When Mortgage Lock-In Locks Out Homebuyers

What Explains the Great Resignation?

Wage Inequality Across the U.S.

Questions and Answers | Research Update | Data in Focus
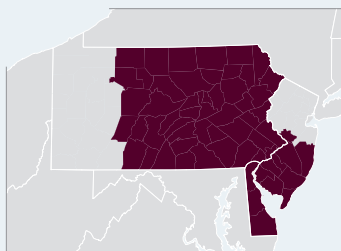
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Q&A...

with Kevin Curran, a Senior Economic Analyst here at the Philadelphia Fed.

Kevin Curran

Senior Economic Analyst Kevin Curran grew up in Valhalla, a small town just north of New York City. After graduating from the University of Maryland, he studied applied economics at Johns Hopkins University. He has worked for the U.S. Bureau of Economic Analysis and the Federal Deposit Insurance Corporation. Since joining the Philadelphia Fed in 2022, Kevin has contributed to our regional charts, Third District historical data, the Beige Book, the early benchmark program, the Manufacturing Business Outlook Survey, and the Nonmanufacturing Business Outlook Survey. Kevin wrote this issue's Regional Spotlight about wage inequality throughout the United States

1 For more on this topic, see Ronel Elul's article, "When Mortgage Lock-in Locks Out Homebuyers," in this issue.

How did you become interested in economics?

I first became interested in economics after taking a couple of introductory courses when I got to college. I enjoyed learning about how and why people make certain decisions, and how those individual decisions aggregate up to the economywide level. I was also very interested in the role that economic institutions play in shaping everything around us.

You got your master's in applied economics. What does that mean in practice?

Applied economics takes a step back from some of the most abstract theory that is in many traditional economics courses. It's about the things we see every day and more about how to use econometrics in a nonacademic setting.

What is the U.S. Bureau of Economic Analysis (BEA)? And what led you to work there?

The BEA is the government agency responsible for producing official gross domestic product and personal income statistics for the United States. I helped produce its estimates for monthly and quarterly personal income by preparing estimates of rental income and wages and salaries—components that go into that headline number the BEA releases every month.

What led you to the Philadelphia Fed?

One thing I really enjoyed about working for federal agencies, and specifically the Federal Deposit Insurance Corporation, was that the organizations' missions centered on benefiting the country and general public. The opportunity at the Philadelphia Fed to continue this type of work, but with a focus on and involvement in the community that I would be living in, really appealed to me.

What made you so interested in wage inequality?

I'm interested in all forms of inequality. And I think that wages—and wage growth in particular—are always interesting to look at. Even though fiscal policy decisions such as tax credits and low-income assistance programs play a huge role in income inequality, wages play a constant role. Tax credits and other transfers may come and go, but wages are the baseline that's always there. During COVID, there was this huge increase in fiscal spending and programs targeting lower-income individuals and families. But income inequality picked up again starting last year once many of those programs were phased out. When we look at wage inequality, we see the underlying trend.

You end your article for this issue with the following statement: "When shaping policy decisions, policymakers need to account for the magnitude of wage inequality and the regional differences associated with it. If they don't, the continuing divergence of economic outcomes will make it increasingly hard to implement policies that work for everyone." What are some specific public policies that would benefit from this knowledge?

This knowledge could be useful for federal or state and local officials. Knowing the wage distribution of the residents within your area, and how it compares to the national average, could help you target your assistance programs or tax policies. But I think it could also help us understand the impact of monetary policy. In the past couple of years, the interest rates set by the Federal Open Market Committee have made a very large difference for people who own their home and are locked into a 30-year fixed rate mortgage—and for those who are renting and attempting to buy a home, who are more likely to be in the lower half of the wage distribution.[1] It's important to know what a higher interest rate means for these groups of people. And that includes understanding differences across the country, like, how higher interest rates may affect people in the Northeast versus people in the Midwest based on how the wage distributions in those regions differ. So, this knowledge could help the Fed understand some of the downstream impacts of interest rate policy.

When Mortgage Lock-In Locks Out Homebuyers

As interest rates rose, home sales fell more than predicted. The era of low rates may explain why.

Omar Ahmad

Senior Research Assistant

FEDERAL RESERVE BANK OF PHILADELPHIA

Ronel Elul

Senior Economic Advisor and Economist

FEDERAL RESERVE BANK OF PHILADELPHIA

The views expressed in this article are not necessarily those of the Federal Reserve.

