Sticky Wage Norms and the Real Wage Cost of Unexpected Inflation*

Erik Hurst
University of Chicago

Christina Patterson
University of Chicago

Nela Richardson
ADP Research

Ye Liv Wang
ADP Research

August 12, 2026

Abstract

We use a sample of administrative payroll data covering a large and nationally representative share of U.S. workers to study how wages adjusted during the recent inflation period. Most firms apply a single modal annual nominal wage increase to the majority of their workers, and these firm-level norms changed little during the recent period of unexpected inflation. As a result, nominal wages did not keep pace with prices for a large share of workers who stayed at their firms. Forty-three percent of workers continuously employed at the same firm over the four years spanning 2021–2024 experienced a real wage decline, with a mean loss of roughly nine percent among those who fell behind. Workers could escape sticky wage norms by changing employers — job-changers' wages rose nearly one-for-one with inflation — but switching was too infrequent to matter for most. Even accounting for job-changers, 37 percent of all workers saw real wages decline over the 4-year period. Indexing firms' modal raises one-for-one to inflation would have closed roughly 40 percent of the resulting shortfall relative to pre-pandemic trend. Drawing on cross-country evidence from Belgium, whose wages are automatically indexed to inflation, we show that incomplete wage indexation, rather than inflation itself, helps explain the persistence of depressed consumer sentiment during the 2021–2024 period.

*Email: erik.hurst@chicagobooth.edu, christina.patterson@chicagobooth.edu, nela.richardson@adp.com, and liv.wang@adp.com. We thank Gianluca Violante, Greg Kaplan, Jonathan Parker and Benjamin Schoefer for very helpful comments. We also thank seminar participants at the 2026 NBER Summer Institute. Per our data use agreement, ADP approved the paper topic ex-ante. Additionally, ADP reviewed the paper prior to the paper's circulation with the sole focus of making sure the paper did not release information that would compromise the privacy of their clients or would reveal proprietary information about the ADP business model.

1 Introduction

After nearly four decades of low and stable inflation, U.S. consumer prices rose sharply and unexpectedly from mid-2021 through late-2023, with the inflation rate peaking at 9 percent in June of 2022. During this period, U.S. consumer sentiment fell to levels not seen since the depths of the Great Recession despite the unemployment rate being at historically low levels.[1] Over 70 percent of Americans in 2022 reported that inflation was a "very big problem" (Pew Research Center 2022). In early 2024, when the inflation rate returned to normal levels, over 40 percent of Americans still claimed that "inflation/high cost of living" was the *most* important financial problem facing their family (Gallup 2024).[2] Americans' unhappiness with inflation has been cited as an important factor in voting patterns during the 2024 presidential election (Steinberg et al. 2025; Riaño and Trebbi 2026; Leonhardt 2024). Importantly, even three years after the inflation rate peaked, Americans are still reporting that inflation and affordability are pressing concerns. As of 2025, U.S. consumer sentiment remains depressed, roughly 30 percent of Americans still report that cost of living is their most pressing financial problem, and over 60 percent of Americans still report that inflation is a very big problem.

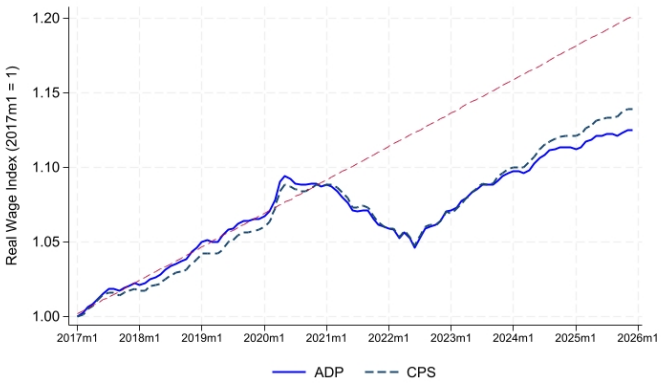
In this paper, we argue that Americans' enduring discontent with inflation reflects the lasting real wage losses generated during the inflationary episode. Using a sample of administrative payroll data from ADP covering roughly 16 million workers per month, we examine real wage dynamics and firm wage-setting from 2016 through 2025. We show that most firms anchor annual raises to a common wage norm applied broadly across workers, and that these norms adjusted only modestly when inflation surged. Larger off-cycle raises and job changes allowed some workers to keep pace, but these responses were too limited to restore real wages for the typical worker. A temporary inflation shock therefore produced a persistent downward shift in real wages, helping explain why Americans' dissatisfaction outlasted the inflation episode itself.

Figure 1 serves as the launching point for our paper. The figure shows a real wage index for the United States computed using either data from ADP (solid line) or data from the Current Population Survey (CPS) (dashed line). The two lines track each other closely, highlighting that the ADP data is representative of the U.S. labor market with respect to

[1] The University of Michigan Consumer Sentiment Index bottomed out at a level of 57.4 in the fourth quarter of 2008. In the third quarter of 2022, the Consumer Sentiment Index plummeted to 56.1. For reference, the index only fell to 74.1 in the second quarter of 2020, when employment losses during the pandemic were at their largest.

[2] For comparison, the share reporting inflation as the most important financial problem facing their family averaged around 8 percent in the Gallup surveys conducted between 2000 and 2021 — never exceeding 18 percent even at the peak of the Great Recession.

Figure 1: U.S. Real Wages 2017–2025: ADP and CPS



Notes: Figure shows real wage indices using CPS and ADP panel micro data. The CPS wage series comes from the weighted median nominal wage growth for all matched CPS respondents as reported by the Atlanta Fed Wage Growth Tracker. The ADP wage series combines the median nominal wage growth of job-stayers and job-changers. An index is created for both series using the monthly nominal growth rates, normalized to 1 in January 2017, and deflated by the corresponding monthly CPI-U in January 2017 prices. The red dashed line extrapolates the 2017–2019 linear trend in the ADP real wage index through December 2025. See text for additional details.

wage dynamics — a point we discuss in greater depth in Section 2.[3] Median real wages fell by 4 percent during the inflation period, and did not recover to its 2020 level until late 2024.

Moreover, zero real wage growth is not an appropriate benchmark for assessing whether real wages kept up. The ADP and CPS wage indices are defined by using the wage growth of a given worker over time. There is a large literature documenting that the wages of a given worker increase year-over-year due to the accumulation of general or firm-specific human capital; such life cycle wage growth occurs even in a world where there is no aggregate productivity growth. The red dashed line in Figure 1 is the predicted real wage path over the 2020–2025 period, based on extrapolating the 2017–2019 trend in the ADP data forward. During the 2017–2019 pre-period, real wages grew at roughly 2.2 percent per year.[4] As of December 2025, the real wage index stands roughly 7 percent below where real wages would have been had the 2017–2019 trend continued. The 2017–2019 trend is a demanding benchmark, since real wage growth in the late 2010s was unusually strong. Measured against

[3]The CPS data come from the Atlanta Fed Wage Growth Tracker. Both the ADP and CPS series combine data from job-stayers and job-changers and use the panel structure of the data to compute the median nominal wage growth of individuals who are employed 12 months apart. We create a nominal wage index using the growth rates, normalizing the index to 1 in January 2017. We deflate the nominal wage index by the corresponding month's CPI-U in January 2017 prices. Section 2 provides additional details on how we constructed this figure.

[4]This is in line with estimates of the annual return to experience. See, for example, Mincer (1974), Topel (1991), Altonji and Williams (2005), and Dustmann and Meghir (2005).

average real wage growth of 1.5 percent per year over the longer 2000–2019 period, the shortfall as of December 2025 was still roughly 4 percent.

The goal of this paper is to use the richness of the ADP data to shed light on the mechanisms driving the dynamics of real wages during this period. First, we document that job-stayers' wages did not keep pace with inflation. Median year-over-year real wage growth fell from roughly 1 percent in 2017–2019 to about negative 4 percent during the inflation surge. Although real wage growth returned to its pre-period rate by mid-2023, the earlier losses were never made up, leaving job-stayers' real wages persistently below trend.

The long panel reveals how widespread these cumulative losses were. Among workers continuously employed at the same firm from December 2020 through December 2024, 43 percent ended the period with lower real wages than at its outset; conditional on a decline, the mean loss was 9 percent and the median loss was roughly 7 percent. More broadly, 55 percent averaged less than 1 percent annual real wage growth over this 4-year period. Both the incidence and magnitude of these losses were far greater than among comparable four-year job-stayers before the pandemic. Thus, nominal wage growth failed to keep pace with inflation for a substantial share of workers who remained with the same employer.

We next examine the firm-level wage-setting practices behind these losses. Because ADP records base-wage changes for every worker within a firm, we can identify the firm-specific month in which most annual raises occur—the firm's "on-cycle" month—and distinguish these raises from "off-cycle" adjustments in other months. Off-cycle raises are systematically larger and are consistent with worker-specific events such as promotions or responses to outside offers.

Among workers who receive exactly one wage adjustment in a year, raises cluster tightly around a firm-specific mode. A majority of all annual wage changes are within 0.5 percentage points of the modal increase, and more than 90 percent are within 1.5 percentage points. We refer to this modal increase as the firm's "wage growth norm." For example, during the 2017-2019 period, the modal firm had a wage growth norm of 3%, meaning that most workers received a nominal wage increase of about 3% during their on-cycle month. Critically, the distribution of wage growth norms across firms shifted only modestly during the 2021–2023 period relative to the pre-pandemic period. Roughly 89 percent of workers were employed in firms that had a wage growth norm of 2, 3, or 4 percent before the pandemic; during the inflation period, that fraction was approximately 76 percent, with a modest shift away from the 2–3 percent range toward 4–5 percent. Even as inflation rose well above prevailing wage norms, firms adjusted those norms only weakly. Because most workers' raises were anchored to their firm's norm, this limited adjustment helps explain the erosion of job-stayers' real wages. Critically, these norms had been set for an era of low and stable inflation; because

the inflation was unexpected, neither the norm nor workers' initial wage bargains had priced it in, so the surprise translated directly into an unanticipated real wage loss. The stickiness we document is therefore a property of a wage-setting regime adapted to low and stable inflation, not a structural constant. Had high inflation persisted, we expect firms would have re-indexed their norms, much as cost-of-living clauses spread through U.S. collective bargaining agreements during the high inflation period of the 1970s and early 1980s.

Firms did, however, adjust on a different margin – they became more likely to grant large, worker-specific raises outside the standard annual review cycle. As a result, the within-firm distribution of nominal wage growth became more right-skewed during the inflation period. Large raises rarely arrive through the on-cycle review: on-cycle increases cluster tightly between 2 and 4 percent, while two-thirds of off-cycle increases exceed 4 percent and one-third exceed 8 percent. More notably, the share of job-stayers receiving more than one base-wage adjustment within a year rose from roughly 16–18 percent before the pandemic to approximately 27 percent in 2021 and 2022. These additional, off-cycle increases were substantially larger and more dispersed than standard on-cycle raises. Thus, rather than broadly resetting their wage norms in response to inflation, firms granted large, individualized adjustments to a growing minority of workers.

Changing employers offered workers a second way to escape sticky firm wage norms. Job-changers' annual nominal wage growth tracked inflation nearly one-for-one, allowing them largely to avoid real-wage erosion in the year they moved. However, switching rose only modestly during the inflation period (Afrouzi et al. 2026), and for any given worker, moves across employers are infrequent. This pattern means that in most years, even those who switched jobs at some point were again subject to sticky firm wage norms. Consequently, including job-changers reduces the share with a cumulative real wage decline only from 43 percent among job-stayers to 37 percent among all workers. The median loss among those who fell behind was approximately 9 percent, and 58 percent of all workers ended the period below the pre-pandemic trend.

How much of the aggregate real wage shortfall does the norm itself account for? We answer this with an accounting exercise that indexes firms' modal raises one-for-one to inflation, holding everything else — off-cycle raises, job-changer wage growth, and the shares of workers in each group — at its observed value. Indexing that single rule closes roughly 40 percent of the gap relative to the 2017–2019 trend and roughly 73 percent of the gap relative to the more conservative 2000–2019 trend. Extending the same rule to all job-stayer wage growth closes more than half of the gap to the 2017–2019 trend and essentially eliminates the gap to the 2000–2019 trend. Together, these exercises show that a broadly applied feature of firm wage-setting, namely the weak indexation of job-stayers' raises, can generate a large

aggregate shortfall.

One implication of these firm-level patterns is that exposure to real-wage erosion should vary with workers' access to both job switching and large worker-specific raises (e.g. promotions). We examine the implication of this for inequality across two dimensions of observable worker heterogeneity – initial wage and age.

Along the wage distribution, greater mobility initially protected lower-wage workers. The U.S. wage distribution was already compressing during 2016–2019, with workers in the bottom two deciles experiencing substantially faster wage growth than higher-wage workers (Autor et al. 2024). This compression accelerated in 2021: real wage growth in the bottom two deciles remained positive and close to its pre-period pace, while all other deciles experienced declines of about 2 percent, roughly four percentage points below their pre-period growth. Higher job-switching rates among lower-wage workers helped them escape sticky firm wage norms. This early acceleration in compression did not persist, however. Over the full 2021–2024 period, cumulative wage compression was similar to the pre-period: lower-wage workers continued to experience faster real wage growth relative to higher wage workers.

We also show that the real wage declines were larger for older workers. Roughly 55 percent of workers age 50 and older experienced a cumulative real wage decline between December 2020 and December 2024. Older workers had less access to both escape margins: they switched employers less often, gained less when they did switch, and were less likely to receive large raises while remaining at the same firm. Even before the inflation episode, their flatter age-earnings profiles left a larger share receiving no nominal wage increase. The inflation surge therefore produced especially large real wage losses for older workers, who have fewer opportunities to advance either within or across firms.

In the last part of the paper we provide several pieces of evidence that speak to the broader consequences of the minimal wage indexation at U.S. firms during the recent inflation period and the resulting declines in real wages experienced by U.S. workers. The real wage declines documented above are costly to the workers who experience them, but even workers who take action to overcome sticky wage norms incur costs of their own — searching for a new job, negotiating with an employer, and so on. These two types of cost are economically distinct: the effort workers expend to escape the firm's norm is a deadweight loss, whereas the real wage decline borne by those who do not take actions is a transfer from workers to firms that benefit from the lower labor costs. We present two additional pieces of evidence consistent with this view that minimal wage indexation is costly to workers but advantageous to firms.

First, we show that the real wage growth that workers did not receive reappears, in roughly the magnitude one would expect, as higher firm profits. Between the pre-pandemic

and inflationary periods, the U.S. corporate profit share of GDP rose by 1.7 percentage points — broadly consistent with the magnitude implied by the real wage shortfall we document, and its highest sustained level in half a century. The firm profit rate jumped when the inflation started in mid 2021 and remained elevated through 2025 as real wages remained depressed.

Second, we use cross-country variation to show that the lack of wage indexation, rather than inflation itself, was an important driver of the persistent decline in consumer sentiment between 2021 and 2024. Belgium offers a natural experiment: its wages are automatically indexed to inflation, insulating workers from real wage erosion, yet it experienced the same inflation, labor market conditions, and aggregate shocks — including Ukrainian immigration — as Germany, the Netherlands, Denmark, and the broader Eurozone. Real wage and consumer confidence measures diverged sharply across the countries. In Belgium, real wages rebounded to pre-inflation levels by 2023 and consumer sentiment recovered with them. In the peer countries, where wages adjusted slowly and incompletely, neither real wages nor consumer confidence had recovered by the end of 2024. We find consistent patterns within the United States across age groups. Retired households have a substantially larger share of their income indexed to inflation — through Social Security, which is indexed by law, and through asset income that kept pace with prices — whereas older workers who have not yet retired are exposed to the same sticky wage norms as everyone else. Consistent with real wage erosion driving sentiment, the decline in consumer confidence was far smaller for age groups in which most individuals are retired than for those in which few are.

Taken together, the cross-country and cross-age evidence suggests that consumer sentiment recovered when real incomes were protected, not simply when inflation subsided. In the United States, sticky firm wage norms left many workers' real wages below their pre-pandemic trajectory, helping to explain why sentiment remained depressed through 2024.

The remainder of the paper proceeds as follows. Section 2 describes the data and assesses the representativeness of the ADP sample. Section 3 documents real wage losses among job-stayers and the firm wage-setting norms behind them, while Section 4 incorporates job-changers to characterize wage growth for the workforce as a whole. Section 5 examines heterogeneity across workers, and Section 6 quantifies the contribution of incomplete indexation to the aggregate real wage shortfall. Section 7 examines the broader consequences of incomplete wage indexation, showing that the associated real wage shortfall is quantitatively consistent with the rise in the corporate profit share and helps explain the persistent decline in consumer sentiment. Section 8 concludes.

Related Literature This paper contributes to a large literature documenting why workers dislike inflation. Di Tella et al. (2001) show that higher inflation reduces reported life satisfaction with effects comparable in magnitude to rising unemployment, while Shiller (1997) and Stantcheva (2024) use survey evidence to document that workers link inflation directly to declining real purchasing power and reduced economic security. An alternative explanation for why workers dislike inflation is "money illusion" — the tendency to reason in nominal rather than real terms. Shafir et al. (1997) show that individuals systematically reason in nominal terms even when real quantities are what matter for welfare, and Fehr and Tyran (2001) provide experimental evidence that money illusion affects economic behavior in ways that are difficult to rationalize under standard assumptions. Our paper provides direct microeconomic evidence that distinguishes between these two stories: we show that real wages did in fact decline substantially and persistently during the 2021–2023 inflation episode, lending empirical support to the view that workers' dislike of inflation reflects genuine real wage erosion rather than a cognitive bias. Our Belgium case-study reinforces this conclusion.

Two papers motivate our empirical analysis and provide structural interpretations for our main findings. Guerreiro et al. (2026) develop a model in which workers must take costly "conflict" actions — renegotiating their contracts, threatening to quit, or pursuing outside offers — in order to obtain nominal wage increases that keep pace with inflation. Because these conflict actions are costly, the welfare losses from inflation exceed those implied by the decline in real wages alone; workers bear an additional burden from the effort required to defend their purchasing power. This framework provides a natural interpretation for our finding that off-cycle wage adjustments rose sharply during the inflation period: workers who received large off-cycle increases had, in many cases, taken precisely the kinds of costly actions described in Guerreiro et al. (2026). For the majority of job-stayers who did not receive off-cycle raises, the cost was paid instead through passive real wage erosion. Afrouzi et al. (2026) develop a complementary model in which nominal wage stickiness induces workers with eroded real wages to search more intensively for new jobs, generating a tight link between inflation and job vacancy creation and predicting that job-changers keep pace with inflation while job-stayers accumulate losses — exactly what we document in the ADP data. Their model also allows job-stayers to pay a menu cost to escape a firm's sticky wage growth norms thereby also reconciling the large increase in off-cycle wage increases during the inflationary period found in the ADP data. Together, both papers imply that keeping up with inflation during this episode was costly, whether through job search, conflict, or passive real wage loss.[5] Both frameworks also share a complementary implication for firms: to the

[5] Pilossoph and Ryngaert (2024) provides evidence of the link between inflation and worker job-search.

extent that adjustment costs allow employers to maintain minimally indexed wage norms, it confers a degree of market power that should be visible in firm profitability during the inflationary episode — a prediction we examine directly in Section 7.1.

A growing literature documents the political consequences of these real wage declines. Steinberg et al. (2025) use a pre-election survey experiment and find that priming voters with information about inflation reduced approval of the Biden-Harris administration, with effects concentrated among Independents and Democrats. Riaño and Trebbi (2026) use county-level variation in local prices and wages and find that it is real wage decline, not higher inflation per se, that predicts Republican electoral gains — directly reinforcing our central argument that material purchasing power losses, rather than rising prices in the abstract, drive individual discontent during inflationary periods. Baccini and Weymouth (2025) document analogous patterns in the 2022 midterms, suggesting these links between real purchasing power and electoral behavior are not unique to the 2024 presidential cycle. Using micro data for large and representative sample of the U.S. workforce, we document that the wages of a large share of Americans did, in fact, substantially decline from early-2021 through late-2024 explaining their overall discontent with their economic situation expressed via their voting behavior.

Finally, our documentation of firm-level wage-setting norms connects to a long literature on nominal wage rigidity and fairness. Bewley (1999) concludes from interviews with managers that firms resist nominal wage cuts primarily to protect worker morale, while Akerlof and Yellen (1990) and Kahneman et al. (1986) formalize the role of fairness norms in wage-setting and show that workers withdraw effort — and firms restrain exploitation of demand shocks — when perceived fairness is violated. These papers establish that nominal wage rigidity reflects social norms rather than purely technological constraints, which is exactly the kind of norm our ADP data reveals at the firm level. Hazell and Taska (2025) provide complementary evidence using posted vacancy data that wages for new hires are asymmetrically rigid — downwardly sticky but responsive to labor market tightening — suggesting that the structural features underlying our findings are broad. Grigsby et al. (2021b) and Grigsby et al. (2021a) use the ADP payroll data during prior periods showing, among other things, that nominal wages of job-stayers are downwardly rigid. All of this prior literature focuses on various aspects of downward nominal wage rigidity. Our paper shows a similar pattern with wage norms for job-stayers being *upwardly rigid* during periods of rising temporary inflation.[6]

[6]Contemporaneously, Jaimovic et al. (2026) uses historical data from both the CPS and the National Income and Product Accounts to show that the real earnings of workers fell sharply during the inflation episodes of the mid-1970s and early-1980s.

2 Data Description

In this section, we describe the data used in the paper and provide some motivating descriptive statistics using the data.

2.1 ADP Data

The majority of our analysis uses administrative individual panel data from ADP. ADP is a large, international provider of human resources services including payroll processing, benefits management, tax services, and compliance. ADP has over 1 million clients worldwide, and currently processes the payroll for one-sixth of the U.S. labor force. Our starting analysis sample contains the payrolls for roughly 16 million U.S. workers per month. Our sample includes firms with 50 or more employees to capture wage setting norms within and across employers. We restrict our analysis to payroll observations between December 2015 and December 2025.[7]

Firms contract with ADP to process the payroll for all workers within their firm. As a result, we observe how nominal wages are adjusted for all workers within a given firm during a given month. This feature of the data allows us to examine the similarity of nominal wage changes across workers within a firm during a given time period. Our sample dataset includes roughly 60,000 unique firms each month.

The data contain monthly aggregates of anonymized individual paycheck information, as well as all relevant information needed for human resources management. Crucially, we observe the statutory per-period before-tax contract rate for all employees. We refer to this as a worker's "base" hourly wage. For workers paid hourly, the worker's base wage is simply their contracted hourly wage at the firm. For salaried workers, their base wage constitutes the pay that the worker is contractually obligated to receive each pay period (weekly, bi-weekly, or monthly) expressed in units of an hourly wage assuming a 40 hour work week.[8] Given the data are aggregated to the monthly level, the base wage is measured as of the last pay period of the month.

[7]The use of data from firms with more than 50 employees is similar to the main analysis in Grigsby et al. (2021b) which used the ADP data to study nominal wage adjustments during the 2008-2016 period. As shown in that paper, the distribution of nominal wage adjustments in firms with more than 50 employees looks very similar to the distribution of nominal wage adjustments in firms with less than 50 employees. Hence, to focus on the firms where it's possible to identify wage norms, we only analyze the dataset containing employees from firms with more than 50 employees in this paper. As shown in Figure 1, the data from this ADP sample matches well the wage dynamics from other nationally representative surveys like the CPS.

[8]For example, assume a salaried worker is contracted to be paid a base salary of $240,000 per year and is paid monthly. Their contracted monthly wage would be $20,000 per month which is observed as an administrative field in the data. Given this, their hourly wage would be $115.38 per hour ($20,000 * 12 months/(52 weeks $*$ 40 hours per week)).

In addition to the administrative base wage information, the ADP data contain all other information that would appear on the worker's paycheck, such as the worker's gross earnings per pay period and any bonuses that were paid to them by the firm. The data also contain other payroll information including whether the worker is paid hourly, the frequency at which the worker is paid and the number of hours paid during the month for hourly workers. We also observe various additional geographic and demographic characteristics of a worker such as gender, age and worker tenure as well as details about the job such as firm size, and industry.

We separately examine nominal wage adjustments for "job-stayers" and "job-changers". Our primary job-stayer analysis examines year-over-year nominal base wage changes for a given worker who remains employed at the firm continuously for 13 consecutive months. For example, to measure the change in nominal base wages for a job-staying worker between March 2022 and March 2023 the worker would have to be continuously employed at the firm for all months between March 2022 and March 2023. We have between 9 and 11 million job-stayers per month in all months of our analysis during our sample period. Our primary job-changer analysis examines year-over-year nominal wage adjustments for a given worker currently working at firm i in month t who we can find working at a separate ADP firm j in month $t-12$ (one year earlier). The ADP data is so large that we have about 1 to 2 million job-changers each month. In some of our analysis, we will define job-stayers and job-changers over four or five-year periods.

