D: Histograms of the Percentage of Employees in an Establishment that Experience a Nominal Wage Cut by Year (Establishments with 30 Employees or More in the Sample)



Notes: Employees refer to those who stay in the same job within an establishment.

Figure 4: Histograms of Average Wage Reduction of Employees in an Establishment that Experience Nominal Wage Reductions



Notes: The results are based on the sample of establishments that have at least 20 employees in the dataset and at least three employees who experience nominal wage cuts. (Employees refer to those who stay in the same job within an establishment.) The results are robust whether those establishments with one or two wage reductions are included in the sample, and/or whether establishments with between 20 and 29 employees are additionally excluded from the sample.

Appendix

Appendix A Data Description

Since 2008, the Survey on Labor Conditions by Type of Employment (SLCTE) has sampled about 32,000 establishments on an annual basis (which corresponds to about 2 percent of all the establishments with one employee or more in South Korea), and collected information on various characteristics of the establishments and those of employees in the establishments. As stated on the official site of the Ministry of Employment and Labor, the primary goal of the survey is to study employment conditions of permanent and temporary workers by personal characteristics (e.g., gender, age, education, tenure) and establishment characteristics (industry, size of establishment), and to develop effective policies for temporary workers.

Our analysis is confined to the establishments with five or more employees. As in Table A1, about 17,000 establishments are included in the sample yearly, which corresponds to about three percent of all establishments with five employees or more in the economy. As noted previously, one of the main advantages of the current sample lies in the large sample size, at both the establishment and individual levels. In particular, the way the SLCTE samples individual workers within each establishment ensures enough individuals in the sample per establishment. Precisely, for those establishments with 29 employees or less, the survey includes all the workers in the sample, permanent or temporary workers; for those with 30 to 99 workers, the survey includes all of the temporary workers and 80 percent of the permanent workers in the sample; for those with 100 to 299, 80 percent of temporary and 50 percent of permanent workers; for 300 to 499, 67 percent and 33 percent; for 500 to 999, 50 percent and 33 percent; for 1,000 to 4,999, 33 percent and 20 percent; and for more than 5,000, 10 percent of each group of temporary and permanent workers.

Matching establishments longitudinally is straightforward, as the survey releases an establishment identifier. As in the penultimate column of Table A1, the year-to-year matching rate, computed as the ratio of the number of matched establishments to the average number of sampled establishments between two adjacent years, is about 87 percent during the recent financial crisis, and increases to 92 percent for 2012–2013. Because some establishments are additionally excluded in the process of matching individuals longitudinally, the number of matched establishments in our final analysis sample is smaller than what is suggested by the matching rate.

As noted in the text, the survey does not contain individual identification numbers. Various personal characteristics are used for year-to-year matches of individual workers. As the survey reports who works for which employer (establishment), all that we need to

do is to identify employees within each establishment. To do so, we use various personal characteristics. Precisely, to be included in the final sample of job stayers, an employee should have the same employer identifier between two adjacent survey years, the same gender status, and the same starting date of employment at the current establishment. In addition, as the survey collects information during the same reference month (June) every year, ages should grow by one year between two neighboring surveys. To further reduce the probability of matching two different individuals with the same characteristics, we also require that longitudinally matched individuals should have the same characteristics in the following variables: education, occupation (4-digit), industry (3-digit), employment type (permanent vs. temporary), work type (full-time, part-time, work at home, etc.), and union status. These strong restrictions excluded a large number of individuals from the final analysis sample, which in turn reduced the number of matched establishments. The final sample involves approximately 9,000 establishments and about 100,000 job stayers in an average matched year. On average, about 11 job stayers are attached to an establishment in the sample. As in the last column of Appendix Table A2, however, a non-negligible portion of establishments have only one employee in the sample (about 15 percent of the establishments in the final sample).