The current cycle of interest rate hikes that began in early 2022 seems to have had a striking impact on the housing market. Mortgage rates went from just above 4 percent in March 2022 to over 7 percent by August 2023. Over this period, home sales fell by more than one third (Figure 1). Although rising rates generally slow housing market activity, this drop in sales was greater than historical experience would suggest.

Mortgage lock-in may explain why interest rate hikes have had such a large impact on the mortgage market. This latest round of interest rate hikes was unusual in that it was preceded by many years of very low rates. So, many homeowners had locked in their historically low mortgage rates before the latest round of interest rate hikes. These homeowners may be reluctant to sacrifice these low rates by moving. This may explain why home sales have declined dramatically. But other than lowering sales, what are the real consequences of high rates? For instance, does mortgage lock-in affect households' willingness to move to find a better job?

FIGURE 1

When Mortgage Rates Rose After COVID, Home Sales Fell by One-Third

The 30-year mortgage rate (quarterly) and the number of home purchase originations (monthly), 2019–2023

THIRTY-YEAR MORTGAGE RATE

NUMBER OF HOME PURCHASE ORIGINATIONS

HOME SALES FELL MORE THAN PREDICTED BY PRIOR RESEARCH
A nearly 3 percentage point increase in mortgage rates

Anenberg and Ringo
The predicted drop
-18%

297,975

244,339

MAR '22   AUG '23

The actual drop
-36%

297,975

189,418

MAR '22   AUG '23

Data Sources: Home purchase mortgage originations data come from ICE, McDash® and are restricted to first-lien mortgages; mortgage rate data come from Freddie Mac.
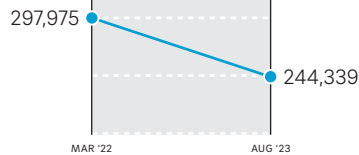
In addition, high mortgage rates may have other consequences–notably, they may increase inequality by making it difficult for low- and moderate-income households to buy a home. Lock-in would exacerbate this inequality by reducing home sales and thus keeping house prices high.

If mortgage lock-in aggravates the impact of high rates on housing sales, and if this has substantial real consequences, then we might be able to one day alleviate these consequences through relatively modest changes to mortgage contracts. This would be particularly important if lock-in's impact on low- and moderate-income households is significant.

How Lock-In Explains Homebuying's Departure from Historical Trends

A recent paper by Federal Reserve Board of Governors economists Elliot Anenberg and Daniel Ringo finds that, historically, the *semi-elasticity* of home purchases with respect to mortgage rates is approximately 6. That is, a 1 percentage point increase in rates reduces purchases by 6 percent relative to a year prior. But their work suggests that historical patterns explain only part of the recent drop in sales. Based on their findings,

FIGURE 2

Most Homeowners Have Locked in Very Low Rates

Share of mortgages with a rate more than 1 percentage point below the market rate, 2005–2023

Data Sources: ICE, McDash® and Freddie Mac

the recent 3 percentage point rise in rates should have led to an 18 percent drop in sales. In fact, sales dropped by more than a third.

One result of the recent refinancing boom is that most existing homeowners have locked in very low rates. Over 80 percent of mortgages have rates more than 1 percentage point below the market rate. By contrast, during most of the period Anenberg and Ringo studied (2002-2021), this was the case for fewer than 10 percent of homeowners (Figure 2). So, in today's environment, moving is very costly for these homeowners. Financing the same house with a new 30-year mortgage would cost the median borrower–who has a $230,000 mortgage and a 3 percent interest rate taken out in mid-2020–more than $450 per month (an increase of over 40 percent in their mortgage payment). This represents the immediate shock to monthly payments.[1]

As a result, these homeowners may be reluctant to move. A decline in the number of homeowners willing to sell would reduce both housing supply and demand, and thus home sales. If this is an accurate diagnosis, then we should expect the impact of rates to be larger and activity to remain depressed for longer, and rates might need to fall further for the market to recover.[2]

In a recent paper, University of Illinois Urbana-Champaign Assistant Professor of Finance Julia Fonseca and University of Pennsylvania Assistant Professor of Finance Lu Liu quantify the consequences of mortgage lock-in. Using credit-bureau data from 2010 to 2018 to identify homeowners who relocate (by changes in borrower zip code), they find that a 1 percentage point change in the difference between a borrower's mortgage interest rate and the current market rate changes moving rates by 9 percent.