2.2 CPS Data

We benchmark the wage dynamics of workers within our ADP sample to the wage dynamics of workers within the Current Population Survey (CPS) as reported by the Atlanta Fed's Wage Tracker Index. CPS respondents are surveyed for four consecutive months (waves 1-4), leave the survey for the next 8 months, and then are surveyed again for another four consecutive months (waves 5-8). In waves 4 and 8, which are one year apart, CPS respondents are asked about their hourly wage (if they are hourly workers), their usual weekly earnings and their usual weekly hours worked. This data allows the creation of a worker's base wage in those two waves where the base wage of workers paid hourly is their reported hourly wage; the base wage of salaried workers is usual weekly earnings divided by usual weekly hours. The Atlanta Fed uses the CPS data to create a measure of a given worker's annualized base wage growth by taking the percentage change in base wages between waves 4 and 8. Pooling across all workers in wave 8 during each month, they then report the median nominal wage growth for U.S. workers at the monthly level.

We download the CPS wage data directly from the Federal Reserve Bank of Atlanta's Wage Growth Tracker website.[9] We use their monthly measure of "overall median nominal wage growth weighted using 1997 weights" when making our CPS wage indices.[10] To make the aggregate CPS real wage index, we first make a nominal wage index using the reported nominal wage growth rates for each month. We normalize the nominal wage index to a value of 1 in January of 2017. We then deflate the nominal wage index into real January 2017 prices by appropriately deflating by the corresponding monthly CPI-U. This is how the dashed line in Figure 1 was created.

2.3 Representativeness of the ADP Data

The ADP data has been shown to be quite representative of the US labor market. For example, as seen from Figure 1, the real wage index computed using our ADP sample matches nearly identically the real wage index computed using CPS data as reported by the Atlanta Fed. Furthermore, as documented in Grigsby et al. (2021b) and Cajner et al. (2019), the overall ADP data is very representative of the US workforce based on demographic characteristics and labor force dynamics. Comparing to U.S. Census data, Grigsby et al. (2021b) shows that the ADP data also matches well both firm size and industry composition conditional on restricting the Census data to firms with at least 50 employees. In our baseline analysis, we do not reweight the ADP sample to match the QCEW industry-by-firm-size distribution, as doing so has virtually no effect on the results. Appendix Figure R1 shows that the aggregate real wage index in Figure 1 is nearly identical with and without reweighting. This insensitivity reflects the broad representativeness of the ADP sample and the limited systematic variation in nominal wage adjustments across industries and firm sizes. We further illustrate this point throughout the paper by discussing our results separately by industry.

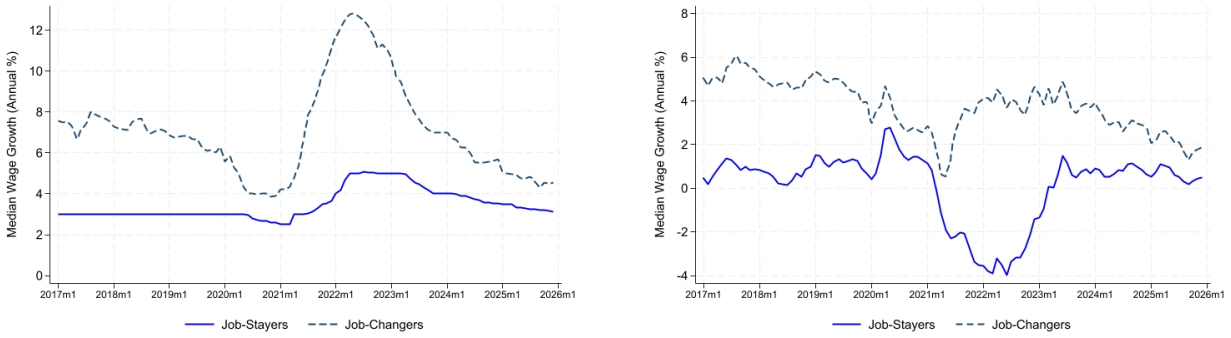
2.4 Descriptive Statistics of Nominal and Real Wage Growth: ADP Sample

Panel A of Figure 2 displays the year-over-year median nominal wage growth of job-stayers and job-changers in our ADP sample. Panel B shows the corresponding year-over-year median real wage growth rates. A few things are of note from the two panels. First,

[9] See https://www.atlantafed.org/research-and-data/data/wage-growth-tracker. We discuss the CPS data, and our processing of the data, in greater detail in the online appendix.

[10] Appendix Figure R3 compares a real wage index created using the weighted CPS median wage growth versus the unweighted CPS median wage growth. The data appendix discusses why researchers should use the weighted CPS wage growth measure when exploring aggregate wage dynamics.

Figure 2: Nominal and Real Wage Growth of Job-Stayers and Job-Changers: ADP Sample



(a) Nominal Wage Growth

(b) Real Wage Growth

Notes: Panel A of the figure shows the nominal wage growth of job-stayers (solid line) and job-changers (dashed line) in ADP sample from January 2017 through December 2025. Panel B of the figure shows the real wage growth of job-stayers (solid line) and job-changers (dashed line) in ADP sample from January 2017 through December 2025.

the median nominal wage growth of job-stayers was exactly 3% from January 2016 through March 2021. As we show below, this results from the fact that firm wage norms are prevalent, with roughly 14% of all U.S. workers receiving a nominal wage increase of exactly 3.00 percent in most months during our sample period and 21% receiving an increase between 2.9 and 3.1 percent. Second, the median nominal wage growth of U.S. job-stayers did not keep up with inflation during the inflation period. During the 2017-2019 pre-period, the median real wage of job-stayers was increasing by about 1% per year. However, between all months between early-2021 and early-2023, median real wage growth was negative for job-stayers. During early-2022, the median real wage of job-stayers contracted by roughly 4%. Third, there was no rebound in the median real wage growth of job-stayers when the inflation period ended. From mid-2023 through late-2025, the median real wage growth of job-stayers was roughly back to pre-period levels of roughly 1% per year. Finally, the median nominal wage growth of job-changers increased sharply during the inflationary period. As seen from the dashed line in panel B, median real wage growth of job-changers increased by about 4% per year during the inflationary period. As we discuss below, the wage growth of job-changers did not systematically deteriorate during the inflationary period.

The above data are used to make the ADP real wage index shown in Figure 1. In particular, we pool together the nominal wage growth of job-stayers with the nominal wage growth of job-changers in each month to create an aggregate median nominal growth rate. Using the ADP data, we can compute the share of ADP employees in month $t-12$ who remain continuously employed at the same firm through month t and the share who are working at another ADP firm in month t. Adjusting the job-changing share for the fact

that our sample of ADP firms comprise approximately one-seventh of U.S. employment, we create a series of the relative weights of job-changers and job-stayers to construct a pooled nominal wage growth rate.[11] We make a nominal wage index using the aggregate growth rates where we normalize the index to 1 in January 2017. We then deflate the nominal wage index by the corresponding monthly CPI, with January 2017 as the base year, to create the aggregate real wage index shown in Figure 1.

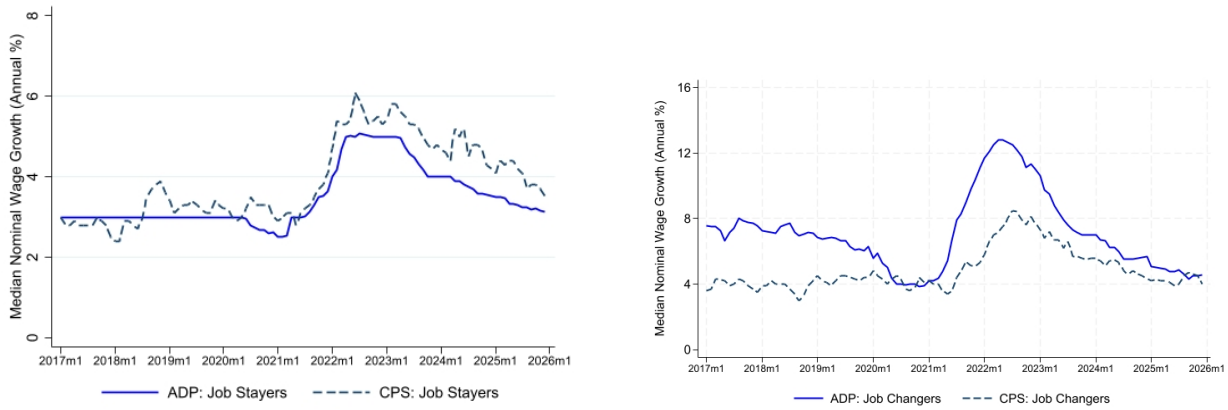
While the ADP and CPS real wage measures track each other closely, it is important to highlight a key limitation when using the CPS data to separately measure the wage growth of job stayers versus job changers. The CPS does not contain information on whether an individual switches to another firm between waves 4 and 8 and, as a result, job-changing status must be imputed.[12] The CPS data processed by the Atlanta Fed imputes whether the individual changed jobs based upon whether the individual reports that either their occupation or industry changed between the 9 months spanning waves 4 and 6. This induces two types of measurement error. First, some job-changers will be included in the job-stayer sample if they changed firms but remained in the same occupation or industry. Second, some job-stayers will be included in the job-changer sample if their occupation or industry was misreported. It has been found that there is a large amount of measurement error in the CPS occupation and industry codes (e.g., Kambourov and Manovskii (2013)).

These two types of measurement error will narrow the gap in the wage change between job-stayers and job-changers. Panels A and B of Figure 3 show the median nominal wage growth of job-stayers and job-changers, respectively, in the CPS data (dashed line). For comparison, we also re-display the ADP nominal wage growth of job-stayers and job-changers (solid line). Consistent with the direction of the measurement error, the median nominal wage growth of job-stayers is slightly higher in the CPS data while the median nominal wage growth of job-changers is substantially lower in the CPS data. The gap in nominal wage growth for job-changers between the ADP and CPS data is particularly striking during the 2021–2023 inflation episode, when ADP records median nominal wage growth for job-changers exceeding 12 percent while the CPS measure peaks at about 8 percent. These results suggest that researchers should proceed with caution when examining wage dynamics

[11] We discuss the procedure in greater detail in the online appendix. For example, Appendix Figure R2 shows (i) the share of employees in our ADP sample who were job-stayers over the prior 12 months, (ii) the share who change to another ADP firm over the prior 12 months, and (iii) the relative job-changer and job-stayer weights used for pooling. We scale the job-changers by seven because the total employees in the ADP sample of firms used in this paper comprises approximately one-seventh of the U.S. workforce during the middle of our sample period.

[12] The CPS only asks individuals directly about whether they changed employers in waves 2, 3, 4, 6, 7, and 8. There is a 9 month gap between wave 4 and wave 6 during which there is no information on whether the CPS respondent changed jobs.

Figure 3: Nominal Wage Growth of Job-Stayers and Job-Changers: ADP vs CPS



(a) Job Stayers

(b) Job Changers

Notes: Panel A of the figure shows the nominal wage growth of job-stayers in ADP (solid line) and the CPS (dashed line) from January 2017 through December 2025. Panel B of the figure shows the nominal wage growth of job-changers in ADP (solid line) and the CPS (dashed line) over the same period. See text for additional details.

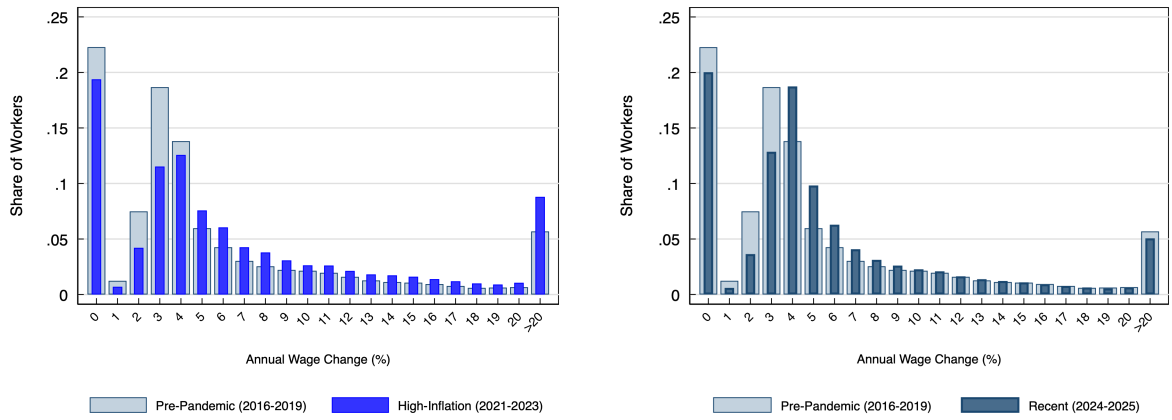
separately for job-changers and job-stayers using the CPS data.

3 Wage Growth Within Firms

There are two notable features of the nominal and real wage dynamics of job-stayers shown in Figure 2 that motivate the analysis in this section. First, median real wages of job-stayers fell sharply during the inflation period, even as their median nominal wages rose; nominal wage growth was positive but simply not enough to keep pace with inflation. Second, the median nominal wage growth of job-stayers was exactly three percent in every month from January 2017 through early 2020. A persistent exact three percent median nominal wage growth is difficult to reconcile with a model in which firms continuously reoptimize wages worker-by-worker in response to changing market conditions. It points instead to something more institutional: many firms maintain a modal annual raise of exactly 3% that applies broadly and uniformly to a large share of their continuing workers.

In this section, we look inside the median to characterize the full distribution of real wage changes for job-stayers, document the firm-level wage norms that generate that distribution, and show that those norms adjusted only modestly during the inflation surge. We also show that an increasing number of workers escaped their firm's wage norm during the inflationary period by receiving multiple wage adjustments within a year — a pattern consistent with workers taking costly actions to negotiate for higher pay. The result, for job-stayers, was a

Figure 4: Annual nominal wage growth for job stayers



(a) 2021–2023 (b) 2024–2025

Notes: Both panels show the distribution of nominal annual wage growth for job stayers during different periods. The distributions are pooled across hourly and salaried workers. For visual clarity, in both panels, the distributions are truncated at 0. In all periods, negative nominal wage changes are exceedingly rare. The fraction of job stayers with negative nominal wage growth was 1.7% in the pre-pandemic period, 1.6% during the high-inflation period, and 1.5% more recently.

distribution of nominal wages that shifted up with inflation, but also a distribution of *real wages* that shifted meaningfully down.

3.1 The Distribution of Annual Nominal Wage Growth, Job Stayers

Figure 4 reports the distribution of annual nominal base-wage changes for job stayers, defined as those workers continuously employed at the same firm for at least thirteen consecutive months. Panel (a) compares the pre-pandemic period (2016–2019) with the high-inflation period of 2021–2023. Panel (b) repeats this comparison but showing the recent period of 2024–2025 against the same pre-pandemic baseline. Several features of these distributions are worth noting.

In the pre-pandemic period, the distribution is concentrated in the range of two to four percent annual nominal growth. Approximately 21.9% of job stayers received no nominal wage change over the preceding year. Conditional on a nominal wage increase, the modal change was between 2 and 3 percent, with 51.4% receiving between 1 and 4 percent, 26.0% between 4 and 10 percent, and 5.6% more than 20 percent. The figure is truncated at zero because nominal wage cuts were exceedingly rare, with only 1.7% of workers in this period getting nominal wage cuts. These patterns are broadly consistent with earlier findings using

ADP data from the 2008–2016 period reported by Grigsby et al. (2021b). The somewhat lower incidence of zero nominal wage growth in our pre-pandemic sample, relative to their earlier period, likely reflects the stronger labor market conditions that prevailed between 2016 and 2019.

During the high-inflation period of 2021–2023, shown in Panel A, the distribution of nominal wage growth shifted to the right. The share of job stayers with no nominal wage change only fell minimally to 19.1%. The largest shifts occurred in the interior of the distribution. Conditional on receiving any nominal wage increase, the median increase rose to between three and four percent. Additionally, conditional on receiving a raise, the share receiving an increase between 1 and 4 percent fell to 35.1% while shares receiving an increase between 4 and 10 percent and above 20 percent rose to 34.0% and 8.7%, respectively. Workers receiving increases above 20% likely include those who received promotions or experienced other substantive changes in their roles. Despite the rightward shift in the distribution, more than half of job-stayers had annual nominal wage growth below 4% even as year-over-year inflation rose above 7%.

After the inflation period, the nominal wage growth distribution for job-stayers mostly returned to the pre-period baseline. The 2024–2025 distribution is shown in Panel B. The fraction of workers with the large pay increases generally associated with promotions returned to pre-pandemic level of around 5.0%, and the distribution largely resembles its pre-pandemic counterpart, with the exception that the modal wage change shifted up slightly. In 2024–2025, workers were getting more wage increases between 3-5% and fewer increases between 1-3%. During this period, both the annual inflation rate and the average nominal wage growth increased by about one percentage point relative to the pre-pandemic period.

3.2 The Distribution of Cumulative Real Wage Growth, Job Stayers

While Figure 4 shows that the distribution of nominal wages clearly shifted upward during the recent inflationary period, workers care about their real wages, which are governed by the relative movement of inflation and nominal wages. As we saw in Figure 2, real wages of the median worker fell sharply during the inflationary period. Moreover, looking only at the distribution of annual wage changes leaves open the possibility that workers who received relatively small increases in one year may have been compensated with larger increases in subsequent years, so that the cumulative experience of a long-tenured job stayer may have been more or less favorable than these annual snapshots suggest.

To trace how these cumulative losses accumulated as the inflationary period progressed,

Table 1: Summary of Job-Stayers With Real Wage Declines

	Dec 2020 Job-Stayers (Inflation Period)			Dec 2015 Job-Stayers (Pre-Period)		
	Share w/ Real Wage Decline	Conditional Mean Real Wage Decline	Share Job-Stayers	Share w/ Real Wage Decline	Conditional Mean Real Wage Decline	Share Job-Stayers
One-Year	66.5%	−5.1%	67.4%	37.7%	−2.2%	74.2%
Two-Year	57.4%	−7.7%	48.3%	29.2%	−3.9%	55.4%
Three-Year	49.3%	−8.3%	36.9%	24.4%	−5.3%	41.9%
Four-Year	43.0%	−8.9%	29.1%	21.4%	−6.9%	31.9%

Notes: Conditional mean real wage decline is the mean cumulative real wage change (annualized rate × years) among workers with negative real wage growth in the given interval. Share Job-Stayers is the fraction of the population-weighted sample that remained at the same firm over the full horizon, where job-changers are upweighted by 7 to reflect their relative frequency in the workforce.

Table 1 reports the share of job-stayers experiencing a real wage decline over progressively longer horizons — one, two, three, and four years — beginning in December 2020, alongside the analogous pre-period statistics beginning in December 2015. We then turn to the full distribution of four-year changes in Figure 5. When computing the cumulative real wage changes over multiple years we restrict our sample to workers who were continuously employed at the same firm over the corresponding time period. For example, for the two-year wage change, workers must have remained continuously employed at the same firm between December 2020 and December 2022. We compute real wage changes by deflating the worker's nominal wage in a given month by the corresponding CPI in that month.

The first three columns of Table 1 summarize the share of job-stayers with a real wage decline over horizons beginning in December 2020; the last three columns report the analogous pre-period statistics beginning in December 2015. As shown in the top row, two-thirds of job-stayers experienced a real wage decline during 2021, averaging roughly 5 percent among those who fell behind. The U.S. experienced a 7 percent inflation rate during 2021, but, as we show later, the median worker during this period received a nominal wage increase of only about 3 percent. These losses were large relative to a lower-inflation period. For comparison, during the pre-period, a little over one-third of workers experienced a real wage decline, with the mean decline for these workers being a modest 2.2 percent.

The fact that real wages fell during 2021 when inflation was high is not surprising. Most sticky-wage models predict real wage declines during a year of inflation, given that nominal wages adjust with a lag. What is more surprising is how persistent these losses were: half of

continuously employed workers still had lower real wages three years later (row 3), and 43 percent remained below their starting real wage four years later (row 4). Moreover, as the horizon lengthens, the share of stayers with a real wage decline falls from two-thirds at one year to 43 percent at four, but the mean decline among those who fall behind grows from roughly 5 percent to nearly 9 percent. Some workers were able to escape declining real wage growth as time progressed, but a substantial minority have nominal wages that persistently failed to keep up with the burst of inflation.[13]

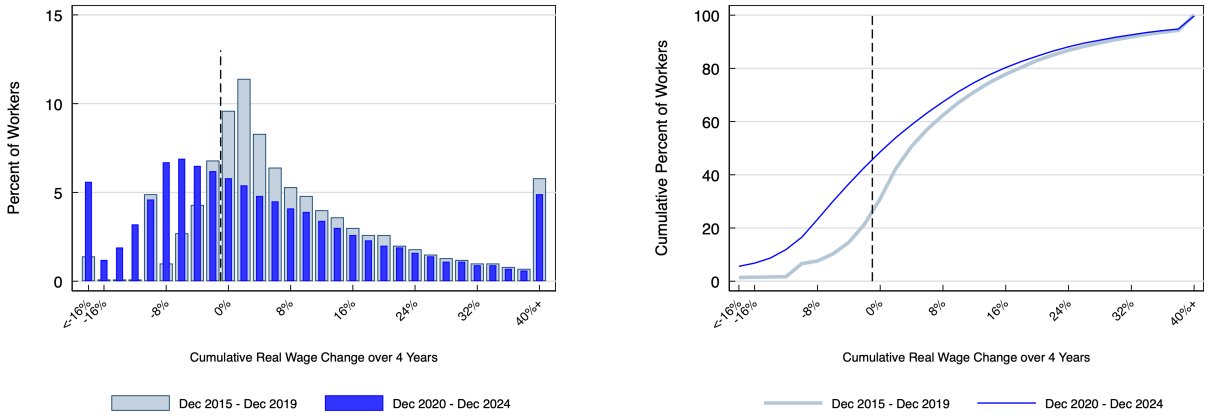
We now turn to the full distribution of four-year changes underlying the last row of Table 1, shown in Figure 5. Panel (a) reports the probability density functions of the four-year real wage changes of job-stayers during the inflation period and the pre-period, while Panel (b) reports the corresponding cumulative distribution functions. In the pre-period, real wage growth for the median worker was between 4 and 6 percent over the four-year period spanning 2016–2019. Twenty-one percent of workers experienced negative real wage growth during this period, with almost 5 percent seeing real wages fall by around 8 percent as a result of receiving zero nominal wage growth in every period, given the inflation rate averaged about 2 percent per year. Among those with negative real wage growth, the median decline in real wages was around 4 percentage points. For those who saw a rise in their real wage, the median real wage growth was roughly 6 to 10 percentage points — or 1.5 to 2 percent per year.

The growth in real wages in the four-year period between 2020 and 2024 looked meaningfully different. The distribution of cumulative wage growth during the inflation period lies substantially to the left of its pre-pandemic counterpart, with the leftward shift being reasonably uniform across the distribution. During this period, the median worker saw real wage growth of only between 2 and 4 percent (0.5 to 1.0 percent per year).

The share of workers taking persistent real wage losses was also far larger during the inflation period. As noted in the last row of Table 1, fully 43 percent of four-year job-stayers experienced declines in their real wages. Moreover, among those with negative wage growth, the decline was large, with a mean decline of nearly 9 percentage points and a median declining of roughly 7 percentage points. In other words, over 20 percent of all workers within the United States who stayed with their employers experienced a real wage cut of roughly 7 percent during the four-year period spanning 2021–2024.

[13] As a robustness exercise, we restricted the sample to people who were continuously employed between December 2020 and December 2024 when computing the one-year, two-year, and three-year changes to explore the role of selection in the changing patterns of real wage declines as the duration of the job-staying spell increased. The share with a real wage decline and the conditional size of the real wage decline were nearly identical to what was reported in Table 1 even controlling for changing sample selection across the rows.

Figure 5: Cumulative real wage growth for job stayers



(a) PDF (b) CDF

Notes: In both panels, the sample consists of workers continuously employed at the same firm at the beginning of the window and the end of the window. The pre-pandemic window covers December 2015 to December 2019; the post-pandemic window covers December 2020 to December 2024. Cumulative real wage growth is computed as the change in the worker's nominal base wage over the window, deflated by cumulative growth in CPI inflation over the same period (2.1% per year from 2016-2019 and 4.9% per year from 2020-2024). The vertical dashed line denotes zero cumulative real wage growth. The x-axis reports the total cumulative real wage change over the four-year period.