While the strong matching conditions are intended to increase the probability that the resulting longitudinal matches are actual matches, it excluded many potentially correct matches from the sample. In addition, we excluded from the sample those individuals who are either younger than 25 or older than 59, and also excluded the top 1 percent and bottom 1 percent of individuals in each year's final wage distribution. Appendix Tables A3 through A5 compare excluded and included observations in various individual and establishment characteristics. Overall, little difference is observed between the two samples. As an exception, relatively small establishments are more likely to be excluded from our final analysis sample. It was initially suspected that the measured extent of downward nominal wage flexibility *would* be understated in the current sample if wages *were* downwardly more flexible in small, relative to large, establishments. As shown in Table 3, however, little heterogeneity is detected in the extent of nominal wage flexibility across different size groups.

Despite the strong matching conditions applied in the current analysis, we cannot rule out a possibility that two different workers with the same characteristics (including establishment identifier) are incorrectly matched when one worker sampled in year $t - 1$ is not resampled in year t , and the other who was out of the sample in year $t - 1$ newly enters the sample in year t . Our analysis in Section 5, however, concludes that the probability of that event is about 1.57 percent, which has little impact on our final estimates.

Table A1: Survey on Labor Conditions by Type of Employment (SLCTE): Establishments

	All establishments		Establishments with 5 or more employees		Year of re-sampling	Matching years	Matched establishment	Matching rate	Final sample additional restrictions
	Economy	Sample	Economy	Sample					
2008	1,484,049	30,132(2.03%)	525,917	16,919(3.22%)	Yes	–	–	–	–
2009	1,507,158	29,654(1.97%)	543,792	16,981(3.12%)	No	2008-2009	14,716	86.8	7,950
2010	1,519,850	31,054(2.04%)	524,891	17,836(3.40%)	No	2009-2010	15,144	86.8	9,287
2011	1,607,030	31,663(2.00%)	564,624	17,244(3.05%)	Yes	–	–	–	–
2012	1,687,476	31,673(1.88%)	612,596	17,564(2.87%)	No	2011-2012	15,232	87.5	8,588
2013	1,752,503	31,663(1.81%)	645,105	17,633(2.73%)	No	2012-2013	16,145	91.7	9,898

Notes: The SLCTE resampled establishments in 2011 and 2014. The matching rate is computed as the ratio of the number of matched establishments to the average number of sampled establishments between two adjacent years.

Table A2: Survey on Labor Conditions by Type of Employment (SOLCTE): Employees

	Number of employees in Establishments w/ 5 or more		Job stayers in the final sample	Number of job stayers in establishment in data set at $t - 1$		
	Economy	Sample		Mean	Median	Only stayer in the establishment
2008	9,145,985	665,797(7.28%)	–	11.14	5	1,311
2009	9,524, 883	663,820(6.97%)	88,575	10.93	6	1,401
2010	10,134,848	687,573(6.78%)	109,085	–	–	–
2011	10,487,593	681,384(6.50%)	–	11.82	5	1,394
2012	10,771,787	699,490(6.49%)	101,490	11.44	6	1,423
2013	11,295,303	708,874(6.28%)	113,211	–	–	–

Sample: We focus on the hourly wages, excluding overtime, for those who are aged between 25 and 59. Each year, we trim the top and bottom one percent of the wage distribution, and focus on the wage changes of job stayers. Individuals are included in the final sample when they have the same characteristics in the following variables between two adjacent years: employer (establishment) identifier, gender, year and month of entry into the current establishment, industry (3-digit) and occupation codes (4-digit), years of completed education, employment type (temporary vs. permanent workers), union status, and establishment size. As the reference month is the same in every survey (June), individuals' ages are to grow by one year between the two years. Finally, if more than one individual has all of the same characteristics in an establishment, all of them are deleted from the sample. These strong requirements not only reduced the number of matched job stayers, but also the number of truly matched establishments. These results address the concern of potential bias in the sample associated with the matching process.