Fonseca and Liu's estimates help explain the gap between the actual decline in sales and estimates based on historical experience. Their model predicts that a 3 percentage point increase in mortgage rates, as occurred from March 2022 through August 2023, should lead to a 27 percent reduction in the homeowner-moving rate solely as the result of lock-in. This effect is on top of any other impact of interest rates on housing market activity. One cannot simply add this 27 percent to the 18 percent predicted by Anenberg and Ringo because their estimates also incorporate any mortgage lock-in that prevailed in past episodes. However, mortgage lock-in was much less likely to have played a role in the past, because, as we have seen, far fewer borrowers had mortgages far under market rates. Thus, a large share of the gap between the actual decline in sales and estimates based on historical experience can be explained by mortgage lock-in.[3]

Fonseca and Liu also suggest that mortgage lock-in hinders moving for better employment opportunities. This would be a real effect of high rates. They consider how likely someone is to move if wages grow in areas 50 to 150 miles away. They focus on these areas because it would be difficult for residents to commute to them. They find that locked-in homeowners are only one-third as responsive to these increases as are other homeowners.

But one should not overemphasize mortgage lock-in's impact on the ability of households to find good jobs. When wage differences are sufficiently large, lock-in should become less important. In addition, the increase in working from home may mitigate this impact, as homeowners may be more willing to commute longer distances if they only need to do so infrequently. Indeed, a group of economists at Stanford University found that the share of workers living more than 50 miles from their employer rose seven-fold from 2019 to 2023.[4] Finally, people who need to move for higher wages can avoid the impact of high rates by choosing to retain their old home as a rental property and rent a new home in their destination market.

Lastly, Fonseca and Liu show that in counties where more borrowers are locked in, the number of homes listed for sale is lower, and as a result, house prices in those locations might

Home Lending Has Strengthened in Relatively Poorer Zip Codes

This is despite the fact that high rates and home prices may be hurting affordability.

Share of loans for home purchases, by quartile of each county's zip codes, ranked by median income, 2021–2023

Data Sources: ICE, McDash® and U.S. Census Bureau

Note: Income quartiles are based on the median 2021 Household Income for Zip Code Tabulation Area.

not fall as much as one might expect in response to higher rates, despite the fact that fewer buyers may be searching as a consequence of those higher rates.[5]

Do High Rates Exacerbate Inequality in the Housing Market?

Federal Reserve policymakers are concerned about the distributional effects of monetary policy.[6] This concern is particularly relevant to the housing market. Researchers have found that, historically, when rates increase, purchases decline more for low- and moderate-income borrowers because of affordability, largely because of payment-to-income ratio ("debt to income," or DTI, in the mortgage industry) constraints. Another paper by Ringo matches 2013-2019 Home Mortgage Disclosure Act (HMDA) loan applications and rate lock data from Optimal Blue, and finds that a 1 percentage point increase in rates leads to a 7.5 percent decline in the share of low- and moderate-income buyers. To understand why, look at what occurs when rates *fall*. For example, Philadelphia Fed Special Advisor Neil Bhutta and Ringo studied the impact of a 50 basis point decline in the Federal Housing Administration (FHA) insurance premium in 2015.[7] (FHA loans are traditionally used by lower-income borrowers.) Bhutta and Ringo show that this decline in the FHA premium, which is added to the interest rate that borrowers pay and thus sheds light on the impact of interest rates on home purchases, led to an almost immediate 14 percent increase in the share of mortgages insured by the FHA. They also show that this occurred because, with lower premia, payments were lower, which allowed more low-income borrowers to satisfy their DTI constraint (typically 45 percent in 2014). In the 2014 HMDA data, inability to satisfy the DTI constraint was reported as an important reason for FHA mortgage denials.

Based on Bhutta and Ringo's work, one would expect a *rise* in rates to make it *more* difficult for low-income borrowers to satisfy DTI constraints. Compounding this difficulty, mortgage lock-in may have kept house prices from falling over the past few years despite the high rates. But recent evidence is more nuanced. Although the share of purchases by below-median-income borrowers fell slightly in 2022,[8] lending shares subsequently grew in zip codes with median income in the bottom half of their county (Figure 3). And the FHA share of purchases has grown since mid-2022 (Figure 4).

Does this mean that low-income borrowers are not faring as badly as one might expect? Not necessarily. Wealthier borrowers may be using FHA loans because of their more generous underwriting criteria. Indeed, the average FICO credit score for FHA borrowers has risen over the past two years, and previous research has found that income and credit scores are positively correlated.[9]

In addition, homebuyers seem to be moving from higher-income to lower-income zip codes (Figure 5)—evidence that wealthier borrowers may also be buying in more affordable, lower-income areas. Both these trends could crowd out the less fortunate.