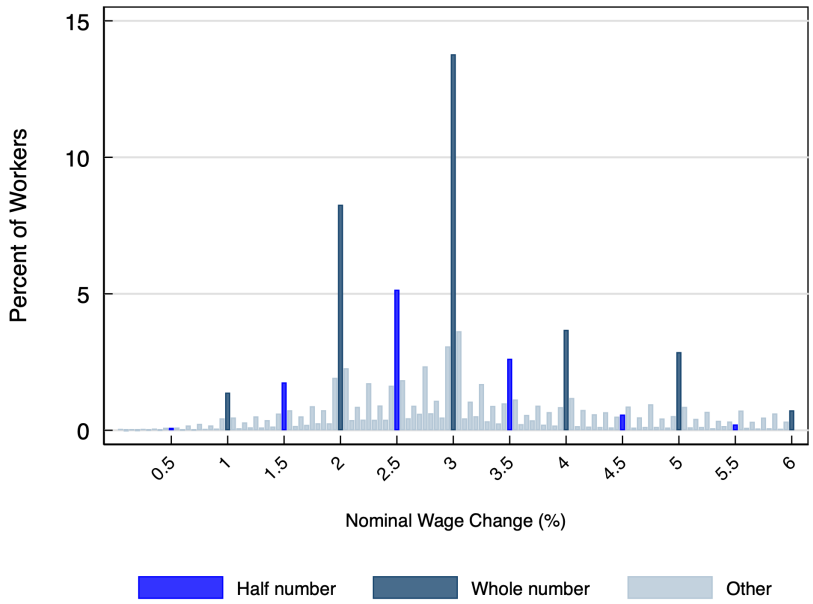
Taken together, Figures 4 and 5 and Table 1 establish a key feature of wage growth within firms during the inflationary period. For workers who remained at their firms, nominal wages rose but not nearly enough to keep up with inflation, resulting in meaningful declines in real wages for a substantial share of workers. These declines persisted through 2024.

3.3 Understanding Within-Firm Wage Growth: Strong Wage Norms

The rightward shift in the distribution of annual wage changes during 2021–2023, while notable, was far smaller than the inflation shock that drove it, leading to large declines in real wages for many job-stayers and much lower real wage growth than normal for others. The obvious question is why. We now show that the answer lies in a key institutional feature of within-firm wage setting: most firms apply a single modal annual raise to the large majority of their continuing workers, and this wage setting norm moved only modestly during the inflationary episode.

We begin by showing that even in the overall distribution of annual wage changes for job stayers, the discreteness in Figure 4 masks even sharper bunching of wage growth around round numbers. Figure 6 breaks down the distribution of annual wage changes by highlighting how many nominal wage changes occurred at exactly whole numbers (e.g., 1, 2, 3,

Figure 6: The bunching of nominal wage changes at round numbers



Notes: The figure plots the distribution of annual nominal base-wage changes averaged over 2017–2019, restricted to workers receiving a wage change between 0.01 and 6 percent. The distribution is renormalized to sum to 100 within this range. Bars shaded in dark gray correspond to wage changes at whole-number values (1, 2, 3, 4, and 5 percent); we measure the whole number bins in 0.02 percentage point intervals (e.g., 2.99 to 3.01). Bars in bright blue correspond to wage changes at half numbers (1.5, 2.5, etc.); again we measure these bins in 0.02 percentage point intervals (e.g., 2.49 to 2.51). All other bins (light gray) are in 0.09 or 0.10 intervals (e.g., 3.01 to 3.099, 3.10 to 3.199, etc.).

etc.), exactly half numbers (e.g., 1.5, 2.5, etc.), or any other number during the 2017-2019 pre-period.[14] The figure shows that between 2016 and 2019, among those workers who received a wage change of between 1 and 6 percent, a full 14% had nominal wage changes of exactly 3% while 21.1% were between 2.9 and 3.1 percent. Roughly 42% of all nominal wage increases below 6% were within 0.01 percentage points of a whole or half number. This stark bunching at round numbers is difficult to reconcile with a model in which firms individually reoptimize each worker's wage in response to that worker's idiosyncratic productivity or outside option. It instead suggests that firms adopt simple wage-setting conventions, wherein they give many workers a uniform 2, 2.5 or 3 percent wage increase.

Figure 6 establishes that nominal wage changes cluster sharply at round numbers in the aggregate. We now assess the extent of the dispersion in nominal wage growth within a firm and how that dispersion changed during the inflation period. For each firm-year, we

[14]Formally, the whole number and half number bins are defined within 0.02 percentage point ranges. For example, the 3% bin includes wage changes between 2.99 and 3.01. All other wage changes are in the intervening bins.

identify the "on-cycle" month as the month in which the largest share of workers receive a nominal wage adjustment and define the firm's wage norm as the modal adjustment made in that month. At nearly all firms, the vast majority of annual wage adjustments occur in this single month. When computing the modal nominal wage change during the on-cycle wage adjustment month, we group nominal wage changes within the firm into one percentage point bins centered around whole numbers. We restrict our sample to those workers within the firm who experienced one nominal wage change during the calendar year.[15] To ensure that the inferred modal change reflects a genuinely broadly applied rule rather than idiosyncratic noise, we further restrict the sample to firm-years in which at least 30 percent of workers received a positive nominal wage increase and at least 30 percent of those received the modal increase. The resulting measure captures the annual raise that a continuing worker at that firm would expect to receive absent a worker-specific adjustment.

Figure 7 shows that during a given year, most workers within a given firm receive a nominal wage increase of a similar size. Specifically, in Figure 7, we plot the distribution of nominal wage changes for all workers receiving a wage increase relative to the firm's own wage growth norm in that year. Among workers who received a wage increase within 5.5 percentage points of the firm's norm, almost 60 percent received a wage increase that was within half a percentage point of their firm's mode.[16] Again, the data reveal that firms for the most part are setting compensation growth similarly for most of their workers as opposed to individually tailoring wage growth to each worker.

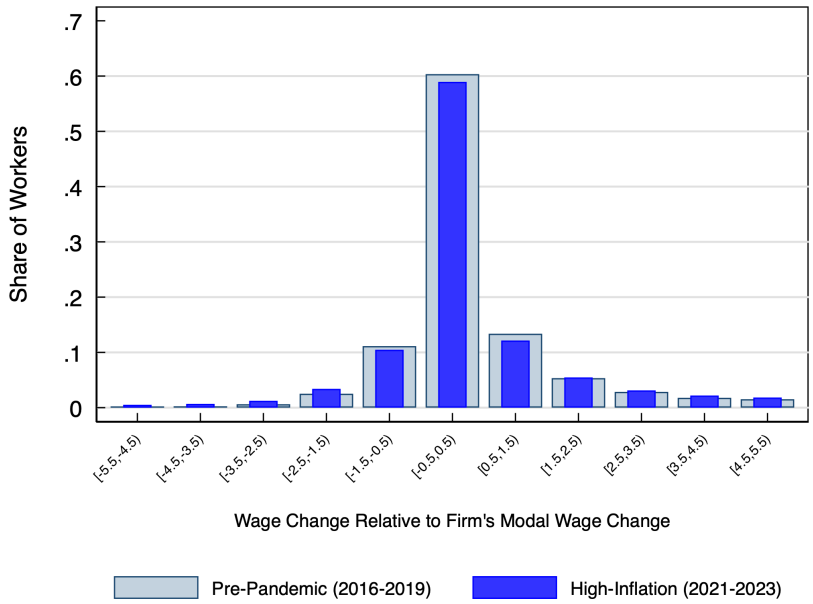
Because this firm-level wage norm applies to the majority of workers, a key input to understanding the behavior of wages within the firm during the inflation period is to understand how this firm-level wage norm evolved over this period. Figure 8 reports the cross-firm distribution of these firm-level wage norms, weighting firms by their number of employees. Panel (a) compares the pre-pandemic period to the high-inflation period and Panel (b) compares the pre-pandemic period with 2024–2025. Before the pandemic, the distribution was tightly concentrated. Indeed, 56% of workers were employed at firms whose modal wage change was between 2.5 and 3.5 percent, consistent with the large bunching at precisely 3% seen in Figure 6.

During the high-inflation period, firms only marginally adjusted their wage rules. 46.5% of workers were still at firms with a wage norm of between 2.5 and 3.5%. Roughly 88.9%

[15]Between 2016–2019, 78% of workers with a pay increase received only one change over the year. As we discuss below, workers receiving multiple wage increases within a year are more likely to reflect "off-cycle", worker-specific adjustments rather than the firm's broadly applied wage rule.

[16]By restricting this figure to workers who are within 5.5 percentage points of the firm wage growth norm we are focusing on workers who get a nominal wage increase during the year of between roughly 0% and 9%. Averaging over our sample period and averaging across all firms, approximately ninety percent of workers who get on-cycle wage increases receive a nominal wage increase of less than 9%.

Figure 7: Within-Firm Wage Norms



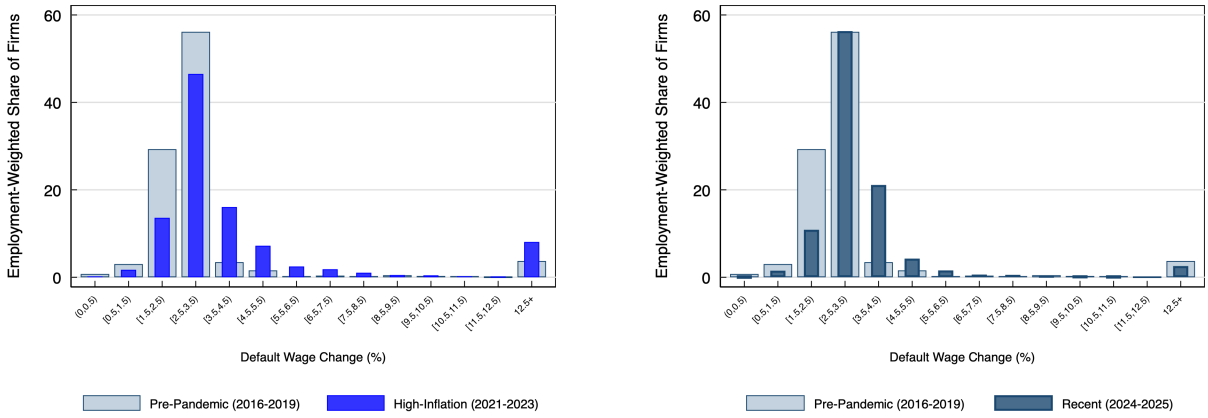
Notes: The figure plots the distribution of annual nominal wage changes for workers receiving a positive wage increase, measured in percentage points relative to the modal wage change at the worker's firm in that year. The sample is truncated to include only those workers receiving wage increases within 5.5 percentage points of the firm's modal wage (this excludes 11.7% and 16.5% of the pre-pandemic and high-inflation samples, respectively). The pre-pandemic series averages across 2016–2019 and the high-inflation series averages across 2021–2023. Each bar covers a one-percentage-point interval centered at a whole number (e.g. the bar at 0 is all wage changes between -0.5 and 0.5). The sample is restricted to firm-years in which at least 30 percent of workers received a positive nominal wage increase and at least 30 percent of those received the modal increase. Firms are weighted by employment.

of workers were employed in firms that had a wage growth norm in the 2-4 percent range before the pandemic. During the inflation period, that fraction fell modestly to 76.2%, with a slight shift away from the 2–3 percent range toward 4–5 percent. At the peak of the inflation period with prices increasing by over 7% per year, most workers were employed in firms with a wage growth norm in the 2-4 percent range. By 2024–2025, the modal wage norm of around 3% growth was restored, but more firms adopted wage norms around 4% and fewer held a norm of 2%.[17]

Figure 9 makes the point that firms did not systematically adjust their wage norms during

[17]Appendix Figures R7 and R8 show that this pattern is pervasive across industries. Specifically, the fraction of workers receiving the modal wage change is above 50 percent in all industries, ranging from 55.0 percent in Professional and Business Services to 67.7 percent in Education and Health Services. Moreover, in all industries except for construction, the median wage norm remained at 3 percent and the average wage norm rose by around 1 percentage point between 2016-2019 and 2021-2023. The median wage norm for construction increased to 4 percent during the inflation period.

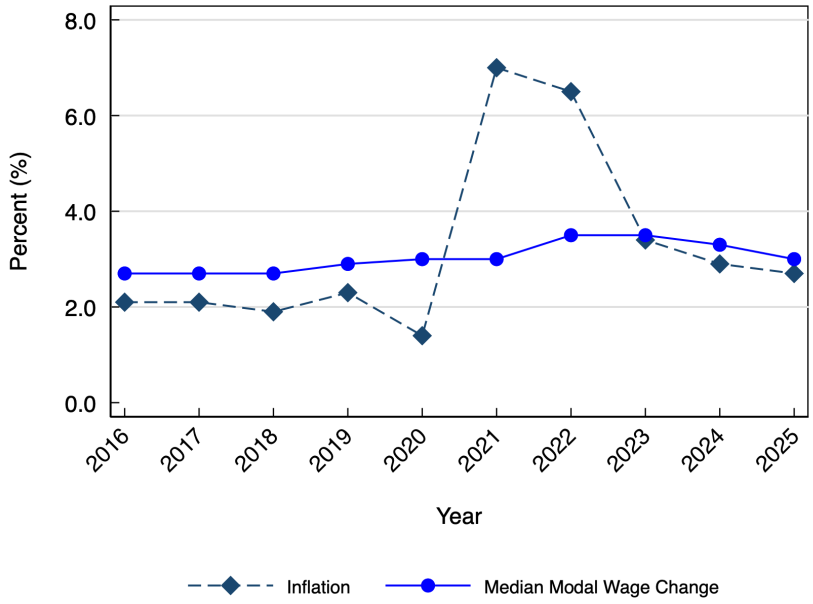
Figure 8: The distribution of firm-level wage norms



(a) 2021–2023 (b) 2024–2025

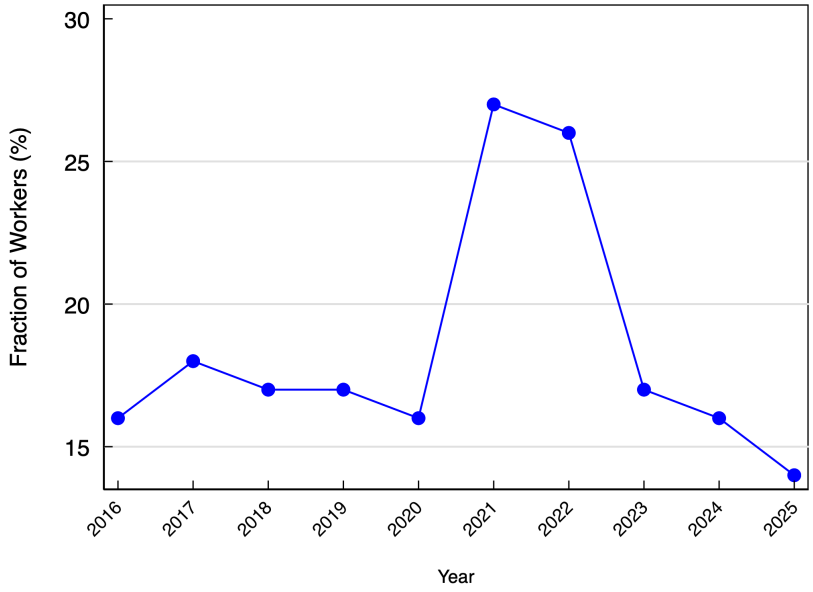
Notes: Panel (a) shows the distribution of firm-level norms in the pre-period (2016-2019) and the inflation period (2021-2023), and Panel (b) shows the distribution of firm-level norms in the pre-period (2016-2019) the post-inflation period (2024-2025). Firm-level norms are defined as the modal increase provided to workers who receive one wage change during the year. See the text for additional details. Firm-level observations are weighted by employment.

Figure 9: Time series for firm-level wage norms



Notes: Inflation is measured as the CPI-U December-to-December percent change from the Bureau of Labor Statistics. The median modal wage change is the median across firms of each firm's modal base wage change in that calendar year. In this calculation, firms are weighted by their number of employees.

Figure 10: The probability of multiple wage changes per year



Notes: The figure plots the fraction of job stayers receiving more than one nominal base-wage change within a twelve-month period, from 2016 to 2025. Job stayers are workers continuously employed at the same firm for at least thirteen months. The sample is restricted to firms with at least 50 job stayers and excludes workers who received a negative wage change.

the inflation period by looking at the evolution of these firm-level wage rules over time. The figure plots the employment-weighted average modal wage change across firms (solid line) alongside inflation rate (dashed line) from 2016 through 2025. In the pre-pandemic period, firm-level wage rules were relatively stable at a median of 2.7%, modestly above the rate of inflation. Beginning in 2021, inflation rose sharply, peaking at approximately seven percent in 2022. The average modal wage change also rose, reaching a peak of 3.5% in 2022 and 2023. By 2025, the median firm had a wage rule granting increases of three percent, roughly in line with inflation in that year. The stickiness of firms' wage rules in the face of inflationary pressure contributed to the systematic fall in real wages for job stayers.

3.4 Wage Adjustments Outside the Firm's Wage Rule

The preceding results show that the median firm's wage rule responded only modestly to inflation. However, a second margin of within-firm adjustment is the extent to which individual workers deviated from this wage norm through off-cycle wage increases. In this subsection, we examine this margin.

To begin, Figure 10 plots the fraction of job stayers who received more than one nomi-

nal base-wage change within a twelve-month period, measured annually from 2016 through 2025. In the pre-pandemic period, approximately 16 to 18 percent of workers received more than one wage change within a year. However, in 2021 and 2022, the fraction of workers receiving multiple wage changes within a year rose sharply to 27 percent. By 2023, this share had begun to decline, and by 2025 it had returned to slightly below its pre-pandemic level. The spike in the frequency of wage changes during the inflationary period indicates that firms became substantially more likely to make off-cycle wage adjustments outside the firm's standard annual review cycle. This pattern is consistent with worker actions being increasingly important for wage growth during this period (Guerreiro et al., 2026; Afrouzi et al., 2026).

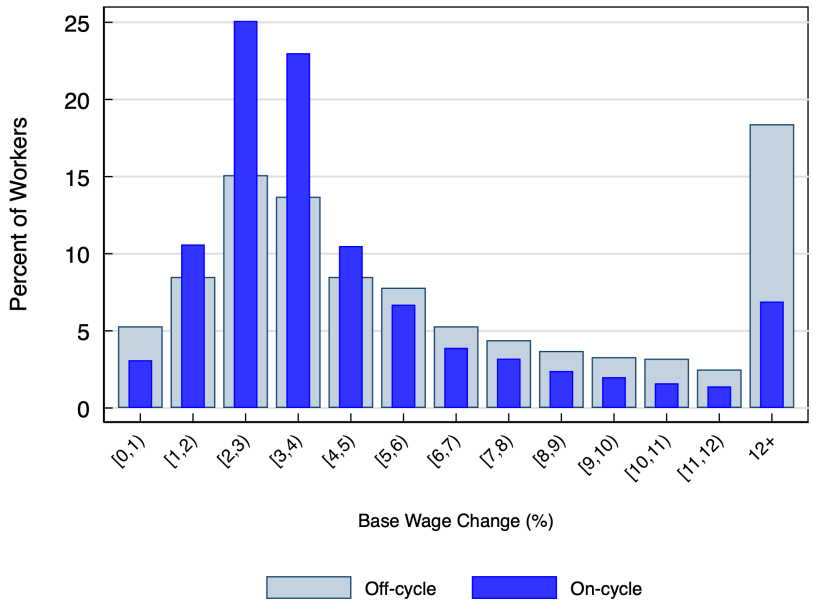
Figure 11 compares the distributions of on- and off-cycle nominal base-wage increases, pooling observations from 2016–2025. The distributions differ sharply. On-cycle increases are tightly concentrated between 2 and 4 percent, consistent with the modal raises documented above. Off-cycle increases are substantially more dispersed and skewed toward larger values: two-thirds exceed 4 percent, one-third exceed 8 percent, and almost 20 percent exceed 12 percent. These off-cycle adjustments likely reflect worker-specific events such as promotions, renegotiations, or merit increases.

Figure 12 shows how the median on-cycle and off-cycle wage changes evolved through this period. The default on-cycle norm of a 3% increase for on-cycle wage changes is again evident in the figure. For the years 2016-2020, the median on-cycle wage change was exactly 3%. Off-cycle wage changes are consistently above on-cycle changes throughout the sample period, but the gap widened considerably during 2021 and 2022, when the median off-cycle increased by around 1.5 percentage points while the median on-cycle increase rose only 1 percentage point.

3.5 Bonus Adjustments: Job Stayers

All of the above figures focus on movements in employees' base wages. However, another margin of adjustment that firms could use to compensate workers for their minimally indexed wage rule is to adjust other forms of compensation, namely bonuses. Indeed, on average, 18 percent of workers received a bonus in December from 2017–2019, but that number rose to 22 percent from 2021–2023. However, despite the increased prevalence of bonuses during the inflationary period, they did very little to stem the real wage losses that workers experienced. Appendix Figure R6 replicates Figure 5 above showing the five year cumulative wage growth of long job-stayers from 2020-2025 but also includes all the bonuses the individual accrued during the five years expressed as an appropriately defined addition to the December 2025

Figure 11: On-Cycle versus Off-Cycle Wage Changes

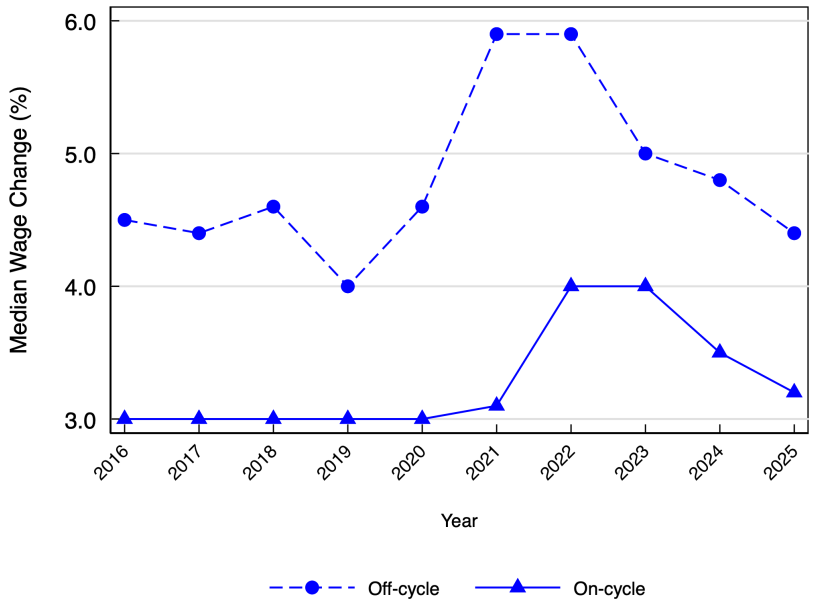


Notes: The figure plots the distribution of nominal base-wage changes separately for on-cycle and off-cycle increases, averaged over 2016–2025. For each firm-year, the on-cycle month is defined as the calendar month in which the largest share of that firm's workers received a wage change. On-cycle changes are those occurring in this month; off-cycle changes are those occurring in any other month. Each bar covers a one-percentage-point interval. The distribution is normalized to sum to 100 within each group. The sample is restricted to workers receiving a positive nominal wage change.

wage. The cumulative real wage distribution for job-stayers is nearly identical with and without bonuses. This is because bonuses are generally small as a fraction of total compensation for most workers, and one-off payments are poorly suited to offset the kind of real wage erosion that accumulates continuously over a multi-year inflationary episode.[18] For example, a bonus received in December 2022 may partially offset the real wage loss in that year, but it does nothing to restore the base wage from which all future raises are calculated. Because firms' wage rules apply to base wages rather than total compensation, a worker who receives a bonus but no adjustment to their base wage will continue to fall behind inflation in every subsequent year, with the gap compounding over time.

[18] Grigsby et al. (2021b) uses the ADP data from 2008-2016 to show that very few workers receive more than 10% of their annual compensation from bonuses and more than a quarter of them receive no bonuses during the year at all.

Figure 12: Time series of on-cycle vs. off-cycle wage changes



Notes: The figure plots the median nominal base-wage change for on-cycle and off-cycle wage increases in each year from 2016 to 2025. On-cycle and off-cycle months are defined as in Figure 11. Medians are computed among workers receiving a positive nominal wage change.

3.6 Summary

Taken together, the evidence in this section points to a coherent picture of within-firm wage setting during the inflationary episode. Firms operated with strong wage rules that determined the nominal wage growth for the majority of workers, and adjusted these rules upward only modestly in response to inflation. The resulting gap between the modal wage change and inflation was the primary driver of real wage erosion among most job stayers. At the same time, firms showed considerably more flexibility in responding to individual worker circumstances, delivering substantially larger increases to workers who took actions that resulted in off-cycle wage adjustments. These off-cycle increases helped to moderate, but did not eliminate, the real wage losses experienced by workers who remained within their firms throughout the inflationary episode.