Table A3: Comparison of Excluded and Included Establishments: Industry Distribution at $t - 1$

	2008		2009		2011		2012	
	Excluded	Included	Excluded	Included	Excluded	Included	Excluded	Included
Agricultural, Forestry, Fishery	1.89	1.79	1.77	2.11	1.73	1.79	1.49	1.97
Mining and quarrying	1.34	1.33	1.18	1.39	0.86	1.07	0.93	1.00
Manufacturing	20.86	21.85	21.92	20.99	18.26	21.03	18.66	20.51
Electricity, gas, steam and water supply			1.77	2.08	1.51	2.45	1.34	2.24
Sewerage, waste management, materials recovery and remediation activities	2.03	2.14	1.01	1.01	1.23	1.16	1.14	1.10
Construction	2.63	2.10	2.75	1.99	4.17	2.81	4.32	3.10
Wholesale/Retail	10.72	10.83	10.88	10.58	9.9	9.83	9.88	10.22
Transportation	9.53	13.04	8.72	12.17	8.13	10.12	8.79	9.57
Accommodation and food service activities	5.51	3.45	6.37	3.66	7.72	5.04	8.28	5.24
Information and communications	2.86	2.11	6.57	5.38	4.38	4.02	4.40	4.14
Finance/Insurance	3.66	4.75	4.03	4.52	4.29	4.56	4.48	4.48
Real estate and renting and leasing	4.32	3.46	4.94	3.07	7.87	4.94	7.44	5.14
Professional, scientific and technical activities			5.44	5.11	4.17	4.41	3.92	4.69
Business facilities management and business support services	12.96	7.99	4.22	2.64	6.44	3.38	5.11	4.00
Education	3.79	6.23	4.96	5.70	3.06	4.44	3.17	4.43
Human health and social work activities	7.33	12.57	6.86	11.54	7.42	10.44	7.25	9.82
Arts, sports and recreation related service	5.20	2.10	2.81	2.02	3.42	3.62	3.73	3.55
Membership organizations, repair and other personal services	5.39	4.26	3.79	4.03	5.45	4.89	5.67	4.80
No of establishments	6,811	7,950	5,827	9,287	6,644	8,588	6,247	9,898

Table A4: Comparison of Excluded and Included Establishments: Establishment Size at $t - 1$

	2008		2009		2011		2012	
	Excluded	Included	Excluded	Included	Excluded	Included	Excluded	Included
5-29	71.91	52.72	74.65	55.32	75.62	52.19	73.52	57.57
30-99	15.58	23.12	15.34	22.58	14.31	26.91	15.86	24.63
100-499	10.86	20.20	8.72	18.52	8.59	16.15	8.66	13.78
More than 500	1.64	3.96	1.29	3.57	1.48	4.75	1.95	4.02
No of establishments	6,811	7,950	5,827	9,287	6,644	8,588	6,247	9,898

Notes: Relatively small establishments (5-29) are under-represented, while relatively larger establishments are over-represented in the sample.

Table A5: Comparison of Excluded and Included Individuals in Various Characteristics at $t - 1$

Characteristics	2008		2009		2011		2012	
	Excluded	Included	Excluded	Included	Excluded	Included	Excluded	Included
	(577,205)	(88,575)	(554,712)	(109,085)	(579,875)	(101,490)	(586,258)	(113,211)
Percentage of females	32.23	29.01	32.45	28.32	34.16	30.87	34.12	32.2
Percentage of college graduates	55.37	50.61	56.63	52.73	57.81	57.11	58.22	58.42
Percentage of union workers	28.11	34.45	27.84	32.55	22.61	28.29	23.22	25.66
Ratio of permanent workers	84.63	93.62	83.55	93.35	82.38	91.34	81.11	91.67
Average age	38.44	39.80	38.99	40.16	39.40	40.16	39.78	40.49
Average tenure	6.59	7.85	6.78	8.07	6.61	8.10	6.80	8.08
Average wage	13.59	12.76	12.77	12.28	14.362	14.32	15.54	15.33
Occupation								
Managers	4.94	1.15	2.33	1.01	1.93	0.76	1.74	0.94
Professionals and related workers	23.35	26.95	27.17	29.85	26.21	30.4	26.78	30.6
Clerks	26.95	22.59	25.82	21.05	26.11	22.77	25.73	23.76
Service workers	3.77	3.17	3.89	2.69	4.99	3.95	5.50	4.02
Sales workers	4.38	3.76	4.73	4.13	5.52	5.05	5.43	5.19
Skilled Agricultural, Forestry and Fishery workers	0.27	0.29	0.27	0.31	0.35	0.35	0.35	0.51
Craft and Related Trades workers	6.09	7.06	6.10	6.90	5.86	6.54	5.99	7.01
Equipment, Machine Operating and Assembling workers	22.35	30.00	21.98	29.18	19.62	24.32	19.64	21.94
Elementary workers	7.91	5.03	7.71	4.88	9.40	5.87	8.83	6.02
No. of workers	665,780		663,820		681,384		699,490	