Finally, credit bureau data suggest that although the number of first-time homebuyers fell, their share of purchases *increased*.

After falling to around 37 percent of purchase mortgage originations in early 2021, by March 2023 they made up nearly 50 per-

The FHA's Share of Purchases Has Grown Since Mid-2022

But the average FICO score at origination for FHA borrowers has risen, too, suggesting that these buyers are not all low income.

The FHA's share of purchase mortgage originations and average FICO score at origination, 2019–2024

FHA'S SHARE OF PURCHASE ORIGINATIONS

AVERAGE FICO SCORE AT ORIGINATION

Data Sources: ICE, McDash®

cent. This is partly due to the retreat of existing mortgage holders–it is not necessarily a sign that new homeowners are finding credit easier to obtain or homes more affordable, but rather that with rates this high, many existing homeowners locked into low rates may feel that moving is too costly. And indeed, the share of homebuyers purchasing in the same zip code they already live in (who tend not to be first-time buyers) has fallen sharply since rates started rising.

Could Changes to Mortgage Contracts Address Mortgage Lock-In?

Mortgage lock-in may be costly: It may slow home sales more than in past rate-rise cycles because so many more homeowners have mortgages at rates far below market; it may impede homeowners' ability to take new jobs; and it may make it harder for low- and moderate-income households to buy homes. Could changes to mortgage contracts moderate these costs? Mortgage lock-in results from the prevalence of fixed-rate mortgages in the United States.[10] If a large share of borrowers had adjustable-rate mortgages with payments that rose and fell in concert with

market rates, then lock-in would not be an issue. But this would mean that they would be exposed to the risk of large fluctuations in their monthly budget, which could lead to considerable pain for households.
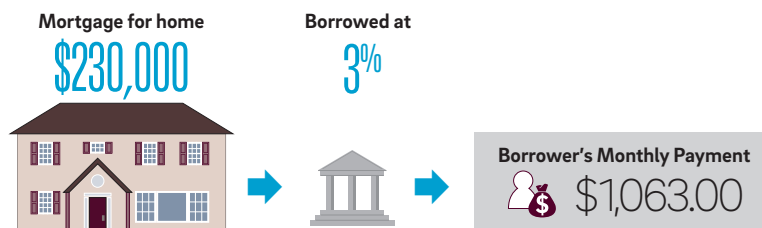
It would be both legally and politically difficult to devise a policy that allows current homeowners to preserve the benefit of their low rates after moving to a new house, because existing holders of mortgages, most notably banks and investors in mortgage-backed securities, would take large losses if they did. But two proposed changes to *new* mortgage contracts might mitigate the cost of *future* rate-hike episodes. These two changes are *assumability* and *portability*.

When a mortgage is *assumable*, a borrower has the option to take over the existing mortgage when buying the property. This might allow a homebuyer to get a lower interest rate than they would otherwise, thus diminishing the effect of mortgage lock-in. FHA and Veterans Affairs (VA) mortgages are already assumable—a borrower has the option to take over the existing mortgage when

How Mortgage Lock-In Works

A homeowner bought their home during the era of low interest rates.

Mortgage for home
$230,000

Borrowed at
3%

Borrower's Monthly Payment
$1,063.00

If the homeowner wants to move to a new home of similar value today even with a mortgage of the same size, their interest rate—and, thus, their monthly mortgage payment—will be much higher. This may dissuade them from buying a new home (and selling their old one).
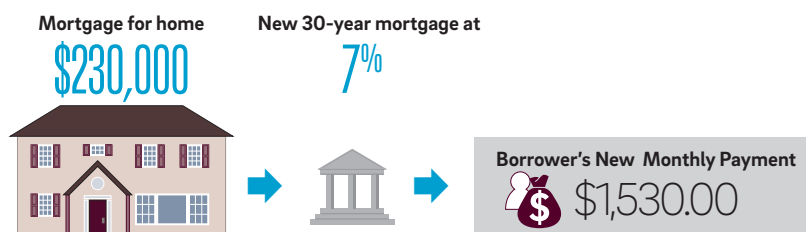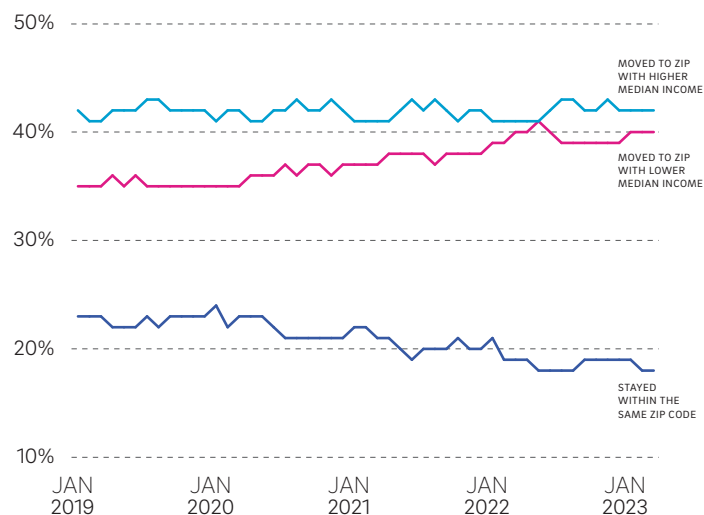