4 Overall Wage Growth: Accounting for Job-Changers

The preceding section established that within-firm wage adjustment during the inflationary episode was constrained by the stickiness of firms' wage rules. An alternative mechanism by

which workers could recover lost real wages was to change employers. Indeed, the 2021-2023 period was one in which there was a notable increase in the fraction of workers who switched employers. Specifically, during 2016-2019, an average of 2.24% of employed workers switched jobs each month, while that number rose to 2.38% per month during the 2021-2023 inflationary period (Afrouzi et al. 2026). Figure 2 also shows that the real wage growth of workers who changed firms, the "job-changers", appeared to keep up during the inflationary period. In this section, we characterize the full distribution of wage changes for job-changers, assess how that distribution has changed during the inflation period, and compute a measure of cumulative four year wage growth for all workers in the economy combining both information on job-changers and job-stayers.

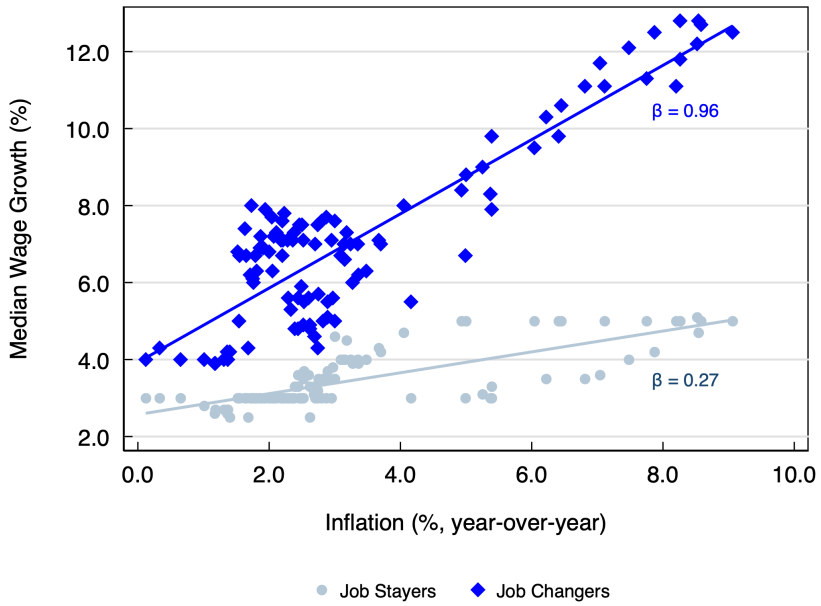
4.1 Wage Growth of Job Changers

Before showing the full distribution of wage changes for job-changers, we provide additional evidence on how the median wages of job-changers evolved relative to job-stayers as the inflation rate changed. Figure 2 above shows that nominal wage growth for job changers in any given period is higher than the nominal wage growth for job stayers, and the gap widened substantially during the inflationary period as job stayers experienced relatively modest nominal wage growth and job changers experienced large increases. Figure 13 makes this point more precisely by plotting, for each calendar month, median annual wage growth against the year-over-year inflation rate separately for job stayers and job changers. As we discussed in detail in Section 3, the nominal wages of the median job stayer in each month were very weakly indexed to inflation. This is especially true for workers subject to the firm's wage norms, but also true even after accounting for any deviations from the firm's wage norm that workers received. This contrasts with the median job changer, whose nominal wage growth was not only higher on average but tracked inflation nearly one-for-one. Formally, regressing median monthly wage growth on year-over-year inflation yields a pass-through of 0.96 for job-changers and just 0.27 for job-stayers. The slope of the firm's wage norm with respect to inflation is even lower at 0.082.[19] Therefore, in any given year, switching employers was the more reliable means of obtaining nominal wage growth that kept pace with contemporaneous inflation.

The time-series evidence on median wage growth, however, masks considerable heterogeneity in the experience of individual job changers. Figure 14 reports the distribution of annual nominal base-wage changes for these job changers, comparing the pre-pandemic period with the high-inflation period of 2021–2023 (Panel a) and the recent period of 2024–2025

[19]This slope is estimated using the annual time series from Figure 9.

Figure 13: Wage growth and Inflation: Job stayers and Job Changers

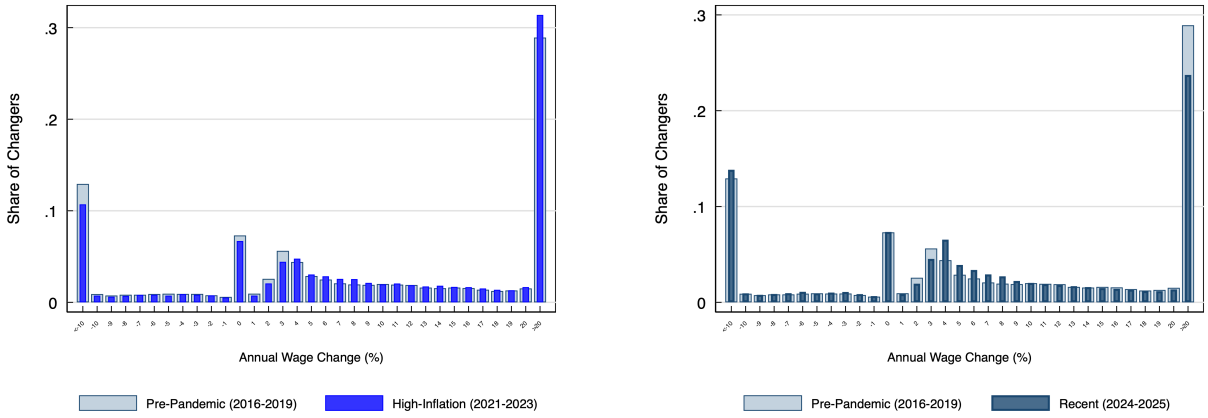


Notes: Each point is a calendar month from January 2017 to December 2025. The horizontal axis shows year-over-year CPI inflation; the vertical axis shows median annual wage growth for job stayers (workers who remain at the same firm for at least 12 months) and job changers (workers who switch employers at some point in the last 12 months). $\hat{\beta}$ reports the estimated slope coefficient from regressing median wage growth on inflation separately for each group.

(Panel b). Consistent with Grigsby et al. (2021b), in all periods, the distributions for job changers are strikingly more dispersed than those for job stayers documented in Figure 4. Both large nominal wage gains and large nominal wage losses are common among changers.

Comparing Panel (a) with the corresponding stayer distribution reveals that the inflationary episode had a qualitatively similar effect on job changers as on job stayers: both distributions shifted to the right. What differed was the magnitude. For job stayers, the rightward shift was modest, with the median increase rising by roughly one to two percentage points relative to the pre-pandemic period. For job changers, the shift was substantially larger. Among job changers, the fraction of job changers with negative wage growth dropped from 28.6% to 24.9%. The result was a widening of the already large gap in nominal wage growth between job changers and job stayers during the inflationary episode. Panel (b) shows the corresponding distribution for 2024–2025. As inflation receded, the job-changer distribution shifted back toward its pre-pandemic shape, and the gap in nominal wage growth between job changers and job stayers narrowed as well.

Figure 14: Annual nominal wage growth for job changers



(a) 2021–2023 (b) 2024–2025

Notes: Each panel compares the distribution of annual nominal wage changes for job changers—workers who switch employers—in the pre-pandemic baseline period (2016–2019, wide bars) against an alternative period (narrow bars). The left panel compares to the high-inflation period (2021–2023) and the right panel to the recent period (2024–2025). The wage change for each worker is measured as the log difference in base wages between jobs.

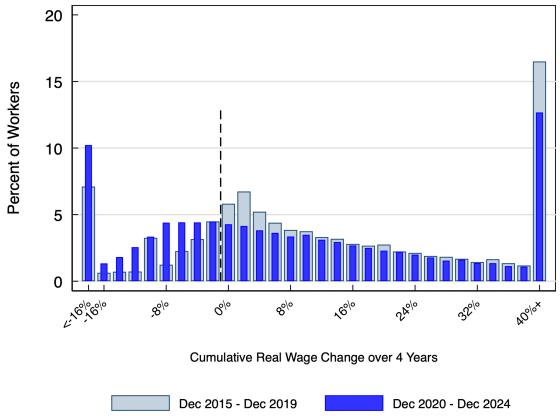
4.2 The Overall Effect of Recent Inflation on U.S. Real Wages

The previous section showed that the median wage gains available to job changers during the inflationary episode were substantially larger than the within-firm adjustments available to job stayers. This raises the question of whether cross-firm mobility was sufficient, in aggregate, to offset the real wage erosion documented in Section 3 for job-stayers. Figure 15 addresses this question by reporting the distribution of cumulative real base-wage growth for all workers — both job stayers and job changers combined — over the two four-year windows of December 2015 to December 2019 and December 2020 to December 2024.[20] Panel (a) reports the probability density function and Panel (b) reports the cumulative distribution function.

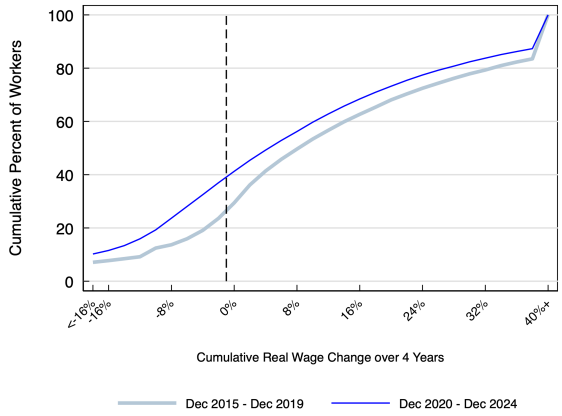
Panel (b) of Figure 15 contains the central result of the paper. Even after incorporating the large wage gains available through job changing, 37.0% of U.S. workers experienced

[20] Appendix Figure R12 shows the cumulative wage growth over these 4-year windows separately for all job changers, defined as those workers who appear in the dataset in the first month and the last month but are at different firms in those two periods. We arrive at the estimates in Figure 15 by taking a weighted average of the changer distribution and the comparable distribution for job stayers shown in Figure 5. Because we only observe the wage growth for the job changers who appear within our sample of ADP data which covers about one-seventh of U.S. employment in the middle of our sample period, we multiply the observed number of job changers over the four-year periods by 7 and then use these adjusted counts when calculating the weights for the stayers and changers. A more detailed discussion can be found in the online appendix. We find that 31.9% of the sample were job stayers over the 2016–2019 period and 29.6% of the sample were job stayers over the 2020–2024 period.

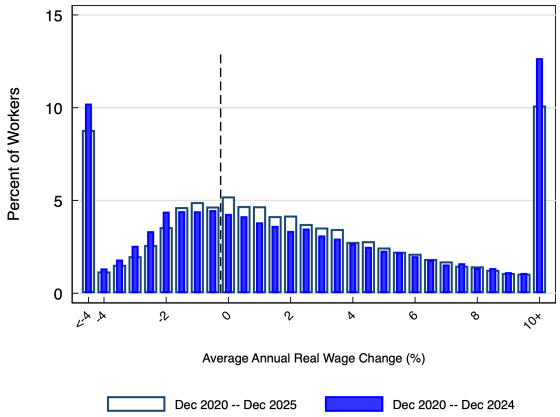
Figure 15: Cumulative real wage growth: All Workers



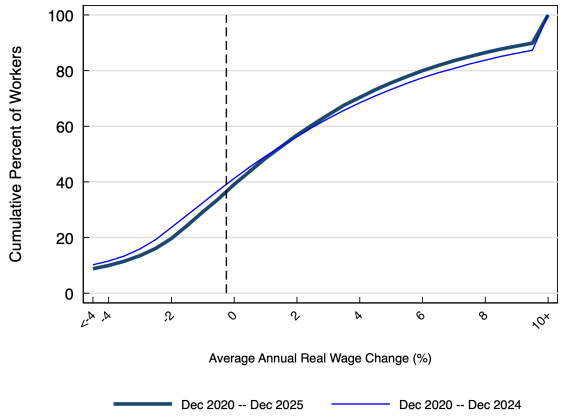
(a) PDF: 4-year changes, pre vs. post



(b) CDF: 4-year changes, pre vs. post



(c) PDF: post period, 4-year vs. 5-year changes



(d) CDF: post period, 4-year vs. 5-year changes

Notes: The top row compares the distribution of cumulative real wage growth over four-year windows beginning in December 2015 (pre-inflation period, ending December 2019) and December 2020 (inflation period, ending December 2024). The bottom row restricts to the inflation period and compares four-year (December 2020–2024) and five-year (December 2020–2025) cumulative real wage growth. The sample combines job-stayers and job-changers, weighting job-changers by a factor of seven to reflect their relative frequency in the workforce.

a cumulative *decline* in real wages over the four years from December 2020 to December 2024. This is 1.6 times larger than the 23.6% of workers who saw a real wage decline over the comparable pre-pandemic window. Moreover, this share is only slightly lower than the 42.8% of *job-stayers* that experienced real wage declines during the 2021-2024 period which shows that incorporating job-changers does not meaningfully alter the findings. And for those who fell behind during the 2021-2024 period, the losses were sizable: conditional on a real wage decline, the median worker lost 9 percent of their real purchasing power over the

four years. Combining the two facts, roughly 20 percent of all American workers — not just those who stayed at the same firm — ended 2024 with real wages more than 9 percent below where they stood in 2020.

These losses are larger still when measured against a reasonable benchmark for what workers had come to expect. Real wages grew at roughly two percent per year during the pre-pandemic period, reflecting a combination of life-cycle earnings growth and aggregate productivity gains. A worker on that trajectory would have accumulated about an eight percent gain in real purchasing power over four years. Measured against this counterfactual, the median worker ended 2024 well below trend, and 58% of U.S. workers failed to achieve the real wage growth they would have realized had pre-pandemic real wage growth trends continued. As seen from Panel (b), the cumulative real wage growth distribution systematically shifted down by about 4 percent during the December 2020 to December 2024 period relative to the four-year period prior to the pandemic.

Panels (c) and (d) of Figure 15 compare the cumulative wage growth in real terms over the 4-year period from 2020-2024 to the growth over the 5-year period from 2020-2025.[21] To make these numbers directly comparable, we annualize the changes and report the average annual wage growth over that period. Despite the fact that 2025 was a year of relatively low inflation and a year in which median wages were growing according to trend (see Figure 1), the story does not change meaningfully when we also account for this additional year. The fraction of workers with negative real wage growth over this period drops from 37.0% to 33.9% and average cumulative real wage growth over this five-year period was still roughly 4 percent below pre-period trends.

The reason job changing did so little to offset the aggregate decline is that switching is an infrequent event for any individual worker. Even though only about 30 percent of workers remained at the same firm for the entire four-year window, most of those who changed jobs did so in just one year of the four and then remained job-stayers — subject to their firm's sticky wage norm — in the others. A single year of elevated job-changer wage growth, however large, could not compensate for three years of within-firm raises that failed to keep pace with inflation. The firm wage rule, which governed the wage trajectory of workers in the years before and after any switching episode, remained the dominant determinant of cumulative real wage growth for the typical worker.

Together, the evidence in Sections 3 and 4 points to a unified interpretation of real wage dynamics during the inflationary episode. Firms adjusted their wage rules only partially

[21] We focus primarily on the 4-year period because we can directly compare that to the pre-pandemic period from 2016-2019. Before 2016, the match rate within the ADP data deteriorates, making the comparable 5-year pre-period from 2015-2019 a less reliable benchmark.

in response to inflation, generating persistent real wage declines for the many workers who remained at their employers. Workers who took action — through off-cycle renegotiation within the firm or by switching to a new employer — achieved better outcomes, but such actions were too infrequent to restore real wages to their pre-pandemic trajectory for a substantial share of the workforce.

We also note that the cumulative real wage declines we document are themselves only part of the burden. As emphasized by Guerreiro et al. (2026), Afrouzi et al. (2026), and Pilossoph and Ryngaert (2024), the very actions that allowed some workers to keep pace — searching for a new job, bearing the disruption of switching employers, or negotiating against a reluctant firm — are themselves costly. The full welfare cost of the recent inflation is therefore twofold: the real wage losses borne by the many workers whose pay was anchored to a sticky firm wage norm, and the costly effort expended by those who managed to escape it. Even workers who "kept up" with inflation, in other words, were made worse off by it.

5 The Distributional Effects of Sticky Wage Norms

In this section, we explore the distributional impacts of these sticky nominal wage norms within a firm.

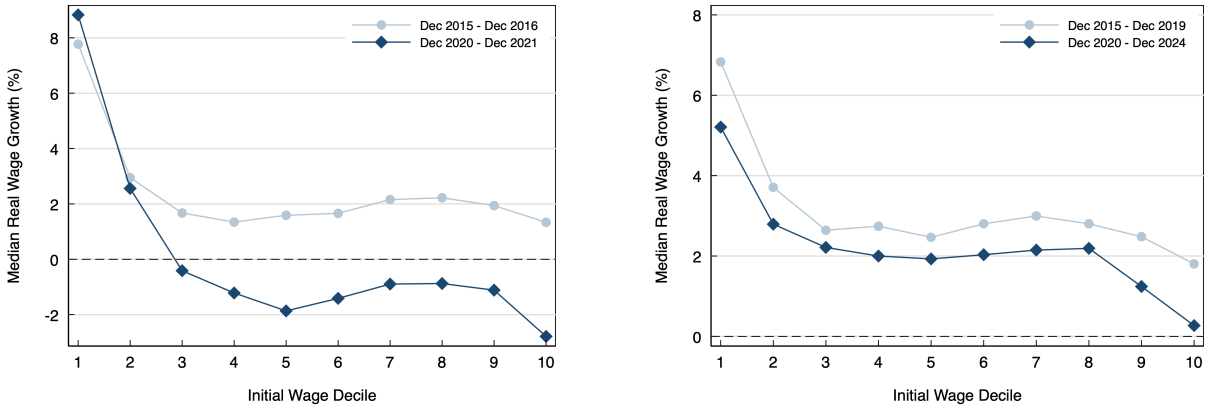
5.1 Initial Wage

What happened to cross-worker income inequality during the recent inflation period? Recent research has used data from the *Atlanta Fed's Wage Tracker Index* to show that there was wage compression during the early parts of the inflation period (Autor et al. 2024; Afrouzi et al. 2026). Panel (a) of Figure 16 shows similar patterns in the ADP data. In particular, higher-wage prime-age workers experienced much larger real wage declines during the 2021–2022 period.

For all the analysis in this section, we restrict the sample to individuals aged between 25 and 50 in the initial period when computing wage changes and pool together data from job-stayers and job-changers.[22] The solid line in Panel (a) shows the real wage change between December 2020 and December 2021 for individuals in different initial wage deciles defined in December 2020. For comparison, we show the same patterns for annual real wage changes by decile during the December 2015 to December 2019 period. Specifically, we compute the real wage growth within each decile for each year during that period (December 2015 to December 2016, December 2016 to December 2017, etc.) and average over the four years.

[22] See the Data Appendix for the full details of the procedure to pool together job-stayers and job-changers.

Figure 16: Real Wage Growth By Initial Income Decile, Inflation Period



(a) One Year Real Wage Growth

(b) Four Year Cumulative Real Wage Growth

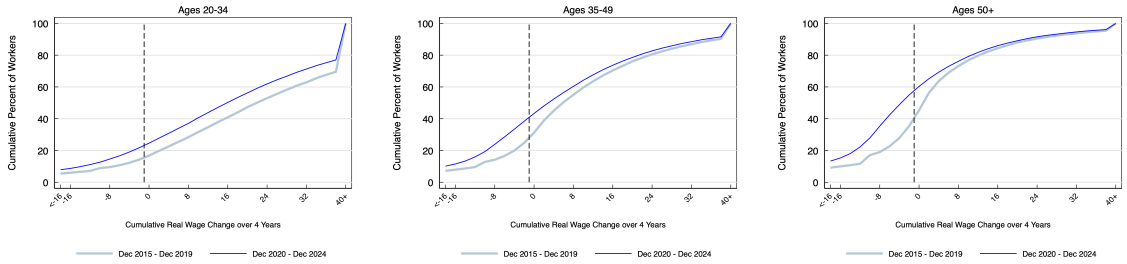
Notes: Panel A of the figure shows the real wage growth between December 2020 and December 2021 (solid line) and the annual one-year real wage growth averaged over the December 2015 to December 2019 period, by initial income decile. Panel B shows the cumulative four-year real wage growth by decile over the December 2020 to December 2024 period and the December 2015 to December 2019 period, respectively. All lines pool together data from job-stayers and job-changers. Sample is restricted to individuals aged 25 to 50 in the initial period. See the text for additional details.

As seen from the figure, the 2016–2019 period was also a period of real wage growth compression — a pattern also documented in Autor et al. (2024). All deciles during this earlier period experienced annual real wage growth, with the growth being the largest for the bottom two deciles of the wage distribution. During 2021, the early part of the inflation period, real wage growth was similar to pre-period patterns for the first and second deciles while real wages fell sharply for all other deciles. During 2021, roughly 40% of individuals in the first two wage deciles switched jobs while only about 30% of individuals in the top eight deciles switched jobs. As seen above, job switching allowed workers to escape the sticky nominal wage norms experienced by job-stayers. These patterns reinforce that 2021 was a period of higher wage compression even when compared to the 2016–2019 pre-period.

Panel (b), however, shows that as the inflation period progressed, real wage growth shifted down similarly for all wage deciles relative to the pre-period. In particular, the figure shows the annualized cumulative real wage growth during the December 2020 through December 2024 period (solid line) and the December 2015 through December 2019 period (dashed line). For the middle deciles, annualized median real wage growth was about 1 percentage point lower during the inflation period.[23] The gap was about 1.5 and 2 percentage points lower per year, respectively, in the bottom and top deciles. Overall, the patterns suggest that over

[23]Note that a 1 percentage point annualized gap over four years is consistent with the 4% cumulative decline for the median worker as of 2024 shown in Figure 1.

Figure 17: Cumulative Real Wage Growth by Age Group



Panel A: Age 20-34 | Panel B: Age 35-49 | Panel C: Age 50+

Notes: Figure plots the cumulative distribution of four-year cumulative real wage growth for workers aged 20–34 (Panel A), 35–49 (Panel B), and 50 and older (Panel C), comparing the pre-pandemic period (solid lines) to the inflation period (dashed lines). Within each age group, job-stayers and job-changers are combined using population weights as described in Section 4. The dashed vertical line denotes zero cumulative real wage growth. Real wage changes are deflated using CPI-U.

the cumulative four-year period, sticky nominal wage norms did not generate any differential wage compression compared to the 2016–2019 pre-period.

5.2 Age

Figure 17 plots the distribution of four-year cumulative real wage growth for workers aged 20–34, 35–49, and 50 and older, comparing the pre-pandemic and inflation periods. Within each age group, job-stayers and job-changers are combined using the population weights described in Section 4. The inflation period eroded real wages substantially more for older workers than for younger workers. The fraction of workers with negative four-year cumulative real wage growth rose by 7.5 percentage points for workers aged 20–34 (from 14.3% to 21.8%), by 13.6 percentage points for workers aged 35–49 (from 24.8% to 38.5%), and by 19.5 percentage points for workers aged 50 and older (from 35.5% to 55.0%).

Three mechanisms account for the worse real wage outcomes of older workers during this inflationary period. First, older workers are substantially more likely to be job-stayers: 55.4% of workers aged 50 and older were job-changers over the four-year pre-pandemic window, compared with 79.4% of workers aged 20–34. Since stayers experienced sharper real wage erosion during the inflation period (Section 3), a larger stayer share directly amplifies the exposure of older workers. Second, job-changing provided less insulation for older workers even conditional on switching. In the pre-pandemic period, the median annualized real wage growth of job-changers exceeded that of job-stayers by around 2.50% for workers aged 20–34 (6.75% versus 4.25%); for workers aged 50 and older, the switching premium was 0.00%

(0.75% versus 0.75%). The job-ladder gains that protect young workers from sticky nominal wage norms dissipate with age, leaving older changers with real wage outcomes no better than those of same-age stayers. Third, even within the stayer population, there is a steep age gradient in real wage outcomes. The fraction of stayers with negative four-year real wage growth was 9.8% for workers aged 20–34 but 30.5% for workers aged 50 and older in the pre-pandemic period, rising to 20.1% and 58.3%, respectively, during the inflation period. Younger stayers accumulate within-firm raises and promotions more frequently, while older stayers were more likely to be at or near the top of their pay scale, subject to only the firm's sticky wage rules.[24]

5.3 Work From Home Occupations

In this subsection, we assess how much of the real wage declines documented above can be explained by the rise of work from home in the post-pandemic labor market. If working from home is a positive amenity, workers should be willing to pay for it by accepting lower wages. In that case, real wages could fall even as worker utility rises.[25]

To do so, we split workers in the ADP data by whether their occupation is amenable to working from home, using the classification in Dingel and Neiman (2020).[26] Only about 60–65% of the workers in our sample have an occupation code, with the exact share depending on the year.[27] For workers with an occupation code, we use the Dingel and Neiman (2020) indicator to classify each occupation as either amenable to working from home (WFH) or not amenable to working from home (non-WFH). We exclude all workers without an occupation code from the analysis in this subsection.