Appendix B Who Experiences Nominal Wage Reductions?

Table B1: Who Experiences Nominal Wage Reductions? (2008–2009)

	Education		Establishment Size				
	High school/less	Some college	5 to 29	30 to 99	100 to 499	500 or more	
Wage reductions	22,700 (51.89%)	26,927 (60.07%)	8,057 (51.12%)	12,077 (52.72%)	21,123 (57.64%)	8,370 (63.11%)	
<i>N</i>	43,746	44,829	15,761	22,906	36,645	13,263	
	Gender		Occupation (One Digit)				
	Men	Women	Managers	Professionals	Clerks	Service workers	
Wage reductions	35,090 (55.80%)	14,537 (56.58%)	857 (83.94%)	14,278 (59.82%)	11,888 (59.42%)	1,523 (54.30%)	
<i>N</i>	62,882	25,693	1,021	23,870	20,008	2,805	
	Tenure		Occupation (One Digit)				
	Less than 3 years	3 years or more	Sales workers	SAFF	Craftsman	PMOA	Laborers
Wage reductions	10,430 (50.55%)	39,197 (57.69%)	1,962 (58.85%)	122 (48.03%)	4,006 (64.03%)	13,186 (49.62%)	1,805 (40.52%)
<i>N</i>	20,633	67,942	3,334	254	6,256	26,572	4,455
	Union status		Employment type				
	Union workers	Non-union	Permanent		Temporary		
Wage reductions	17,083 (55.98%)	32,544 (56.06%)	46,337 (55.88%)		3,290 (58.19%)		
<i>N</i>	30,518	58,057	82,921		5,654		
	Wage percentile at $t - 1$						
	[0, 10]	[0, 20]	(20, 40]	(40, 60]	(60, 80]	(80,100]	[90, 100]
Wage reductions	2,859 (27.70%)	7,155 (36.60%)	9,551 (49.13%)	10,854 (59.35%)	10,744 (66.81%)	11,323 (74.41%)	5,729 (80.01%)
<i>N</i>	10,323	19,547	19,440	18,289	16,082	15,217	7,160

Notes: Professionals: Professionals & related workers; SAFF: Skilled agricultural, forestry and fishery workers; Craftsman: Craft and related trades workers; PMOA: Plant, machine operators and assemblers.

Table B2: Who Experiences Nominal Wage Reductions? (2009–2010)

	Education		Establishment Size				
	High school/less	Some college	5 to 29	30 to 99	100 to 499	500 or more	
Wage reductions	19,513 (37.84%)	19,346 (33.63%)	7,414 (34.05%)	10,355 (36.60%)	16,288 (36.96%)	4,802 (32.10%)	
<i>N</i>	51,563	57,522	21,771	28,291	44,064	14,959	
	Gender		Occupation (One Digit)				
	Men	Women	Managers	Professionals	Clerks	Service workers	
Wage reductions	27,844 (35.61%)	11,015 (35.66%)	776 (70.35%)	12,198 (37.46%)	5,961 (25.97%)	1,226 (41.84%)	
<i>N</i>	78,196	30,889	1,103	32,565	22,957	2,930	
	Tenure		Occupation (One Digit)				
	Less than 3 years	3 years or more	Sales workers	SAFF	Craftsman	PMOA	Laborers
Wage reductions	8,208 (35.18%)	30,651 (35.74%)	1,288 (28.58%)	134 (39.76%)	2,753 (36.57%)	12,831 (40.31%)	1,692 (31.76%)
<i>N</i>	23,329	85,756	4,507	337	7,528	31,831	5,327
	Union status		Employment type				
	Union workers	Non-union	Permanent		Temporary		
Wage reductions	13,053 (36.76%)	25,806 (35.07%)	36,455 (35.80%)		2,404 (33.13%)		
<i>N</i>	35,510	73,575	101,828		7,257		
	Wage percentile at $t - 1$						
	[0, 10]	[0, 20]	(20, 40]	(40, 60]	(60, 80]	(80,100]	[90, 100]
Wage reductions	2,940 (25.93%)	6,708 (30.29%)	7,577 (33.69%)	8,454 (35.68%)	7,626 (35.62%)	8,494 (43.91%)	4,524 (49.32%)
<i>N</i>	11,338	22,146	22,489	23,694	21,411	19,345	9,172