Panel (a) of Figure 18 plots the median annual nominal wage growth of job-stayers by work-from-home status. The solid line shows job-stayers in non-WFH occupations; the dashed line shows job-stayers in WFH occupations. The two series track each other closely except in 2021 and 2022 — the years when the economy shifted toward work from home. Over those two years, nominal wage growth for workers in WFH occupations ran about 1

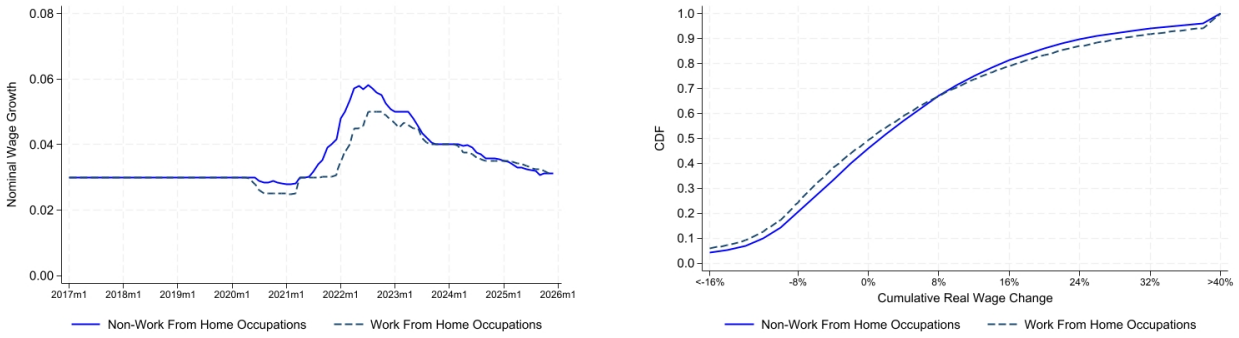
[24]We also explore whether the real wage patterns documented in the paper differ by gender. The results are shown in Appendix Figure R17. As shown in the appendix, real wages during this period evolved similarly between men and women.

[25]There is a large literature studying the labor market implications of working from home. See, for example, Bick et al. (2023), Akan et al. (2025), Bagga et al. (2025), Cullen et al. (2025), and Emanuel et al. (2026).

[26]Based on occupational task measures, Dingel and Neiman (2020) create a 0/1 indicator for whether workers in over 750 detailed occupations have the ability to work from home. The detailed occupation codes used in Dingel and Neiman (2020) map directly to the SOC codes used to classify occupations in the ADP dataset.

[27]Occupation is not required for the payroll services ADP provides, but many employers also use the ADP platform for their broader HR services.

Figure 18: Job-Stayer Wage Growth by Work From Home Status



(a) Annual Nominal Wage Growth

(b) Dec 2020-Dec 2024 Real Wage Growth

Notes: Panel A of the figure shows year-over-year nominal wage growth for job-stayers in occupations not amenable to working from home (solid line) and occupations amenable to working from home (dashed line). Panel B shows the four-year cumulative real wage growth of job-stayers between December 2020 and December 2024 working in occupations not amenable to working from home (solid line) and occupations amenable to working from home (dashed line). Occupations are classified by their work-from-home status using the classification in Dingel and Neiman (2020). Only about 60% of the workers in our ADP dataset have an occupation code. See the text for additional details.

percentage point lower per year, or about 2 percentage points in total. While not causal, this gap is consistent with workers being willing to give up about 2% of their annual earnings to work from home.[28]

Table 2 shows a consistent pattern for job-changers. It reports the median annual real wage growth of job-changers over 2018–2019 (column 2) and over 2021–2023 (column 3), with column 4 giving the difference.[29] Each row corresponds to a type of move, defined by the work-from-home status of the origin and destination occupation. The first row is workers who switch jobs but stay in non-WFH occupations; they make up about 43% of job-changers, a share that is stable across the two periods. The second row is workers who switch jobs but stay in WFH occupations, about 35% of job-changers. The third row is workers who move from a WFH to a non-WFH occupation, and the fourth is the converse — workers who move from a non-WFH to a WFH occupation.

If working from home became more valuable after the pandemic, wage gains associated with moving into a WFH occupation should have declined relative to the pre-pandemic period. Table 2 provides suggestive evidence consistent with this prediction. Real wage

[28] Afrouzi et al. (2026) find a similar 2% decline in real wages for individuals in work from home occupations within the CPS data provided by the Atlanta Federal Reserve.

[29] Specifically, we compute the median real wage growth of job-changers from December to December in each of the years (i.e., December 2017 to December 2018 for the 2018 value). We then average over the years in each column.

Table 2: Annual Real Wage Change of Job-Changers, Within and Across Occupations by Work From Home (WFH) Status

	Average Annual Real Wage Change		
	Dec 2017–Dec 2019	Dec 2020–Dec 2023	Difference
Non-WFH to Non-WFH	2.6%	2.1%	−0.5 p.p.
WFH to WFH	4.4%	3.8%	−0.6 p.p.
WFH to Non-WFH	3.5%	3.1%	−0.4 p.p.
Non-WFH to WFH	11.0%	8.7%	−2.3 p.p.

Notes: Table shows the average real wage change of job-changers within and between occupations categorized by their work-from-home (WFH) status. We use the Dingel and Neiman (2020) classification to categorize occupations. Row 1 shows the wage changes of job-changers within non-work-from-home occupations. Row 2 shows the wage changes of job-changers within work-from-home occupations. Row 3 shows the wage changes of job-changers who move from a work-from-home occupation to a non-work-from-home occupation. Row 4 shows the wage changes of job-changers who move from a non-work-from-home occupation to a work-from-home occupation. Column 2 shows the median real wage change of job-changers averaged over 2018 and 2019. Column 3 shows the median real wage change of job-changers averaged over 2021, 2022, and 2023. The last column shows the difference between columns 3 and 2. See text for additional details.

growth declined by only 0.4–0.6 percentage points for the other three types of job changes, but by 2.3 percentage points for workers moving from a non-WFH to a WFH occupation. Although these workers continued to receive the largest wage gains—likely because WFH occupations are concentrated in higher-paying professional services—the differential decline is consistent with a willingness to pay roughly 2 percent of wages for the option to work from home.[30]

These results are, at best, suggestive. Workers in WFH occupations tend to be older and higher-income, and, as documented above, these workers had lower real wage growth during the inflation period because they are older, sit on a flatter part of the age-earnings profile, and change jobs less often. But even granting that workers value the option to work from home at about 2% of their wages, this does not change the paper's conclusions. Panel (b) of Figure 18 plots the cumulative four-year real wage growth of job-stayers over December 2020 to December 2024, separately for non-WFH occupations (solid line) and WFH occupations (dashed line). It is the counterpart to panel (b) of Figure 5, split by work-from-home status. The two lines sit nearly on top of each other: 40% of job-stayers in non-WFH occupations experienced real wage losses over this period, compared with 44% of job-stayers in WFH occupations.

Overall, the results in this section are consistent with workers valuing the option to work

[30]It is worth noting that individuals switching away from WFH occupations to non-WFH occupations did not receive a real wage increase in the post-pandemic period.

from home at roughly 2% of their wages. However, even adjusting for that amenity – that is, counting only real wage declines larger than 2% for workers in WFH occupations — nearly 40% of job-stayers in WFH occupations still fell behind between December 2020 and December 2024, essentially the same share as the 40% of job-stayers in non-WFH occupations who saw any real wage decline.

6 Putting It Together: The Size and Sources of the Real Wage Shortfall

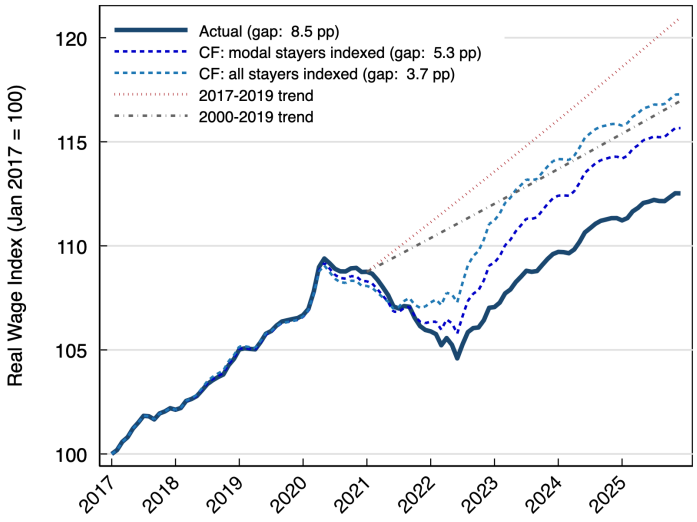
The preceding sections establish that the inflation episode left real wages persistently below their pre-pandemic trajectory and that wage growth within firms responded only partially to rising prices. We now bring these findings together by asking how much of the real wage shortfall can be accounted for by the incomplete indexation of job-stayers' wages. Because the answer depends in part on the path that wages would otherwise have followed, Figure 19 presents two alternative trend benchmarks alongside two indexation counterfactuals.

The more demanding benchmark extrapolates the 2017–2019 trend, when the aggregate real wage index grew by 2.2 percent per year. Because the index follows workers over time and combines job-stayers and job-changers, its trend captures not only aggregate productivity growth but also returns to experience, career progression, and gains from job switching. This short period may overstate the relevant post-pandemic counterfactual if underlying productivity growth subsequently slowed during the 2020-2025 period.[31] We therefore also report a longer-run benchmark based on average real wage growth of 1.5 percent per year over 2000–2019. By December 2025, the observed real wage index was 8.5 index points below the 2017–2019 trend and 4.4 points below the 2000–2019 trend. The conclusion that real wages remained below trend therefore does not depend on extrapolating the unusually strong real wage growth during the pre-pandemic period, although the magnitude of the shortfall does.

We next ask how much of these gaps reflects incomplete wage indexation within firms. In both counterfactuals, we preserve the wage growth that prevailed under low and stable inflation and add one-for-one pass-through of inflation above its 2017–2019 average. Thus, when inflation equals its pre-pandemic average, the counterfactual reproduces the corresponding pre-period wage-growth rate; each additional percentage point of inflation raises nominal

[31] From 2021Q1 through 2022Q4, U.S. labor productivity growth was close to zero as real GDP stagnated and aggregate hours increased. However, from 2023Q1 through 2025Q4, U.S. labor productivity grew at an above historical average annual rate of 2.3%. Over the entire 2021-2025 period, labor productivity growth was lower than the 2017-2019 pre-period.

Figure 19: Accounting for the Real Wage Shortfall



Notes: The figure plots the observed ADP real wage index and two accounting counterfactuals. All series are normalized to 100 in January 2017. Both counterfactuals begin in January 2021 and are initialized at the observed index. In the first counterfactual, the modal raise equals its 2017–2019 average plus one-for-one pass-through of CPI inflation relative to its 2017–2019 average; wage growth among non-modal stayers and job-changers is held at its observed value. In the second counterfactual, the same indexation rule is applied to wage growth for all job-stayers, while job-changer wage growth remains at its observed value. The observed shares of stayers and job-changers are preserved in both exercises. The dotted and dash-dotted lines extrapolate the 2017–2019 and 2000–2019 real wage trends, respectively, with both anchored to the observed index in January 2021. Reported gaps are index-point differences relative to the 2017–2019 trend in December 2025.

wage growth by one percentage point.

The first counterfactual, shown in the darker blue line in Figure 19, applies this rule only to workers receiving their firm's modal raise. Wage growth among the other stayers and job-changers, along with the shares of workers in each of these groups, remains at its observed value. This deliberately narrow exercise isolates the direct contribution of the broadly applied wage norm. Under this counterfactual, the December 2025 real wage index rises by 3.2 index points, reducing the gap to the 2017–2019 trend from 8.5 to 5.3 points. Indexing the modal raise alone therefore closes roughly 40 percent of the shortfall relative to this benchmark. Relative to the lower 2000–2019 trend, simply indexing the modal raise to inflation closes roughly 73 percent of the shortfall. The size of this effect underscores the aggregate importance of firms' wage norms, above and beyond changes in workforce composition, job-switching patterns, and worker-specific wage adjustments.

The narrow counterfactual may understate the consequences of indexing firms' wage-setting rules. Raises of all job stayers likely are determined within the same firm-level wage-setting system – if a firm adjusted its broadly applied wage norm fully for inflation, it

is plausible that the rest of its within-firm wage schedule would shift as well. We therefore construct a second counterfactual in which wage growth for all job-stayers is fully indexed, while job-changer wage growth and the relative shares of stayers and job-changers remain at their observed values.[32] Under this broader counterfactual, the end-of-2025 real wage index rises by 4.8 index points, the gap to the 2017–2019 trend falls to 3.7 points and the gap to the 2000-2019 trend is essentially eliminated. Extending indexation from the modal raise to all job-stayers therefore closes a substantial amount of the real wage gap regardless of the assumed pre-period or longer time series counterfactual real wage trend.[33] These are point estimates from an accounting exercise that embeds specific modeling choices — the indexation rule, the treatment of job-changers, and the fixed group shares — and the exact magnitudes should be read with that in mind. What is robust across specifications is the qualitative conclusion: incomplete indexation of job-stayers' wages accounts for the bulk of the real wage shortfall, and full indexation would have restored real wages to their pre-pandemic trajectory under our conservative benchmark.

We note that these calculations quantify the consequences of slow wage adjustment to a temporary inflation shock, but they do not imply that firms' wage norms would remain fixed in a permanently high-inflation environment. The norms documented in this paper developed during several decades of low and stable inflation. In that setting, a customary nominal raise of roughly three percent generally delivered positive real wage growth. If high inflation became a persistent feature of the environment, we might expect wage-setting institutions to adjust endogenously and firms may choose to adopt higher wage growth norms. The historical experience is consistent with this interpretation: cost-of-living adjustment clauses became substantially more prevalent in U.S. collective bargaining agreements during the high-inflation period of the 1970s and early 1980s and declined as inflation receded in subsequent decades (Holland, 1995). The stickiness documented here is therefore a feature of a wage-setting regime adapted to low and stable inflation, rather than a structural constant that would persist under any inflation process.

[32] These are accounting counterfactuals rather than general-equilibrium policy experiments. Some off-cycle raises and job changes were likely responses to the inadequacy of firms' wage norms and might have occurred less frequently under an indexed wage-setting regime. In the all-stayer exercise, observed stayer wage growth is replaced by the indexed path rather than receiving an additional inflation adjustment on top of observed raises.

[33] The remaining gap to the 2017–2019 trend should not be interpreted as evidence of continued under-indexation among job-stayers: in the broader counterfactual, their wage growth passes through excess inflation one-for-one. Although job-changers' nominal wage growth tracked inflation closely during the inflation episode, their subsequent real wage growth did not reproduce the unusually rapid gains observed in 2018 and 2019.

7 Broader Consequences of Incomplete Wage Indexation

The preceding sections show that sticky firm wage norms transformed a temporary and unexpected inflation shock into persistent real wage losses. We now examine two broader consequences of this incomplete adjustment. First, we ask whether the resulting reduction in real labor costs is reflected in higher firm profits. Second, we ask whether persistent losses in purchasing power help explain why consumer sentiment remained depressed even after inflation subsided.

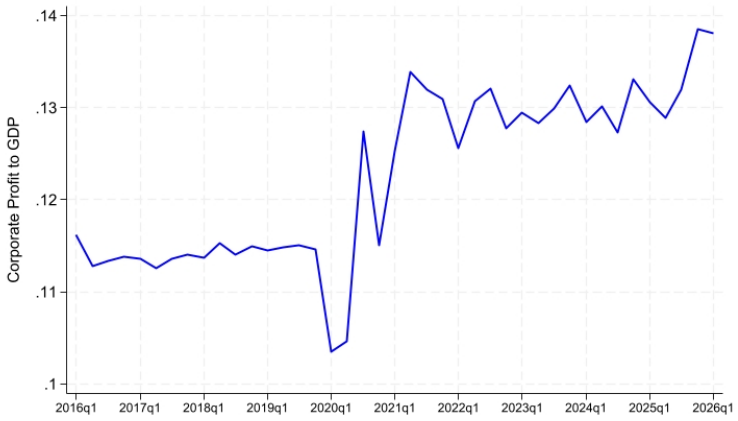
7.1 Wage Markdowns and Firm Profits

We begin by examining the incidence of this real wage erosion. Workers' incomplete ability to discipline their employer's wage-setting — owing to the costs of renegotiation and job search documented above — confers on firms a degree of market power over their incumbent workforce in the period following an unanticipated inflationary shock. Since nominal wage growth that is dampened by a sticky firm norm accrues directly to the firm as a labor-cost saving, a natural implication is that, all else equal, firm profits should rise correspondingly during the inflation period and its aftermath. The magnitude of that rise should be proportional to the estimated real wage shortfall, weighted by the importance of labor in production — i.e., the labor share. The labor share of the private non-farm business sector averaged roughly 0.6 over 2016–2019. If real wages fell by 2 to 4 percentage points relative to trend during 2021–2025 (i.e., the shortfall implied by the conservative benchmark) and this shortfall accrued to firms, the aggregate profit share of output would rise by roughly 1.2 to 2.4 percentage points — the labor share multiplied by the real wage shortfall. We show below that this prediction is borne out in the data.

Figure 20 shows the U.S. corporate profit to nominal GDP ratio between 2016Q1 and 2026Q1. Our measure of corporate profits is pre-tax corporate profits with inventory valuation and consumption adjustment for U.S. domestic industries.[34] The profit rate jumped from a steady 11.4 percent in the 2016–2019 pre-period to 13.1 percent during 2021–2025 — its highest sustained level in half a century. This increase of 1.7 percentage points falls squarely within the 1.2 to 2.4 point range implied by the decline in real wages documented above. The profit rate also remained elevated throughout 2021–2025 rather than spiking and reverting, mirroring the timing of the real wage shortfall, which began in mid-2021 and

[34]The data come from the U.S. Bureau of Economic Analysis and were downloaded directly from the FRED at https://fred.stlouisfed.org/series/A445RC1Q027SBEA. See the online appendix for additional details.

Figure 20: U.S. Corporate Profits to Nominal GDP



Notes: Figure shows data on the ratio of corporate profits to nominal GDP for the United States from 2016Q1 through 2026Q1. The measure of corporate profits is pre-tax corporate profits with inventory valuation and capital consumption adjustments for domestic industries. Data from U.S. Bureau of Economic Analysis.

persisted through 2025. Almost certainly other factors also influenced the aggregate profit share during this period, so we view this as a consistency check rather than a decomposition. These findings are consistent with the logic developed in Afrouzi et al. (2026). In a model with sticky wage norms and costly worker adjustment, firm market power rises during inflationary periods, reducing real wages and raising profits — precisely the patterns documented in Figures 1 and 20.

7.2 Real Wage Losses and Consumer Sentiment

We next turn from the incidence of the real wage shortfall to its implications for workers' assessments of economic well-being. Sluggish adjustment of nominal wage norms turned a temporary burst of inflation into a lasting loss of purchasing power, providing a direct economic reason for sentiment to remain depressed even after inflation subsided.[35]

This mechanism is distinct from explanations based on "money illusion," as in Shafir et al. (1997) and Fehr and Tyran (2001), in which workers' real wages keep pace with inflation

[35]There is a recent discussion about how the level of consumer confidence in the United States, as measured by the University of Michigan's Survey of Consumers, is related to the political party of the respondent. However, between early 2021 and late 2024, measures of consumer confidence of respondents of all political parties fell sharply during the peak of inflation period in 2022 and rebounded sluggishly through 2024. See, for example, the discussion in (Sahm, 2026).

but they attribute nominal raises to productivity gains and perceive rising prices as unfairly eroding those gains. The real-income mechanism also delivers a clear empirical prediction: sentiment should recover when real incomes recover, not simply when inflation falls. We evaluate this prediction using two complementary comparisons: Belgium, where wages are automatically indexed to inflation, and age groups within the United States, where retirement income provides differing degrees of protection from inflation. Across both comparisons, sentiment declined less and recovered more where real incomes were better protected.

7.2.1 A Case Study of Belgium

We begin by comparing consumer sentiment trends in Belgium to those in other similar European countries. Belgium is uniquely suited for this comparison because its wages are automatically indexed to inflation, effectively insulating workers from real wage erosion during inflationary periods. Specifically, the wages of all Belgian workers are indexed, via collective bargaining agreements, to the 'health index' — the headline CPI basket excluding tobacco, alcoholic beverages, and motor fuel — smoothed via a four-month moving average. This indexation covers nearly all private-sector employees, public-sector staff, and government transfers including public pensions. The timing of adjustments varies by contract: most private-sector wages adjust on January 1 each year by at least the cumulative health index increase over the prior twelve months, while others adjust whenever the index rises by 2%, potentially triggering multiple increases within a year. Belgian federal law additionally caps merit-based wage growth above indexation, a ceiling set at 0.0% during the inflation episode, to protect firm competitiveness.[36]

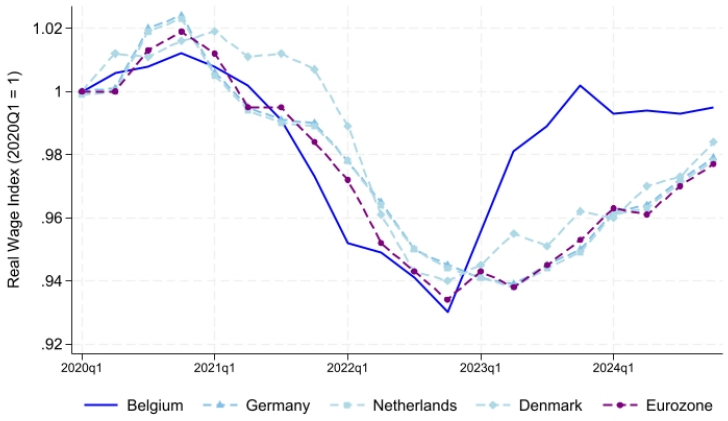
Figure 21 shows the evolution of real wages in Belgium, Germany, the Netherlands, Denmark and the Euro Zone as a whole during the 2020Q1 through 2024Q4 period.[37] We use the EU-19 data, which includes the 19 members of the Euro Zone prior to 2023, when describing the Eurozone. We stop our analysis in 2024Q4 because that was the last quarter when Eurostat provided a wage series for the EU-19 countries. Using the quarterly growth rate data, we make a nominal wage index for each country indexing the 2020Q1 data to 1. We then make a real wage series by deflating the nominal wage index by the corresponding CPI in each period.[38]

[36]Starting in 2026, Belgian budget agreements have reduced the extent to which wages are indexed; going forward there will be full indexation for all earnings less than 4000 euros per month and no indexation on earnings above 4000 per month.

[37]We downloaded the nominal wage growth rate series for each country directly from Eurostat. Eurostat harmonizes economic statistics across countries within the European Union. The series focuses on the growth rate of nominal wages and salaries across all firms in the economy. See the online appendix for additional details.

[38]We download the consumer price index for each country and the EU-19 as a whole from the Federal

Figure 21: Real Wages: Belgium vs Other European Countries



Notes: Figure shows the real wage evolution between 2020Q1 and 2024Q4 for Belgium, Germany, the Netherlands, Denmark and the Euro Zone 19 countries. The nominal wage growth by quarter was downloaded from each country from Eurostat. A real wage index was made for each country normalizing 2020Q1 to 1 and deflating by the CPI in each country for the corresponding month. See the text for additional details.

As seen from the figure, real wages fell sharply in each country between the first quarter of 2021 and the last quarter of 2022. The decline in real wages was roughly 8% in all four of the countries and the Euro Zone as a whole during 2021 and 2022. This is not surprising given that each of the countries experienced a similar inflation trajectory over the 2021-2024 period.[39] However, the dynamics of real wage declines differed dramatically across the countries post-2022. Consistent with the complete indexing of wages in Belgium, real wages returned to baseline levels by mid-2023 and remained at baseline levels through the end of 2024. The patterns for real wages in Germany, Denmark, the Netherlands and Euro Zone as a whole are nearly identical. They also resemble the patterns for the U.S. described above. By the end of 2024, nominal wages had not recovered from the inflation during 2022 and 2023.

Table 3 then shows how consumer confidence evolved in Belgium, Germany, the Netherlands, Denmark and Euro Zone from 2016 through 2024.[40] We re-normalize the consumer confidence measures so that they take the value of 0 averaged over the 2016Q1-2019Q4 pe-

Reserve's Economic Data (FRED) website, also indexing the price index for each country to 1 in 2020Q1.