Notes: Professionals: Professionals & related workers; SAFF: Skilled agricultural, forestry and fishery workers; Craftsman: Craft and related trades workers; PMOA: Plant, machine operators and assemblers.

Table B3: Who Experiences Nominal Wage Reductions? (2011–2012)

	Education		Establishment Size				
	High school/less	Some college	5 to 29	30 to 99	100 to 499	500 or more	
Wage reductions	12,930 (29.71%)	13,424 (23.16%)	4,381 (24.45%)	7,090 (24.86%)	8,660 (26.32%)	6,223 (28.09%)	
N	43,525	57,965	17,919	28,515	32,903	22,153	
	Gender		Occupation (One Digit)				
	Men	Women	Managers	Professionals	Clerks	Service workers	
Wage reductions	18,703 (26.66%)	7,651 (24.42%)	237 (30.70%)	7,042 (22.83%)	4,733 (20.48%)	1,585 (39.52%)	
N	70,165	31,325	772	30,849	23,108	4,011	
	Tenure		Occupation (One Digit)				
	Less than 3 years	3 years or more	Sales workers	SAFF	Craftsman	PMOA	Laborers
Wage reductions	7,036 (29.01%)	19,318 (25.01%)	1,493 (29.15%)	146 (41.36%)	1,782 (26.85%)	7,295 (29.56%)	2,041 (34.25%)
N	24,250	77,240	5,121	353	6,637	24,680	5,959
	Union status		Employment type				
	Union workers	Non-union	Permanent		Temporary		
Wage reductions	8,064 (28.09%)	18,290 (25.13%)	22,655 (24.44%)		3,699 (42.11%)		
N	28,708	72,782	92,705		8,785		
	Wage percentile at $t - 1$						
	[0, 10]	[0, 20]	(20, 40]	(40, 60]	(60, 80]	(80,100]	[90, 100]
Wage reductions	1241 (13.16%)	3626 (18.93%)	5071 (23.87%)	5874 (27.82%)	5933 (28.93%)	5850 (30.06%)	3107 (34.43%)
N	9,427	19,158	21,241	21,118	20,510	19,463	9,026

Notes: Professionals: Professionals & related workers; SAFF: Skilled agricultural, forestry and fishery workers; Craftsman: Craft and related trades workers; PMOA: Plant, machine operators and assemblers.

Table B4: Who Experiences Nominal Wage Reductions? (2012–2013)