[39]Between 2020Q1 and 2024Q4, Belgium, Germany, the Netherlands and the broader set of Euro Zone countries all experienced a roughly 22-24% increase in consumer prices. Consumer prices in Denmark increased by about 16% over this period.

[40]We download the consumer confidence measures for each of the countries directly from the FRED website.

Table 3: Consumer Confidence 2016-2024: Belgium vs Other European Countries

	2016–2019	2022 Q3–Q4	2023 Q1–Q4	2024 Q1–Q4
Belgium	0.0	-15.4	-5.3	-3.2
Germany	0.0	-24.5	-15.1	-10.7
The Netherlands	0.0	-29.2	-16.9	-10.6
Denmark	0.0	-23.3	-12.7	-9.7
Euro Zone	0.0	-19.6	-11.2	-7.8

Notes: Table shows the average consumer confidence measures for Belgium, Germany, The Netherlands, Denmark and the Euro Zone group of 19 countries over time. We normalize the consumer confidence level of all countries to the value of 0 for the average of the 2016-2019 period. All other values are reported as percentage point deviations in confidence relative to January 2016. The columns show average measures of normalized confidence during the respective time periods. See text for additional details.

riod. Column 2 shows the level of consumer confidence during the third and fourth quarters of 2022 when the inflation rate had peaked. Measured consumer confidence plummeted in all countries in late 2022. Consistent with the expectation of indexation, the decline in Belgium in late 2022 was smaller, at 15.4 percentage points, compared to the roughly 20-25 percentage point decline in the other countries. By 2023 (column 3) consumer confidence in Belgium mostly returned to baseline levels; as nominal wages rose sharply due to indexation in 2023, consumer confidence rebounded. By 2024 (column 4), consumer confidence in Belgium was back near 2016-2019 levels.

The patterns of confidence were dramatically different in the other countries. In 2023, consumer confidence remained 13-17 percentage points lower than the pre-period in Germany, Denmark and the Netherlands. Likewise, by 2024, consumer confidence in these countries still remained substantially depressed relative to the pre-period; consumer confidence in these three comparison countries remained 10 percentage points lower than pre-period levels during 2024. We focus on these countries as a comparison set to Belgium because of both their spatial proximity and the fact that Belgian policymakers routinely benchmark wages against these neighboring economies. Additionally, all of these countries absorbed similar shares of Ukrainian refugees relative to their domestic population. In the online appendix, we show that the time series trends in inflation, labor productivity, the unemployment rate and the job vacancy rate were nearly identical in Belgium, Denmark, Germany, and the Netherlands during the 2020-2024 period. What differed in macroeconomic outcomes was only the indexation of real wages in Belgium. As a result, these countries are a good potential benchmark for Belgium, but the last row shows that the patterns are also similar when we compare Belgium to the broader set of Euro Zone countries.

Table 4: Consumer Confidence by Age Group: 2016-2024

	Age 50–54	Age 55–59	Age 60–64	Age 65–69	Age 70–84
2016–2019 (Normalized)	0.0	0.0	0.0	0.0	0.0
2022	−41.1	−46.0	−38.2	−35.4	−32.5
2023	−34.5	−34.3	−29.6	−27.8	−24.7
2024	−26.9	−27.2	−21.8	−17.5	−14.9
Share w/ Any Retirement Income	0.07	0.11	0.29	0.71	0.90

Notes: Table shows consumer sentiment for different age groups during the 2016-2019 period using the micro data from the University of Michigan's Survey of Consumers. For each age group, 2016-2019 pre-period responses are normalized to zero. All other years are percentage point deviations from the pre-period. Data downloaded directly from https://sda.umsurvey.org/sda-public/cgi-bin/hsda?harcsda+sca. We use data from the CPS to compute the share of total individual income in each age range that comes from social security earnings, pension income or other retirement income. To do this, we restrict individuals to having at least $5,000 of total income.

Taken together, these patterns provide compelling evidence that it is the lack of wage indexation — not inflation per se — that drives the decline in worker well-being during inflationary periods. The timing of the confidence recovery tracks the timing of the real wage recovery — not the timing of disinflation — which is difficult to reconcile with stories based on money illusion or a general aversion to rising prices.

7.2.2 Within U.S. Variation in Consumer Sentiment by Age

The Belgian comparison exploits cross-country variation in wage indexation. We next ask whether the same relationship appears within the United States, where retirement generates substantial age variation in the extent to which income is protected from inflation. Retirement income is not fully indexed, but it is generally more insulated from inflation than labor income. Social Security benefits receive annual cost-of-living adjustments tied to the Consumer Price Index for Urban Wage Earners, and many public-sector pensions also include inflation adjustments. Defined-contribution balances were further supported by asset returns that broadly kept pace with inflation over 2021–2024. Protection is incomplete, however, because many defined-benefit pensions are fixed in nominal terms. Retirees therefore provide an informative, though imperfect, comparison group, as a much larger share of their income is protected from inflation than that of older workers who remain employed.

As shown in Section 5, older workers (50+) experienced large real wage declines during the inflation period. If real wage declines are contributing to declines in consumer confidence we should expect to see confidence decline more for older workers at ages when few individuals

are retired (in the 50-59 range) than older workers at ages when most individuals are retired (65+). Table 4 shows changes in measures of consumer sentiment from Michigan's Survey of Consumers by age group over the 2016-2024 period. For each age group, we normalize their level of consumer sentiment to zero in the 2016-2019 period. For each subsequent year, we report the level of their consumer sentiment in percentage point deviations from their normalized 2016-2019 levels.

Table 4 reinforces the results from Belgium that a lack of wage indexation contributes to persistent decline in consumer sentiment. Sentiment fell sharply across all age groups in 2022, consistent with inflation protection from indexing operating with a lag. By 2024, however, confidence remained about 27 percentage points below its pre-period level among respondents aged 50–59, who receive little retirement income, but the shortfall narrowed as retirement income became more prevalent: to 22 percentage points at ages 60–64, 18 points at ages 65–69, and 15 points at ages 70–84.[41] This comparison is imperfect because some older households remain employed and some pension benefits are fixed in nominal terms. Nonetheless, the substantially smaller decline among groups whose income is more protected from inflation is consistent with persistent real-income losses being an important driver of the U.S. sentiment decline.[42]

8 Conclusion

In this paper, we show that sticky firm-level wage norms can turn a temporary burst of inflation into persistent real wage losses for workers. Using administrative data sample from ADP, we document that real wages have systematically declined during the 2021-2025 period compared to the 2016-2019 pre-period. Roughly 40% of workers experienced a real wage decline between December 2020 and December 2024, with an even larger number of workers having real wage growth that failed to keep up with normal life cycle increases. The losses were disproportionately concentrated among older workers. The erosion of real wages was long-lasting and the declining purchasing power of U.S. workers provides one explanation for why their reported level of consumer confidence remained persistently low during the 2023-2025 period despite inflation returning to normal levels and the unemployment rate being historically low. Our case study of Belgium, which has automatically indexed real

[41] The results were similar across narrower age groups between 70 and 84, so we pool them to make the table more compact. For comparison, sentiment among individuals aged 35–49 fell by roughly 25 percentage points between the pre-period and 2024, similar to the decline among those aged 50–59.

[42] In the online appendix, we examine sentiment by income quintile among individuals aged 25–54. The bottom quintile experienced the smallest decline among the bottom four quintiles, consistent with its stronger real wage growth. Sentiment also declined less in the top quintile, whose greater exposure to asset income may have provided an offset to real wage losses.

wages, reinforces that conclusion.

The central mechanism behind these losses is the stickiness of firm wage-setting norms. Most firms rely on a single modal nominal raise applied broadly to continuing workers, rather than determining each raise through worker-specific bargaining. Yet these norms adjusted only modestly even as inflation rose above 7 percent. This is the mirror image of the downward nominal wage rigidity documented in earlier work: during a temporary inflation surge, firm wage norms proved *upwardly* rigid. Because the typical worker's raise remained anchored to the norm, real wages fell. Firms granted large off-cycle raises to a growing minority of workers, while job-changers' wages rose nearly one-for-one with inflation. But off-cycle raises reached too few workers, and job changes were too infrequent, to offset the aggregate real wage loss.

Overall, our findings suggest that inflation is more costly to workers than standard macro models imply. In most benchmark models with sticky wages, a burst of inflation redistributes resources from workers to firms for a short period of time. Given a relatively high frequency of wage adjustments during a given year in the micro data, wages return to baseline quickly. In our data, however, the adjustment process takes much longer despite a high frequency of wage adjustments. The reason is that the wage norm of the firm is sticky. Wages adjust each period, but by an amount that is less than the temporary burst of unanticipated inflation. As a result, a temporary period of inflation generates a persistent downward shift in the level of real wages, so the loss to workers is far longer-lived. Furthermore, the loss in real wages understates the full cost of inflation. The workers who kept pace did so by searching for new jobs, bearing the disruption of switching, or negotiating against a reluctant employer — real resources spent to defend real wages. The workers who did not take those actions simply fell behind. The first cost is a deadweight loss; the second is a transfer to firms. A welfare accounting needs to account for both of these costs borne by workers. Going forward, macro models need to modify the way they model nominal wage rigidities to account for sticky wage norms at the firm level and costly adjustments on the part of workers to escape those norms. Recent work by Afrouzi et al. (2026) and Guerreiro et al. (2026) provide a step in that direction.

References

Afrouzi, Hassan, Andres Blanco, Andres Drenik, and Erik Hurst, "A Theory of How Workers Keep Up With Inflation," *The Quarterly Journal of Economics*, May 2026, *141* (2).

Akan, Mert, Jose Maria Barrero, Nicholas Bloom, Thomas Bowen, Shelby R Buckman, Steven J Davis, and Hyoseul Kim, "The New Geography of Labor Markets," Working Paper 33582, National Bureau of Economic Research March 2025.

Akerlof, George A. and Janet L. Yellen, "The Fair Wage-Effort Hypothesis and Unemployment," *Quarterly Journal of Economics*, 1990, *105* (2), 255–283.

Altonji, Joseph G. and Nicolas Williams, "Do wages rise with job seniority? A reassessment," *Industrial and Labor Relations Review*, 2005, *58* (3), 370–397.

Autor, David, Arindrajit Dube, and Annie McGrew, "The Unexpected Compression: Competition at Work in the Low Wage Labor Market," NBER Working Paper 31010, National Bureau of Economic Research 2024.

Baccini, Leonardo and Stephen Weymouth, "Inflation, Blame Attribution, and the 2022 US Congressional Elections," *British Journal of Political Science*, 2025, *55*, e74.

Bagga, Sadhika, Lukas Mann, Ayşegül Şahin, and Giovanni L. Violante, "Job Amenity Shocks and Labor Reallocation," NBER Working Paper 33787, National Bureau of Economic Research 2025.

Bewley, Truman F., *Why Wages Don't Fall During a Recession*, Harvard University Press, 1999.

Bick, Alexander, Adam Blandin, and Karel Mertens, "Work from Home before and after the COVID-19 Outbreak," *American Economic Journal: Macroeconomics*, October 2023, *15* (4), 1–39.

Bollinger, Christopher R. and Barry T. Hirsch, "Is Earnings Nonresponse Ignorable?," *Review of Economics and Statistics*, 2013, *95* (2), 407–416.

Cai, Julie and Dean Baker, "Masking Real Unemployment: The Overall and Racial Impact of Survey Non-Response on Measured Labor Market Outcomes," Working Paper 150, Institute for New Economic Thinking March 2021.

Cajner, Tomaz, Leland D. Crane, Ryan A. Decker, Adrian Hamins-Puertolas, and Christopher Kurz, *Improving the Accuracy of Economic Measurement with Multiple Data Sources: The Case of Payroll Employment Data*, University of Chicago Press, July

Cullen, Zoë B., Bobak Pakzad-Hurson, and Ricardo Perez-Truglia, "Home Sweet Home: How Much Do Employees Value Remote Work?," *AEA Papers and Proceedings*, 2025, *115*, 276–281.

Dingel, Jonathan I. and Brent Neiman, "How Many Jobs Can be Done at Home?," *Journal of Public Economics*, 2020, *189*, 104235.

Dustmann, Christian and Costas Meghir, "Wages, experience and seniority," *The Review of Economic Studies*, 2005, *72* (1), 77–108.

Emanuel, Natalia, Emma Harrington, and Amanda Pallais, "The Power of Proximity to Coworkers," *The Quarterly Journal of Economics*, 2026. qjag027, forthcoming.

Fehr, Ernst and Jean-Robert Tyran, "Does Money Illusion Matter?," *American Economic Review*, 2001, *91* (5), 1239–1262.

Gallup, "Americans Continue to Name Inflation as Top Financial Problem," Economy and Personal Finance Survey 2024.

Grigsby, John, Erik Hurst, Ahu Yildirmaz, and Yulia Zhestkova, "Nominal Wage Adjustments During the Pandemic Recession," *American Economic Review Papers and Proceedings*, 2021, *111*, 258–262.

_ , _ , and _ , "Aggregate Nominal Wage Adjustments: New Evidence from Administrative Payroll Data," *American Economic Review*, 2021, *111* (2), 428–471.

Guerreiro, João, Jonathon Hazell, Chen Lian, and Christina Patterson, "Why do Workers Dislike Inflation? Wage Erosion and Conflict Costs," *Econometrica*, 2026. Forthcoming.

Hazell, Jonathon and Bledi Taska, "Downward Rigidity in the Wage for New Hires," *American Economic Review*, December 2025, *115* (12), 4183–4217.

Holland, A. Steven, "Inflation and Wage Indexation in the Postwar United States," *The Review of Economics and Statistics*, 1995, *77* (1), 172–176.

Jaimovic, Nir, Fabrizio Perri, and Nicolas Vincent, "Inflation and the distribution of real income," Working Paper 2026.

Kahneman, Daniel, Jack L. Knetsch, and Richard Thaler, "Fairness as a Constraint on Profit Seeking: Entitlements in the Market," *American Economic Review*, 1986, *76* (4), 728–741.

Kambourov, Gueorgui and Iourii Manovskii, "A Cautionary Note on Using (March) Current Population Survey and Panel Study of Income Dynamics Data to Study Worker Mobility," *Macroeconomic Dynamics*, 2013, *17* (1), 172–194.

Krueger, Alan B., Alexandre Mas, and Xiaotong Niu, "The Evolution of Rotation Group Bias: Will the Real Unemployment Rate Please Stand Up?," *Review of Economics and Statistics*, 2017, *99* (2), 258–264.

Leonhardt, David, "How Inflation Shaped Voting," The New York Times, The Morning Newsletter November 2024.

Mincer, Jacob, *Schooling, experience, and earnings*, New York, NY: National Bureau of Economic Research, 1974.

Pew Research Center, "By a Wide Margin, Americans View Inflation as the Top Problem Facing the Country Today," American Trends Panel Survey May 2022.

Pilossoph, Laura and Jane M. Ryngaert, "Job Search, Wages, and Inflation," NBER Working Paper 33042, National Bureau of Economic Research September 2024.

Riaño, Juan Felipe and Francesco Trebbi, "Do Voters Punish Inflation or Pay Cuts? Inflation and Real Wages in U.S. Elections," Working Paper 35301, National Bureau of Economic Research June 2026.

Sahm, Claudia, "Consumer Sentiment Isn't Politics, but Politics is Reshaping It," Stay-At-Home Macro (SAHM) May 2026. Accessed: 2026-07-26.

Shafir, Eldar, Peter Diamond, and Amos Tversky, "Money Illusion," *Quarterly Journal of Economics*, 1997, *112* (2), 341–374.

Shiller, Robert J., "Why Do People Dislike Inflation?," in Christina D. Romer and David H. Romer, eds., *Reducing Inflation: Motivation and Strategy*, University of Chicago Press, 1997, pp. 13–70.

Stantcheva, Stefanie, "Why Do We Dislike Inflation?," *Brookings Papers on Economic Activity*, 2024, *55* (1 (Spring)), 1–65.

Steinberg, David, Daniel McDowell, and Selim Erdem Aytaç, "Inflation and Incumbent Support: Experimental Evidence from the 2024 US Presidential Election," *British Journal of Political Science*, 2025, *55*, 1–12.

Tella, Rafael Di, Robert J. MacCulloch, and Andrew J. Oswald, "Preferences over Inflation and Unemployment: Evidence from Surveys of Happiness," *American Economic Review*, 2001, *91* (1), 335–341.

Topel, Robert, "Wages rise with job seniority," *Journal of Political Economy*, 1991, *99* (1), 145–176.

Ward, Jason M. and Kathryn Edwards, "CPS Nonresponse During the COVID-19 Pandemic: Explanations, Extent, and Effects," *Labour Economics*, 2021, *72*, 102060.

Online Appendix for "Sticky Wage Norms and the Real Wage Cost of Unexpected Inflation"

by Erik Hurst, Christina Patterson, Nela Richardson and Liv Wang

Appendix A: Data Description

In this section we discuss the data sources used in this paper.

A.1 ADP Data

The majority of our analysis uses administrative individual panel data from ADP. ADP is a large, international provider of human resources services including payroll processing, benefits management, tax services, and compliance. We discuss many of the details of the ADP data in Section 2. In this subsection, we discuss a few remaining issues with our use of the ADP data.

A.1.1 Weighting ADP Data

As documented in Grigsby et al. (2021b), the ADP sample of firms with more than fifty employees is broadly representative of the industry-firm size distribution as measured by the QCEW. However, the industry-firm size distribution does not match exactly and the ADP sample composition does change from year to year. In our base analysis we do not reweight the ADP data so that it exactly matches the US industry by firm size distribution in all periods. The reason is that reweighting our data made no difference for any of our key results on how nominal wage growth evolved across workers or within firms.

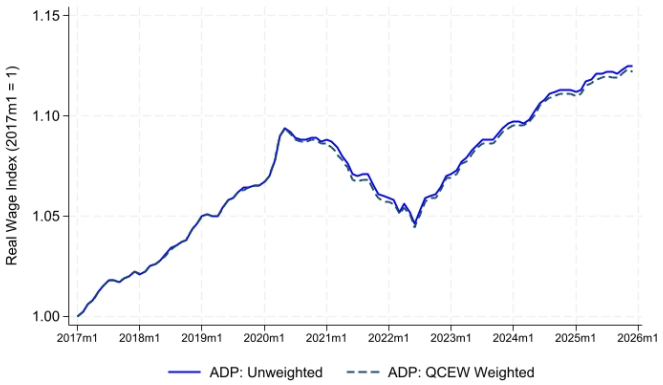
In this sub-section, we show the real wage series from Figure 1 using unweighted data (solid line) and weighting the ADP data so it is exactly representative of the U.S. firm size by industry composition (dotted line).[A1] Appendix Figure R1 documents that the unweighted and weighted ADP real wage indices are essentially identical to each other in all periods. Given that weighting does not make a difference to our results, we show the unweighted results throughout the paper.

A.1.2 Merging Job-Stayer and Job-Changer Data, Figure 1

When making the real wage index shown in Figure 1, we merge together the median nominal wage growth of job-stayers with the median nominal wage growth of job-changers. Figure R2 shows how we make the weights to combine the two series together. Panel A measures the share of ADP workers in month t-12 who continuously work at the same firm between month t-12 and month t. We compute this share in all months between January 2017 and

[A1] It should be noted that the definition of a firm in the ADP data is an ADP-provided client code. This will usually be an autonomous firm, rather than any individual establishment. One possible exception to this rule arises if large conglomerates have multiple subsidiaries, all of which separately hire ADP to handle their payroll. In this case, each subsidiary would count as a separate ADP client. Such instances are rare. As a result, we map ADP client codes to the U.S. Census's notion of a firm.

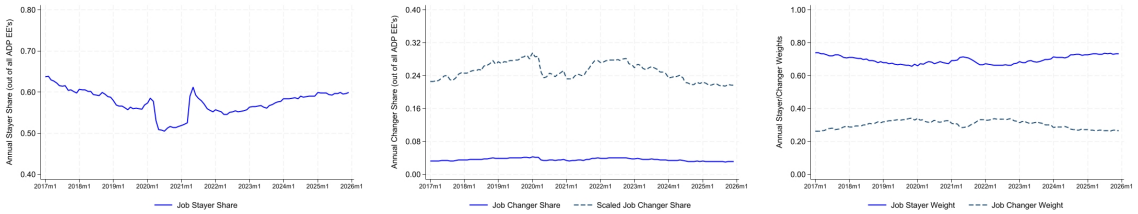
Figure R1: U.S. Real Wages 2017-2025: ADP Weighted vs ADP Unweighted Data



Notes: Figure shows real wage indices using ADP weighted and ADP unweighted data. The ADP weighted series ensures that the industry composition and firm size of the ADP firms matches exactly the industry composition and firm size of the QCEW data in 2017. See text for additional details.

December 2025. This share relate to our sample of workers in firms with more than 50 employees. For example, of all the workers in firms with 50 employees whose payroll was processed by ADP in January 2016, 63% of them were continuously employed at the same firm through January 2017. As seen from the figure, the share of the ADP sample who remain consistently employed at the same firm for 13 consecutive months ranges from about 50% to 63% in all months. There was a noticeable dip during the pandemic, as expected, given the large displacement of workers that occurred in March and April of 2020.

Figure R2: ADP Job-Stayer and Job-Changer: Share of Sample and Pooling Weights



Panel A: Stayer Share

Panel B: Changer Share

Panel C: Pooling Weight

Notes: Panel A shows the ADP sample's share of employees in month $t-12$ who remained continuously employed at the same firm through month t between January 2017 and December 2025. The solid line in Panel B shows the ADP sample's share of employees in month $t-12$ who are working at another ADP firm in month t during the same time period. The dashed line in Panel B is the solid line multiplied by 7. Panel C computes the relative weights of job-changers and job-stayers that are used for pooling together our job-changers and job-stayers samples to make a series of aggregate annual wage growth for each month. See text for additional details.

The solid line in Panel B shows the share of workers who were in the ADP sample in

month t-12 who are found working in another ADP firm in the sample in month t. As above, our sample only includes employees in firms with more than 50 employees. The ADP sample of employees in firms with at least 50 employees used in our analysis represents a fraction of total U.S. employment. Given that, in all months between January 2017 and December 2025 roughly 4% of ADP workers ended up being employed in a different ADP firm 13 months later. Given we are observing about one-seventh of all employees in this sample, we scale up the job-changer share by 7; those results are shown in the dashed line in Panel B. Weighting appropriately, we estimate that roughly between 24% and 31% of workers change jobs each month. These results are consistent with data from the CPS that find monthly job-changing rates during this period in the range of 2.0% to 2.4% per month. Like the job-stayer rate, the job-changer rate also dipped during the pandemic period.

Panel C shows the weights we use to create Figure 1 in the main text. The solid line shows the job-stayer weight while the dashed line shows the job-changer weight. The two series sum to 1 in each month. We define the job-stayer weight as the job-stayer share (solid line in Panel A) divided by the sum of the job-stayer share and the job-changer share (dashed line in Panel B). When making the real growth rate from ADP in Figure 1 of the main text, we create an aggregate nominal growth rate measure by multiplying the nominal growth rate of job-stayers by the job-stayer weight and adding it to the nominal growth rate of job-changers times the job-changer weight. We then make a real wage index from this aggregate nominal wage index.

A.1.3 Merging Job-Stayer and Job-Changer Data, Figure 15

To construct the combined distribution of cumulative real wage growth for all workers, we combine the separate stayer and changer distributions using population-weighted counts. Because our ADP sample covers around a portion of the aggregate workforce, the sample naturally misses job changers who transition to firms outside of the sample. As a result, the raw counts within the sample for the number of job stayers and job changers will underweight the importance of job changers. To correct for this, as we discuss in the main text, we upweight each changer observation by a factor of seven. The combined distribution is then formed as $\text{combined}_b = N_b^S + 7 \times N_b^C$ for each wage growth bin b, where N_b^S and N_b^C are the raw stayer and changer counts in that bin.

After applying this adjustment, job stayers account for 31.9% of the combined pre-pandemic four-year distribution (December 2015–2019) and 29.6% of the post-pandemic four-year distribution (December 2020–2024). This is consistent with the findings in the CPS that the inflation period was a time in which there was a rise in job switching. The stayer share is somewhat lower in the five-year windows shown in panel (b) of Figure 15. In the period from 2020-2025, stayers account for 24.5% of the post-pandemic five-year distribution (December 2020–2025).

A.2 CPS Data

We download all the CPS data from the Atlanta Federal Reserve's Wage Growth Tracker: https://www.atlantafed.org/research-and-data/data/wage-growth-tracker. The Atlanta Fed provides both an unweighted measure of the median nominal wage growth of U.S.

workers and a weighted measure of the median nominal wage growth of U.S. workers. For Figure 1, we use their measure of the median nominal wage growth weighted by 1997 weights found in their "Overall: Weighted 97" column in the "data overall" tab. We use the data from the "Job Stayer" and "Job Switcher" columns of the same tab when making the real wage series in Figure 3.

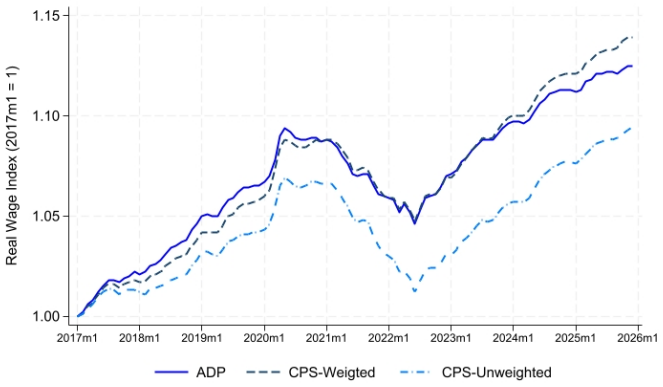
It is worth noting that the Atlanta Fed headline series reports the unweighted nominal wage growth series found in the "Overall" column in the "data overall" tab. This is the series that the Atlanta Fed highlights in their baseline figures on their webpage. We now compare the results of the unweighted and weighted CPS nominal wage growth measures when making a real wage index. As a reminder, respondents in the CPS enter in wave 1 and then are interviewed for four consecutive months (waves 1-4). The respondents are then out of the CPS sample for the next eight months. They then re-enter the CPS one year after their initial wave and are surveyed for an additional four months (waves 5-8). The CPS measures the nominal wages of individuals only waves 4 and 8. These waves are referred to as the "outgoing rotation" given this is when individuals rotate out temporarily (after wave 4) or permanently (after wave 8). Nominal wage growth for CPS respondents is computed by taking the growth rate of the nominal wages reported in wave 8 relative to the nominal wages reported in wave 4. Individuals must make it to wave 8 – 16 months after they entered the CPS – to have a nominal wage growth measure.

There are four reasons to expect the unweighted CPS results to be systematically biased relative to the weighted CPS results. First it is well documented that younger households are more likely to attrit from the CPS over time. Second, it has also been shown that higher income individuals are less likely to report their income in the outgoing rotation samples; they have a higher item non-response rate. Third, younger individuals are more likely to change residences during a year. Given the CPS samples housing structures (as opposed to people), the CPS panel sample will systematically skew older given that it will not include movers. Finally, there is a growing literature showing item non-response and attrition have been increasing in the CPS over the past twenty years and that the non-response and attrition issues were particularly severe during the COVID period.[A2] If younger and higher income individuals are disproportionately underrepresented in the unweighted CPS data, nominal wage growth would be understated, all else equal. The reason is the younger households, who are on the steeper portion of their age-earnings profile, and higher income individuals, who have steeper age-earnings profiles, would be disproportionately underrepresented in the unweighted data. Given the sample selection issues associated with not tracking younger and higher income households, we would expect the unweighted data to show lower nominal wage growth than the weighted data and we would expect the gap between the weighted and unweighted data to grow during the COVID period as the selection issues became more severe.

Figure R3 shows the real wage index computed using the CPS weighted data (dashed line) and the CPS unweighted data (dash-dot) line. We also show the ADP real wage index for comparison (solid). Two things are of note from comparing the CPS weighted and

[A2]For a discussion of non-response and attrition in the CPS and how those issues have evolved over time see, for example, Bollinger and Hirsch (2013), Krueger et al. (2017), Ward and Edwards (2021), and Cai and Baker (2021).

Figure R3: U.S. Real Wages 2017-2025: CPS Weighted vs CPS Unweighted Data



Notes: Figure shows real wage indices using CPS weighted and CPS unweighted micro data. Figure also shows the ADP real wage series combining both job-stayer and job-changer data. See text for additional details.

unweighted real wage series. First, the unweighted real wage series is systematically below the weighted series in all periods stemming from the fact that median nominal wage growth is systematically lower in the unweighted series. This is consistent with the unweighted data underrepresenting younger and higher income households who have higher nominal wage growth on average. Second, the gap between the two increased sharply during the COVID period when attrition issues were most severe. The close alignment between the weighted CPS series and the ADP series suggests that non-random sampling in the unweighted data biases wage growth downward, consistent with the underrepresentation of younger and higher-income households. Collectively, these results suggest that researchers may want to use the weighted CPS series when studying aggregate wage dynamics as opposed to the unweighted CPS series.

A.3 Cross Country Nominal Wage Growth Data

We download the nominal wage growth rates for the countries shown in Figure 21 of the main text directly from the Eurostat database.[A3] We use the year over year growth rate in the country's labor cost index, for each quarter, as our measure of the country's nominal wage growth rate. Specifically, we download variable `lc_lci_r2_q` as our variable of interest. We choose the unit of measure as the percentage change in "wages and salaries (total)" compared to the same quarter in the previous year. We choose the seasonally and calendar adjusted version of the data. We use the broadest measure of wages and salaries (total) for the country which combines data from all sectors ("Industry, construction, and services (except activities of households as employers and extra-territorial organisations and bodies)".

Once we have the nominal wage growth rates, we compute a real wage index similarly to our procedure for the US in Figure 1 of the main text. First, we create a nominal wage

[A3] See https://ec.europa.eu/eurostat/data/database.

index normalizing 2020Q1 to 1. We then deflate the nominal wage index by the country's consumer price index for the corresponding month. We then renormalize the real wage index so it takes a value of 1 in 2020Q1. We download the country specific price indices directly from FRED. For each country and the EU-19 set of countries, we use the price index measure from FRED "Consumer Price Indices (CPS, HICSPs), COICOP 1999: Consumer Price Index: Total". We use the quarterly version for each CPI measure where the index for each country is normalized to 100 in 2015.

A.4 Cross Country Consumer Confidence Measures

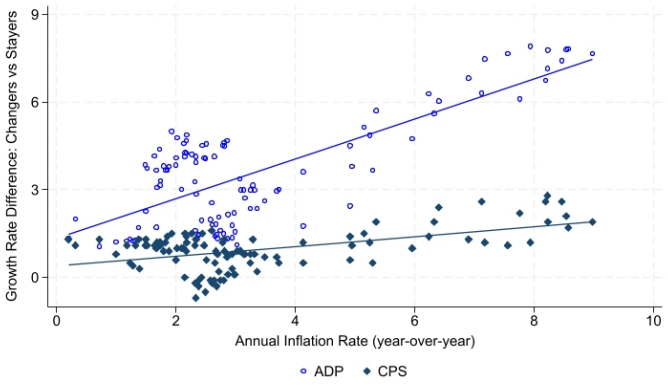
We download the consumer confidence measures for each of the countries in Table 3 from FRED. FRED gets the data from the OECD's Main Economic Indicators Release. The data from FRED for each country are "Consumer Opinion Surveys: Consumer Confidence". We download a quarterly version of the data. We then average across quarters to make Table 3.

Appendix B: Comparison of Wage Data: ADP vs CPS

The Atlanta Fed Wage Growth Tracker, constructed from CPS microdata, has become a widely used measure of nominal wage dynamics in the United States. As seen in Figure 1, the ADP real wage index matches nearly identically a real wage index computed using the CPS microdata as reported by the Atlanta Fed over the 2017-2025 period. The close correspondence between the two series provides confidence that both data sources accurately capture nominal and real wage dynamics for the average U.S. worker. However, as discussed in Section 2 of the main paper, the CPS data does not measure job-changing status. As a result, their job-changing indicator is imputed causing measurement error in both their job-changing and job-staying samples.

In this section of the Appendix, we show additional results about the measurement error in the CPS classification of job-stayers. The misclassification actually matters when trying to understand the mechanisms for aggregate wage dynamics during the recent inflation period. Figure R4 is a scatter plot of the gap in wage growth between job-changers and job-stayers, plotted against the inflation rate, for both the ADP sample (circles) and the CPS sample (diamonds). Each observation is a month. The x-axis shows the annual year-over-year inflation for that month. The y-axis shows the gap between the year-over-year median wage growth of job-changers relative to job-stayers in that month. The ADP gaps are just the difference between the two lines shown in Figure 13. The ADP data show that the gap between the nominal wage growth of job-changers relative to job-stayers increased sharply during the recent inflation period. As shown above, the nominal wage growth of job-changers changed one-for-one with the inflation rate while the nominal wage growth of job-stayers only changed by roughly 30% of the inflation rate.

Figure R4: The Gap in Nominal Wage Growth Between Changers and Stayers vs Inflation

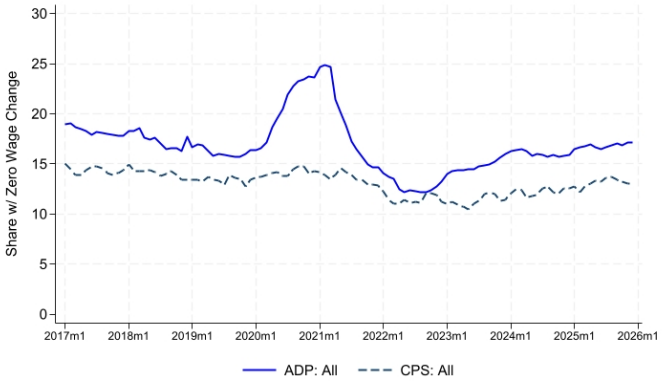


Notes: Figure shows a scatter plot of the gap between the nominal wage growth between job-changers and job-stayers versus the inflation rate. Each observation is a month between January 2017 and December 2025. The ADP data are shown with circles while the CPS data are shown with diamonds. The inflation rate is the year-over year annual rate of change in that month. The fitted regression line for the ADP data has a coefficient of 0.68 with a standard error of 0.06. The fitted regression line for the CPS data has a coefficient of 0.17 with a standard error of 0.03.

The relationship between the gap between nominal wage growth of job-changers relative to job-stayers relative to the inflation rate is much more muted in the CPS data. On average, a 10 percentage point increase in the inflation rate was associated with only 1.7 percentage point increase in the relative nominal wage growth of job-changers relative to job-stayers. In the ADP data, the relative gap in the nominal wage growth of job-changers increased by 6.8 percentage points with a 10 percentage point increase in the inflation rate. These results further reinforce that researchers should be cautious when using the CPS nominal wage growth measures of job-changers and job-stayers.

We end this section by showing another limitation of the CPS data. Figure R5 shows the share of workers who receive no year-over-year nominal wage increase in the ADP and CPS data. The CPS data are downloaded directly from the Atlanta Fed web site and combine patterns for both job-stayers and job-changers. For the ADP data, we combine the fraction of job-stayers with zero nominal wage change with the fraction of job-changers with zero nominal wage change.[A4] As seen from the Figure, the share of workers who have zero nominal wage changes is systematically higher in the ADP data. This is not surprising: self-reported wages in the CPS are measured with error, which attenuates the mass point at zero and compresses the true distribution of wage changes. Importantly, the share of workers receiving no wage increase in the CPS data was fairly constant at around 14 percent during the 2017-2025 period. The ADP data, on the other hand, shows much larger variation. During the pandemic, roughly one-fourth of workers did not get a nominal wage change during the year. During the inflation period, only 13% of workers did not get a wage increase suggesting that wage adjustments were more flexible. These results suggest that researchers should use caution when inferring time series patterns from the share of workers who receive nominal wage changes from the CPS data.

Figure R5: Share of Workers With Zero Year-Over-Year Wage Change



Notes: Figure shows the share of workers with zero wage change in ADP (solid line) and the CPS (dashed line) between January 2017 and December 2025. For the ADP data, we combine both job-stayers and job-changers. See text for additional details.

Taken together, the results in this section point to a consistent conclusion: while the ADP

[A4] We combine the job-changer and job-stayer data similarly to what we did in Figure 1.

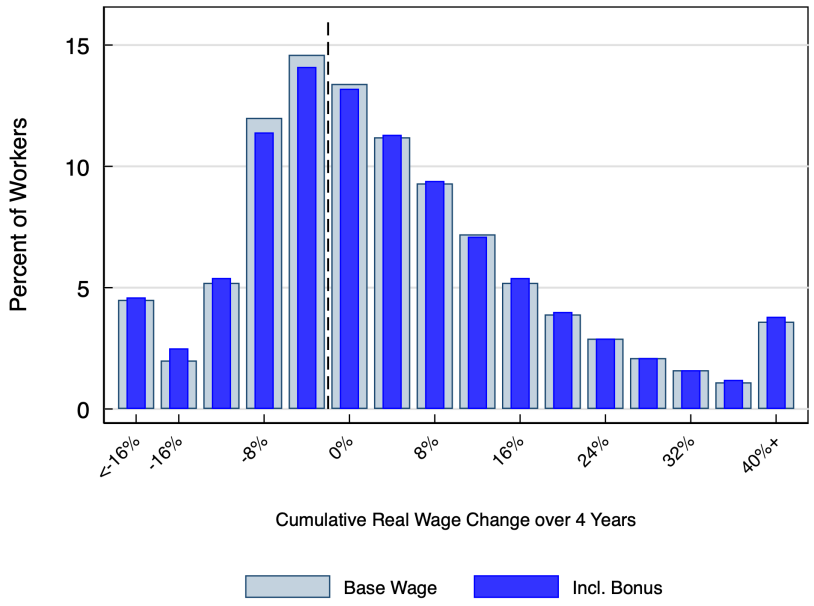
and weighted CPS data tell a similar story for aggregate wage dynamics, the CPS is poorly suited for studying some of the mechanisms underlying those dynamics. The CPS data should be used with caution when examining patterns between job-stayers and job-changers and when examining time series patterns in the fraction of workers with no nominal wage change. Importantly, researchers should use the weighted CPS median nominal growth changes when analyzing aggregate labor market dynamics.

Appendix C: Robustness

C.1 Accounting for Bonuses

Figure R6 examines whether including bonus payments changes the picture of real wage growth during the inflation period. The figure plots the distribution of annualized real wage growth for job stayers over the five-year window from December 2020 to December 2025, comparing total compensation (base wages plus bonuses) to base wages alone. The two distributions are nearly identical, indicating that bonuses did not systematically offset real wage declines for workers during this period. This is consistent with the broader evidence that employers relied primarily on adjustments to base pay rather than variable compensation when responding to the inflation episode.

Figure R6: Real Wage Growth within the Firm: Including Bonus Payments

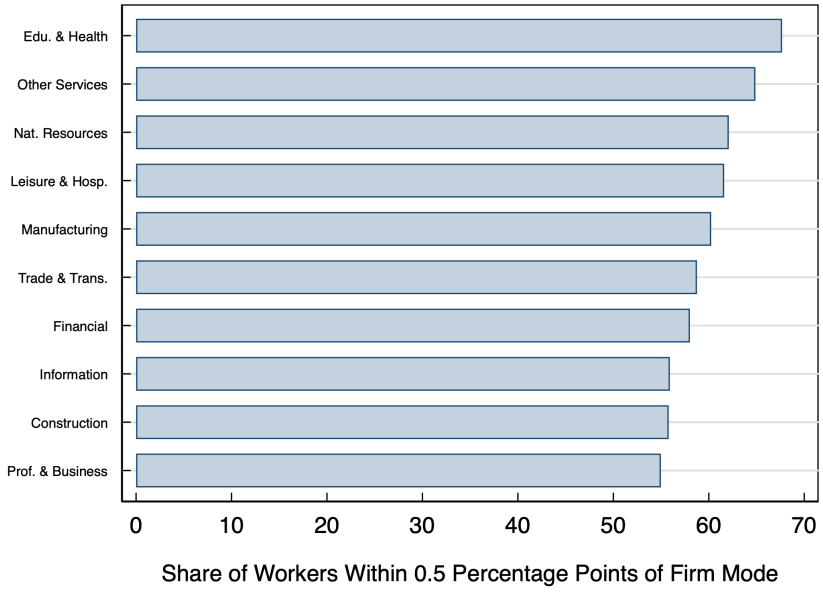


Notes: Distribution of annualized real wage growth for job stayers from December 2020–2025, with and without bonuses.

C.2 Prevalence of Wage Norms Across Industries

Figure R7 shows that the systematic clumping of wage changes at the firm's modal value documented in the main text is not confined to any particular sector. Across all ten major industry groups, more than 55 percent of workers receive a wage change within 0.5 percentage points of their employer's modal wage changes. The consistency of this pattern across industries suggests that firm-level wage norms are a pervasive feature of the U.S. labor market.

Figure R7: Prevalence of Wage Norms By Industry

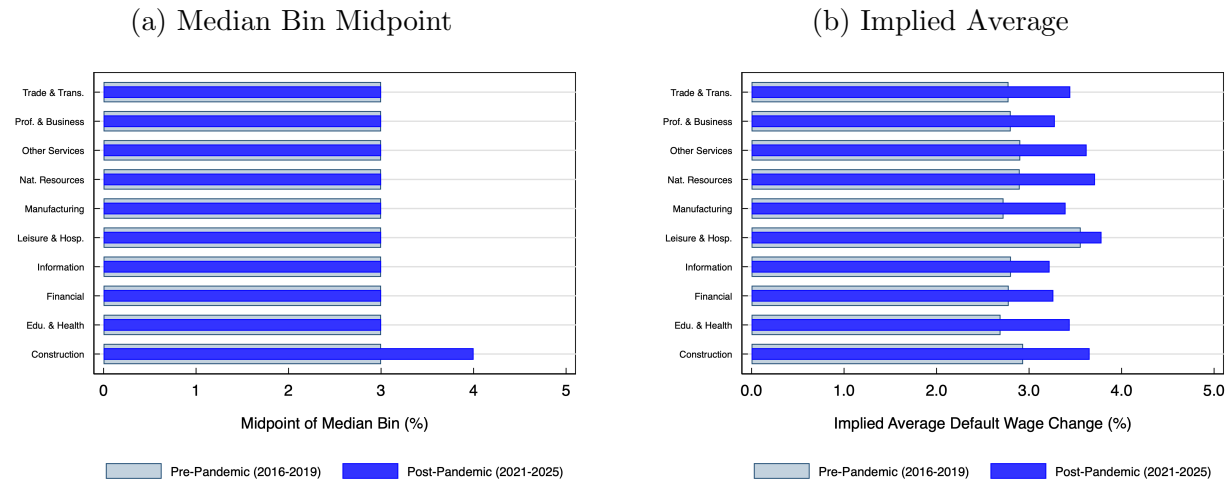


Notes: Each bar shows the share of workers whose annual wage change falls within 0.5 percentage points of their employer's modal wage change, by industry, averaged over 2016–2025. The sample is restricted to workers whose wage change is within 5.5 percentage points of their firm's mode, and shares are computed conditional on that restriction. Industries are sorted in ascending order by the share shown.

C.3 Wage Norms by Industry

Figure R8 characterizes the level and post-pandemic shift of firm's modal wage changes for each industry, using two summary measures. Panel A shows the wage norm faced by the median worker for the pre-pandemic (2016–2019) and post-pandemic (2021–2025) periods. Panel B shows the wage norm for the average worker in each industry. Across all industries, wage norms were concentrated near 3 percent before the pandemic. The post-pandemic shift was modest in all industries, with the median not changing at all and the average changing by less than 1 percentage point in all industries.

Figure R8: Median and Average Wage Norm by Industry

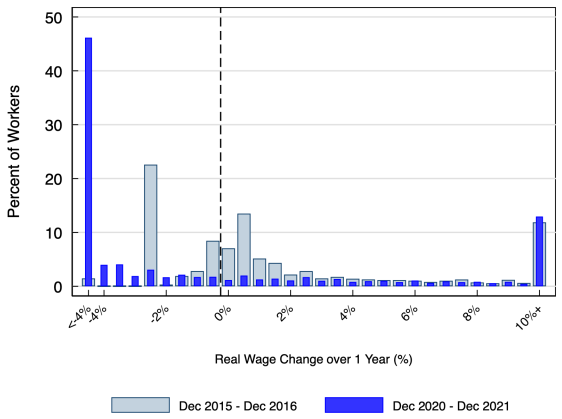


Notes: Each panel compares the pre-pandemic period (2016–2019) to the post-pandemic period (2021–2025) for each industry. Panel A shows the midpoint of the median bin — the bin containing the 50th percentile of the modal wage change distribution within each industry and period. Panel B shows the average modal wage change, computed as the weighted average of bin midpoints using each bin's share of firms as weights. The top open-ended bin (12.5%+) is excluded from the average.

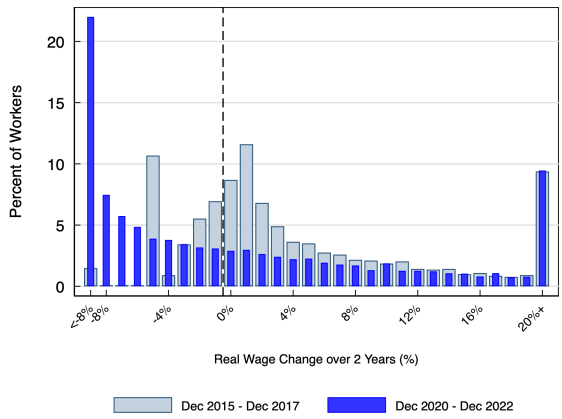
C.4 One-year, Two-year and Three-Year Real Wage Growth of Job-Stayers

Appendix Figures R9 and R10 are analogous to Panels (a) and (b) of Figure 15 of the main text, respectively. These appendix figures show the 1-year, 2-year, and 3-year distributions of real wage changes for job-stayers.

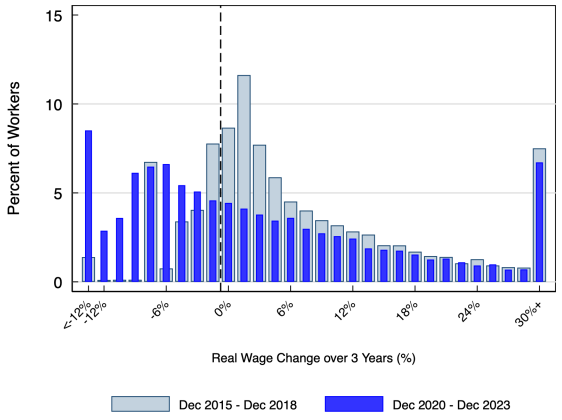
Figure R9: Cumulative real wage growth of job-stayers, PDF over Different Time Horizons



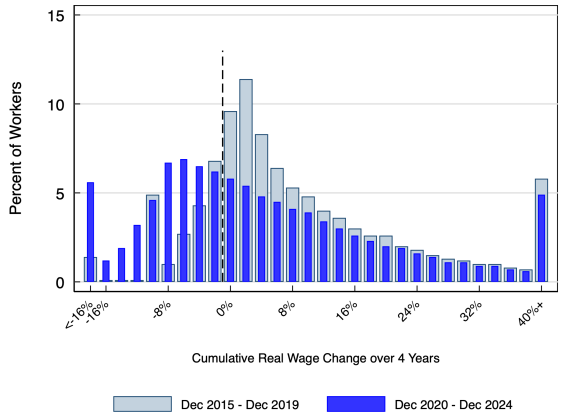
(a) 1-Year



(b) 2-Year



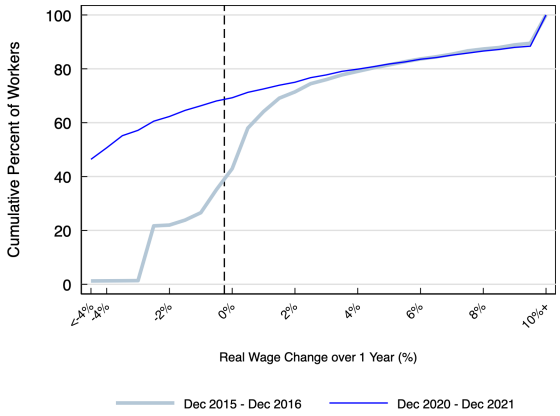
(c) 3-Year



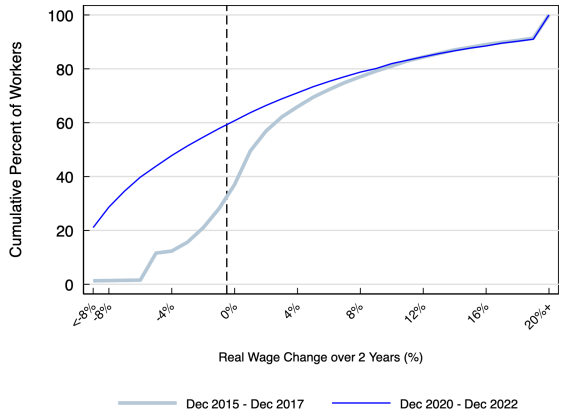
(d) 4-Year

Notes: Each panel shows the PDF of cumulative real wage changes for job-stayers, comparing the pre-pandemic period to the inflation period. For the inflation period, we explore the distribution of real wage growth between December 2020 and one-year later (panel (a)), two years later (panel (b)), three years later (panel (c)), and four years later (panel (d)). For the pre-period, we explore the real wage growth between December 2015 and similar future time periods. Panel (d) is similar to what is shown in Figure 5a of the main text. The dashed vertical line marks zero real wage growth.