	Education		Establishment Size				
	High school/less	Some college	5 to 29	30 to 99	100 to 499	500 or more	
Wage reductions	13,276 (28.21%)	15,317 (23.16%)	6,468 (25.83%)	8,117 (23.53%)	9,195 (26.73%)	4,813 (24.99%)	
N	47,069	66,142	25,042	34,502	34,405	19,262	
	Gender		Occupation (One Digit)				
	Men	Women	Managers	Professionals	Clerks	Service workers	
Wage reductions	19,403 (25.28%)	9,190 (25.21%)	134 (12.63%)	7,959 (22.98%)	6,195 (23.03%)	1,602 (35.22%)	
N	76,753	36,458	1,061	34,640	26,897	4,549	
	Tenure		Occupation (One Digit)				
	Less than 3 years	3 years or more	Sales workers	SAFF	Craftsman	PMOA	Laborers
Wage reductions	7,071 (26.19%)	21,522 (24.96%)	1,653 (28.11%)	154 (26.51%)	2,028 (25.54%)	7,043 (28.35%)	1,825 (26.76%)
N	26,998	86,213	5,880	581	7,941	24,842	6,820
	Union status		Employment type				
	Union workers	Non-union	Permanent		Temporary		
Wage reductions	7,887 (27.15%)	20,706 (24.60%)	26,269 (25.31%)		2,324 (24.65%)		
N	29,055	84,156	103,783		9,428		
	Wage percentile at $t - 1$						
	[0, 10]	[0, 20]	(20, 40]	(40, 60]	(60, 80]	(80,100]	[90, 100]
Wage reductions	1,941 (17.69%)	4,739 (21.72%)	5,837 (24.60%)	6,251 (25.74%)	5,628 (25.31%)	6,138 (29.05%)	3,264 (31.92%)
N	10,971	21,821	23,730	24,288	22,240	21,132	10,224

Notes: Professionals: Professionals & related workers; SAFF: Skilled agricultural, forestry and fishery workers; Craftsman: Craft and related trades workers; PMOA: Plant, machine operators and assemblers.

Appendix C

Table C: Distribution of the Percentage of Employees in a Larger Establishment (100 or More) that Experience a Nominal Wage Cut by Year

Percentage of nominal wage reductions	2008–2009	2009–2010	2011–2012	2012–2013
$x = 0$	9.37	21.35	33.18	36.08
$0 < x \leq 10$	8.87	15.03	17.46	16.39
$10 < x \leq 20$	7.28	10.74	12.39	11.34
$20 < x \leq 30$	7.62	8.59	7.33	7.65
$30 < x \leq 40$	7.20	7.85	6.40	5.50
$40 < x \leq 50$	7.78	5.95	4.06	3.40
$50 < x \leq 60$	6.03	6.26	2.80	3.35
$60 < x \leq 70$	8.12	4.54	2.00	3.70
$70 < x \leq 80$	8.28	4.85	3.53	3.05
$80 < x \leq 90$	9.54	4.91	4.33	3.05
$90 < x < 100$	8.62	4.91	2.47	2.60
$x = 100$	11.30	5.03	4.06	3.90
Total	100	100	100	100
N	1,195	1,630	1,501	2,001

Notes: Employees refer to those who stay in the same job within an establishment.

Appendix D

Table D1: Extent of Nominal Wage Flexibility/Inflexibility: Establishments with 5 to 29 Employees

	2008–2009	2009–2010	2011–2012	2012–2013
Reductions	8,057 (51.12%)	7,143 (34.05%)	4,381 (24.45%)	6,473 (25.85%)
Freezes	1 (0%)	128 (0.28%)	4 (0.01%)	13 (0.03%)
Total job stayers	15,761	21,771	17,919	25,042