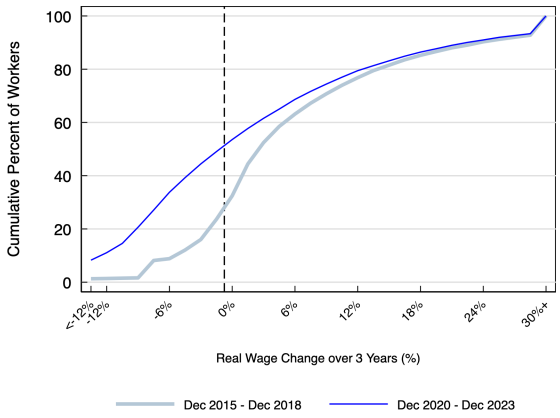
Figure R10: Cumulative real wage growth of job-stayers, CDF over Different Time Horizons



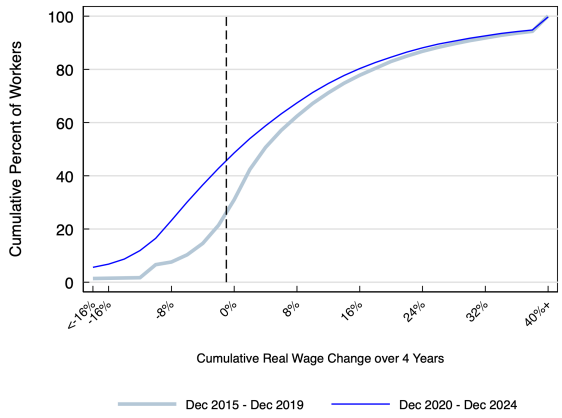
(a) 1-Year



(b) 2-Year



(c) 3-Year



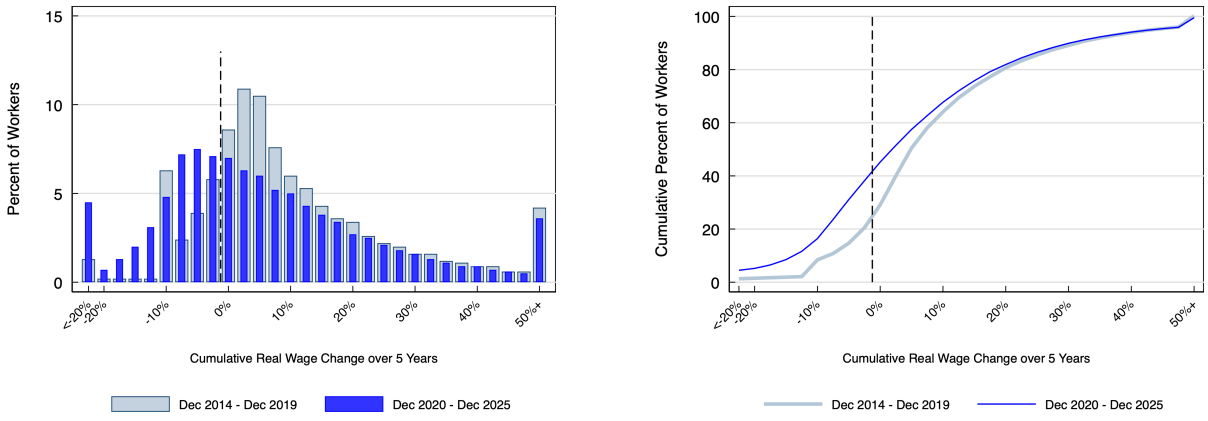
(d) 4-Year

Notes: Each panel shows the CDF of cumulative real wage changes for job-stayers, comparing the pre-pandemic period to the inflation period. For the inflation period, we explore the distribution of real wage growth between December 2020 and one-year later (panel (a)), two years later (panel (b)), three years later (panel (c)), and four years later (panel (d)). For the pre-period, we explore the real wage growth between December 2015 and similar future time periods. Panel (d) is similar to what is shown in Figure 5b of the main text. The dashed vertical line marks zero real wage growth.

C.5 Five-Year Real Wage Growth for Job Stayers

Figure R11 replicates the main analysis of cumulative real wage growth using a five-year window (December 2020 to December 2025) rather than the four-year window used in the text. Both the PDF and CDF of the distribution are shown alongside the corresponding pre-pandemic benchmark (December 2014 to December 2019). Extending the window by one additional year partially offsets the real wage losses incurred during the peak inflation years but does not eliminate them. 33.9% of job stayers still experienced negative cumulative real wage growth over the five-year period, compared to 37.0% over the four-year window, and the overall shape of the distribution remains shifted to the left relative to the pre-pandemic benchmark.

Figure R11: Cumulative real wage growth for job stayers (five-year window)



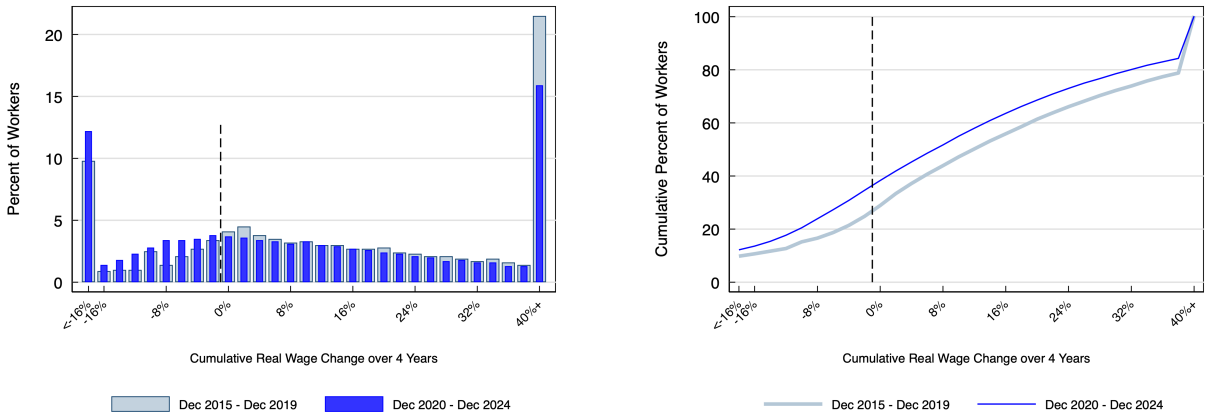
(a) PDF (b) CDF

Notes: Distribution of cumulative real wage growth for job stayers comparing the five-year post-pandemic window (December 2020–2025) to the pre-pandemic benchmark (December 2014–2019). Real wages are deflated using the CPI-U. The dashed vertical line marks zero cumulative real wage growth.

C.6 Cumulative Real Wage Growth for Job Changers

Figure R12 shows the distribution of four-year cumulative real wage growth for job changers — workers who were at a different employer in 2024 than they were at in 2020. Job changers saw more diffuse changes in base wages over this period, but also had larger average real wage gains in this period.

Figure R12: Cumulative real wage growth: Job Changers



(a) PDF (b) CDF

Notes: Distribution of cumulative real wage growth for job changers comparing the four-year post-pandemic window (December 2020–2024) to the pre-pandemic benchmark (December 2015–2019). Real wages are deflated using the CPI-U. The dashed vertical line marks zero cumulative real wage growth.

C.7 Nominal Wage Growth By Income Quintile

Appendix Figure R13 shows the median nominal wage growth by initial wage quintile. In each month $t-12$, we rank all workers in the ADP sample by their base wage. We then segment workers into five initial wage quintiles. For each bin, we define a set of job-stayers who are continuously employed at the same employer between $t-12$ and t and a set of job-changers who are a new ADP firm in month t. Defining weights similarly to what we did in Appendix Figure R2 but for each quintile individually, we pool together the job-stayer and job-changer data.

Panel A shows the median nominal growth rate for workers in the bottom wage quintile. Nominal wage growth increased sharply during the early parts of the inflation period even relative to the pre-period; this is part of the well documented wage compression that occurred during this period. However, starting in early 2024, the nominal wage growth of low-wage workers dipped well below their pre-trend levels. As discussed in the main text, wage compression was relatively stable on net during the entire 2021-2025 period; although wage compression occurred relative to trend during the early part of the inflation period it was undone during the 2024-2025 period. Panels B and C show patterns for the middle and top quintiles. For these quintiles, nominal wage growth remained above pre-period levels through late 2025.

Figure R13: Nominal Wage Growth Rates by Initial Income Quintile

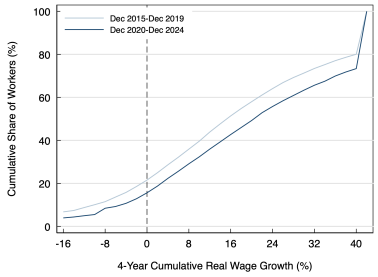
Panel A: Quintile 1 | Panel B: Quintile 3 | Panel C: Quintile 5

Notes: This figure shows the nominal wage growth of individuals in different initial income quintiles over time. Figure combines together data for both job-stayers and job-changers. See the text for additional details.

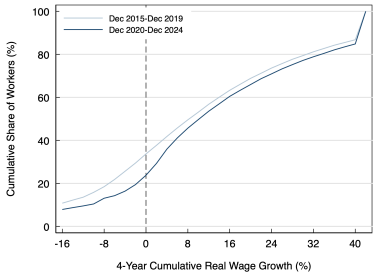
C.8 Cumulative Real Wage Growth by Initial Income

Panels (a)–(e) of Figure R14 show the CDF of cumulative four-year real wage growth for workers in each income quintile between 2021–2024 (dashed line) and 2016–2019 (solid line). We restrict the sample to individuals aged between 25 and 50 in the initial period and pool together job-changers and job-stayers. For all quintiles, the CDF of real wage changes shifted down during the inflation period. While workers in each quintile experienced a similar median real wage decline relative to the pre-period, the large real wage losses were concentrated in higher income quintiles. In the top income quintile, 42% of individuals experienced a real wage decline during the 2021–2024 period, compared with only 25% during the 2016–2019 pre-period. For the third and bottom quintiles, 35% and 22% of workers, respectively, experienced negative real wage growth during 2021–2024; the comparable pre-period numbers were 23% and 16%.

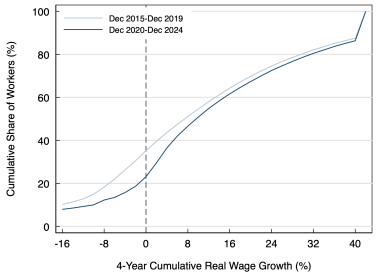
Figure R14: CDF of Real Wage Growth by Income Quintiles: Inflation Period vs. Pre-Period



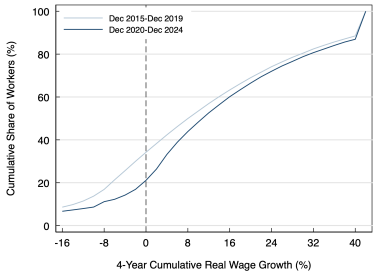
(a) Quintile 1



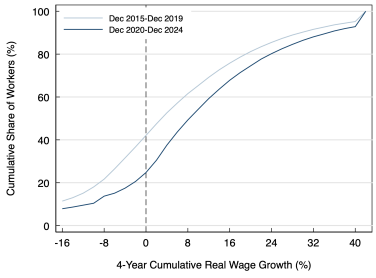
(b) Quintile 2



(c) Quintile 3



(d) Quintile 4

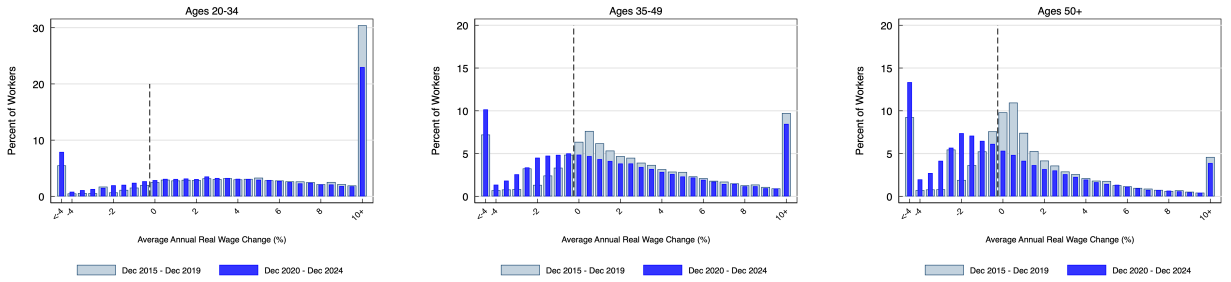


(e) Quintile 5

Notes: Figure shows the CDF of cumulative four-year wage changes during the December 2020 to December 2024 period (dashed line) and the December 2015 to December 2019 period (solid line) for workers in each wage quintile. The wage quintiles are defined in the initial period. Sample includes individuals aged 25 to 50 in the initial period and combines both job-stayers and job-changers.

C.9 Cumulative Real Wage Growth by Age

Figure R15 shows the distribution of average annual real wage growth separately for workers aged 20–34, 35–49, and 50 and older, combining job-stayers and population-weighted job-changers in each age group. The distributions shift leftward during the inflation period across all three panels, but the shift is largest for workers aged 50 and older, where a substantial mass moves from positive into negative real wage growth. The contrast between the 20–34 and 50-and-older panels illustrates the age gradient documented in Section 5.2.



(a) Ages 20–34 (b) Ages 35–49 (c) Ages 50 and Older

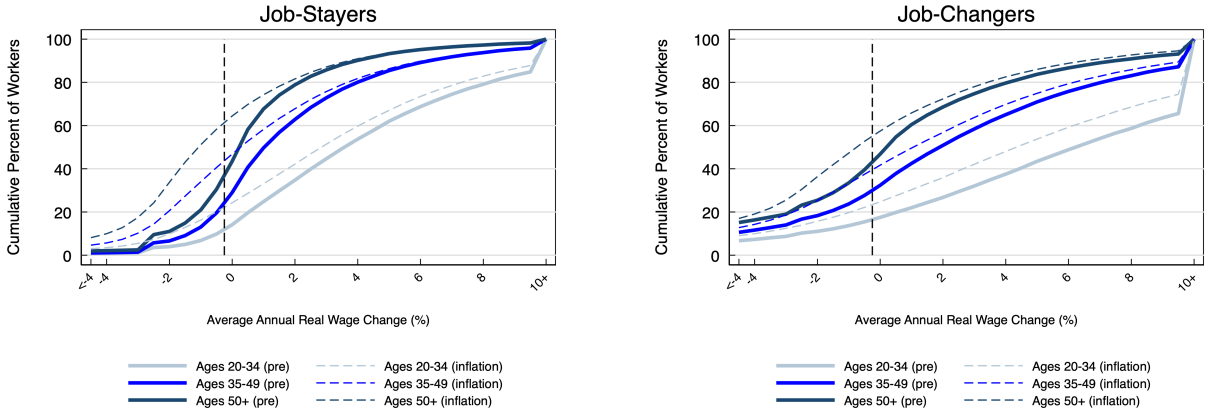
Figure R15: Distribution of Real Wage Growth by Age Group

Notes: Each panel plots the distribution of average annual real wage growth for the indicated age group, combining job-stayers and job-changers using population weights as described in Section 4. Wide bars show the pre-pandemic period (December 2015–December 2019); narrow bars show the inflation period (December 2020–December 2024). The dashed vertical line denotes zero real wage growth. Real wage changes are deflated using CPI-U.

C.10 Cumulative Real Wage Growth by Age: Stayers vs. Changers

Figure R16 decomposes the age-group distributions into job-stayers (Panel A) and job-changers (Panel B) separately. The age gradient is present within both groups: in each panel, older workers have a distribution shifted further to the left in both periods, with the inflation-period deterioration largest for workers aged 50 and older. Comparing the two panels directly, the gap between the changer and stayer CDFs within a given age group—the switching premium—is large for workers aged 20–34 and essentially absent for workers aged 50 and older in the pre-pandemic period, as documented in Section 5.2.

Figure R16: Age Heterogeneity: Job Changers and Job Stayers



(a) Job-Stayers

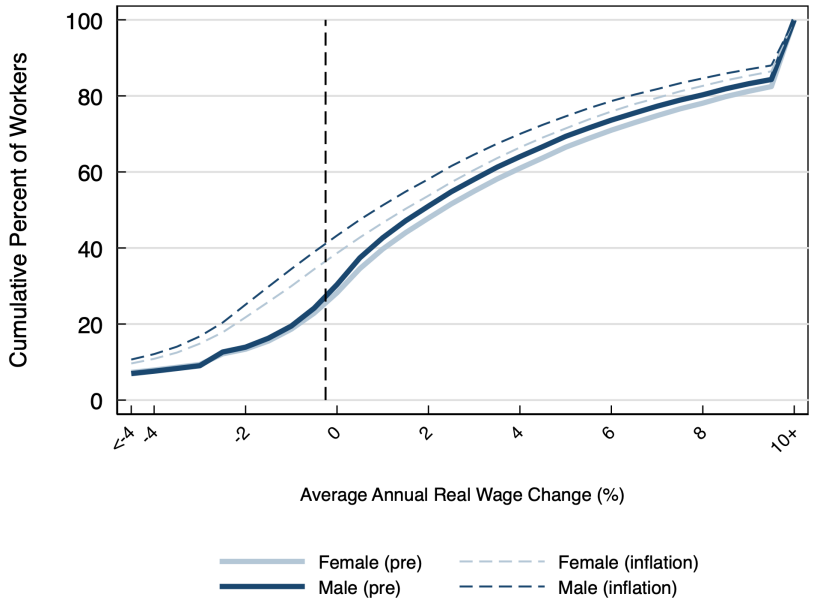
(b) Job-Changers

Notes: Each panel plots the cumulative distribution of average annual real wage growth for workers aged 20–34 (light blue), 35–49 (medium blue), and 50 and older (dark blue), comparing the pre-pandemic period (solid lines) to the inflation period (dashed lines). The left panel shows job-stayers; the right panel shows job-changers, with population weights applied as described in Section 4. The dashed vertical line denotes zero real wage growth. Real wage changes are deflated using CPI-U.

C.11 Cumulative Real Wage Growth by Gender

Figure R17 shows the cumulative four year growth rate in real wages for men (dark blue lines) and women (light blue lines) during the December 2015-December 2019 pre-period (solid lines) and during the December 2020-December 2024 inflation period (dashed lines). The declining real wages during the inflation period (relative to the pre-period) were roughly similar between men and women.

Figure R17: CDF of Cumulative Wage Growth, By Gender



Notes: Figure plots the distribution of four-year cumulative real wage growth for men (dark blue) and women (light blue), comparing the pre-pandemic period (solid lines) to the inflation period (dashed lines). Within each gender, job-stayers and job-changers are combined using population weights as described in Section 4. The dashed vertical line denotes zero cumulative real wage growth. Real wage changes are deflated using CPI-U.

C.12 Comparison of Belgium, Denmark, Germany, and The Netherlands

The interpretation of our cross-country evidence in Section 7 rests on the premise that Belgium and its neighboring economies — Denmark, Germany, and the Netherlands — experienced the recent inflationary period similarly in all relevant respects except for the automatic indexation of Belgian wages. If these countries differed systematically along other dimensions of the labor market, then the divergence in consumer sentiment we document could reflect those differences rather than the presence or absence of wage indexation. Table R1 addresses this concern by comparing the four countries across a set of standard labor market and macroeconomic indicators over the 2020–2024 period, all drawn from the Eurostat database.

The table shows that the four countries were broadly comparable throughout this period. Each experienced a similar inflation trajectory, with prices rising sharply in 2021 and 2022 before decelerating, and cumulative inflation over the period was of a similar magnitude across countries. Labor productivity was essentially flat in all four economies, so the divergence in real wages we document cannot be attributed to differential productivity growth. Unemployment rates, while differing in level across countries, were low and stable everywhere over the period, indicating that no country experienced a differential labor market contraction that might independently depress sentiment. Job vacancy rates, available for three of the four countries, followed a common pattern of tightening during the inflationary period. Taken together, these patterns indicate that Belgium was not unusual along the standard dimensions of labor market performance during this period. What distinguished Belgium was its system of automatic wage indexation, reinforcing our interpretation that it was the indexation of real wages — rather than some other feature of the Belgian economy — that accounts for the more rapid recovery of consumer sentiment documented in the main text.

Table R1: Comparison of Belgium, Denmark, Germany and The Netherlands along various macroeconomic dimensions

	Belgium	Denmark	Germany	The Netherlands
Panel A: Inflation				
2020	0.4%	0.3%	0.4%	1.1%
2021	3.2%	1.9%	3.2%	2.8%
2022	10.3%	8.5%	8.7%	10.0%
2023	2.3%	3.4%	6.0%	4.3%
2024	4.3%	1.3%	2.5%	3.2%
Cumulative 2020–2024	23.9%	16.2%	22.4%	23.1%
Panel B: Labor Productivity (Index, 2015 = 100)				
2020	104.6	108.0	105.3	100.1
2021	102.8	108.5	107.0	101.6
2022	102.3	105.0	107.4	102.8
2023	103.1	106.1	106.1	100.9
2024	104.5	110.0	105.8	100.3
Cumulative Change (p.p.)	−0.1	2.0	0.5	0.2
Panel C: Unemployment Rate				
2020	5.8%	5.6%	3.6%	4.9%
2021	6.3%	5.1%	3.6%	4.2%
2022	5.6%	4.5%	3.1%	3.5%
2023	5.5%	5.1%	3.1%	3.6%
2024	5.7%	6.2%	3.5%	3.7%
Panel D: Job Vacancy Rate				
2020	2.9	—	2.8	2.5
2021	4.7	—	3.9	4.1
2022	4.5	—	4.5	4.5
2023	4.4	—	3.9	4.1
2024	4.1	—	3.2	4.1

Notes: Figure shows the inflation rate, labor productivity (indexed such that 2015=100), the unemployment rate and the job vacancy rate from Belgium, Denmark, Germany, and the Netherlands over the 2020-2024 period. All data downloaded from the Eurostat database. The Eurostat database does not include vacancy data for Denmark.

C.13 US Consumer Sentiment by Income Quintiles

The analysis of consumer sentiment in Section 7 focused on variation across age groups, exploiting the fact that retired households have a larger share of their income indexed to inflation. In this subsection, we examine how consumer sentiment evolved across the income distribution. We use the micro data from the University of Michigan's Survey of Consumers, restricting attention to individuals aged 25–54 with total household income above $10,000, and normalize each income quintile's sentiment to zero over the 2016–2019 pre-period. Table R2 reports the results. One important caveat is that the Michigan survey measures total household income from all sources rather than labor earnings, so the income concept is not directly comparable to the wage measures from the ADP data used elsewhere in the paper.

The patterns across the income distribution are consistent with the two forces emphasized in the main text. At the lower end of the distribution, the decline in sentiment was smaller for the bottom quintile than for the middle quintiles. This mirrors the wage evidence from the ADP data: lower-wage workers were partially insulated from real wage erosion during the inflation period, both because their nominal wages grew relatively quickly early in the episode and because they were more likely to change employers and escape sticky wage norms. Moving up through the middle of the distribution, sentiment declines grew larger, consistent with these workers being increasingly exposed to the real wage erosion documented throughout the paper. The top quintile, however, breaks this pattern: sentiment declined by less at the top of the distribution than in the upper-middle quintiles. This is consistent with high-income households deriving a substantial share of their income from assets rather than labor. As documented in Section 7.1, the real wages that workers did not receive during the inflation period accrued in part to firms as higher profits; high-income households, who disproportionately own those firms, were therefore partially insulated from the real wage erosion that eroded sentiment further down the distribution. Taken together, the sentiment declines were largest in the upper-middle of the income distribution — households high enough to be exposed to real wage erosion but not wealthy enough to benefit meaningfully from the offsetting rise in asset income.

Table R2: Evolution of US Consumer Sentiment, By Income Quintile

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
2016–2019 (Normalized)	0.0	0.0	0.0	0.0	0.0
2021	−9.4	−14.2	−20.0	−23.4	−17.3
2022	−23.3	−33.0	−40.9	−45.9	−39.4
2023	−25.4	−30.2	−35.9	−38.6	−30.1
2024	−25.1	−33.8	−32.4	−26.2	−19.4

Notes: Figure shows the measure of consumer sentiment by income group for individuals aged 25-54 with total income greater than $10,000 from the University of Michigan's Survey of Consumers. The measure of income in the Michigan survey is "total household income from all sources". As a result, the income measure is not directly comparable to the wage measures from ADP. Data downloaded directly from https://sda.umsurvey.org/sda-public/cgi-bin/hsda?harcsda+sca.