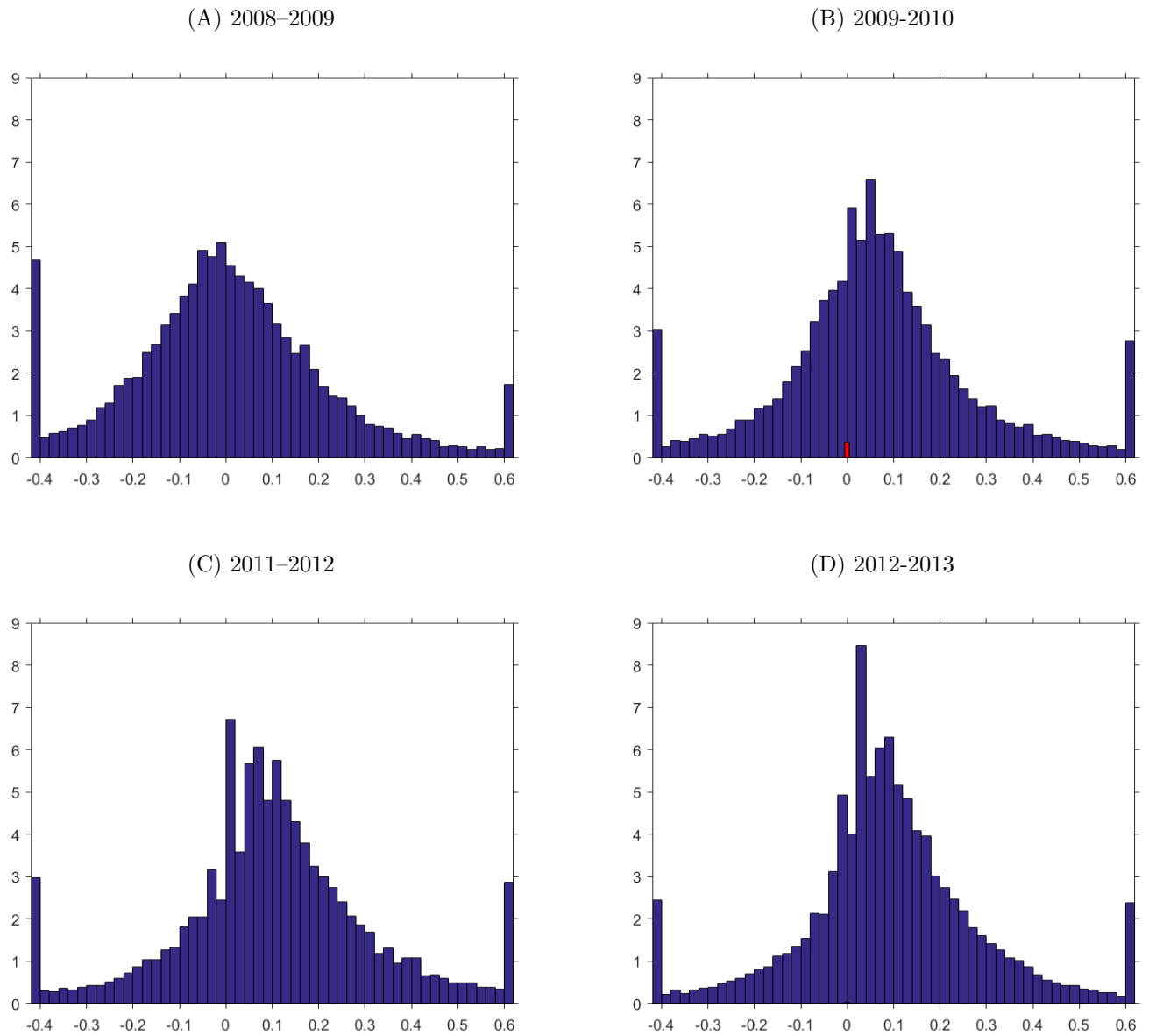
Notes: The hourly wage rate is defined as the ratio of actual monthly regular pay to actual monthly regular hours, excluding overtime/incentive pay and overtime hours. Numbers in parentheses represent the percentage of the frequency of each case among the total number of job stayers in each matched year.

Table D2: Who Experiences Nominal Wage Reductions? Average of 2008–2009 through 2012–2013

	Wage percentile at $t - 1$						
	[0, 10]	[0, 20]	(20, 40]	(40, 60]	(60, 80]	(80, 100]	[90, 100]
Wage reductions	458 (21.13%)	1183 (26.76%)	1693 (36.16%)	1628 (42.58%)	1463 (49.10%)	1107 (55.79%)	505 (60.52%)
N	2243	4550	4807	4031	3160	2122	891

Notes: Numbers in parentheses represent the percentage of the frequency of each case among the total number of job stayers in each matched year.

Figure D1: Robustness Test: Analysis of Relatively Small Establishments (5-29 workers) that Survey All Workers: Distribution of Nominal Wage Changes among Job Stayers



Source: Authors' calculation based on the SLCTE data. The hourly wage rate is defined as the ratio of actual monthly regular pay to actual monthly regular hours, excluding overtime/incentive pay and overtime hours.