Mortgage for home
$230,000

New 30-year mortgage at
7%

Borrower's New Monthly Payment
$1,530.00

More Homebuyers Are Moving from Higher-Income to Lower-Income Zip Codes

This could be a sign that higher-income households are crowding out the less fortunate.

Share of all mortgages where the homebuyer stayed within the same zip code, moved to a higher-income zip code, or moved to a lower-income zip code, 2019–2023

Data Sources: Federal Reserve Bank of New York/Equifax Consumer Credit Panel and U.S. Census Bureau

Note: This figure uses the median 2021 Household Income for Zip Code Tabulation Area.

buying the property. This doesn't happen often: Our estimates using deeds data from CoreLogic Solutions suggest that fewer than 5 percent of FHA or VA borrowers who took out a mortgage in 2021 or early 2022 (when mortgage rates were low) and sold their house in 2023 (when rates were higher) sold to a buyer who also used an FHA or VA loan of comparable size (and thus might have assumed the original loan). This low percentage may be because house prices rose rapidly during the low-rate period. Thus, these new borrowers, who tend to be credit-constrained, may have found it difficult to come up with the extra cash or financing needed to bridge the gap between the original mortgage and the amount needed to purchase the home. In addition, making non-FHA and non-VA loans assumable would be challenging, as the new homebuyer might not be as creditworthy as the original homeowner.[11]

Alternatively, when a mortgage is *portable*, a homeowner can take the mortgage with them to their new home, thus retaining the lower rate they had locked in.[12] Mortgages are already portable in some countries (for example, Canada, the UK, the Netherlands, and Denmark).[13] In these countries, the borrower can take their mortgage to a new property (if the purchase price is no lower than the sale price of the old property, so that the loan-to-value ratio does not deteriorate). Because the borrower does not change, creditworthiness is less likely to be an issue.

Because lenders would need to recoup the cost of providing the low rate for the newly purchased homes, mortgage rates would likely rise in response to instituting portability. But the increase might be relatively modest because market participants

likely won't anticipate that rates will increase in every future eventuality. In addition, even if mortgage rates did rise, homeowners may still be better off, as portability would ensure that they could move during a future high-rate episode.

Of the two proposed changes, portability seems more workable in the U.S., as it would avoid the challenges associated with assessing the credit worthiness of a new borrower.

Conclusion

The slowdown in housing sales is greater than what is predicted by research into the link between home purchases and interest rates. We attribute a substantial share of this gap to *mortgage lock-in*. That is, for a large share of borrowers today, moving would entail giving up a substantial benefit in the form of their low-rate mortgage (Figure 6). Many of these borrowers would also find it difficult to qualify for a mortgage of the same size but at a higher rate. Mortgage lock-in can have additional real consequences, in that it makes labor markets less agile by making moving for a better job more expensive for homeowners. But the overall impact of this is unclear.

Our estimates of the impact are based on research that uses historical data preceding the current rate rise cycle; more recent data can help refine these estimates. Researchers may also want to quantify the costs of making future mortgages portable, so that they can see if the benefits would outweigh the costs. Another topic for further research is the extent to which high rates lead better-off borrowers to crowd out lower-income borrowers, and the channels through which that occurs. ▣

Notes

1 Of course, this is an upper bound because borrowers can refinance if rates drop. This would also represent a significant increase in their monthly debt payments overall, since credit bureau data indicate that mortgage payments represent about two-thirds of a typical homeowner's monthly debt payments.

2 Following the collapse of the housing bubble and the subsequent sharp decline in house prices, some authors—such as Fernando Ferreira, Joseph Gyourko, and Joseph Tracy—also found that household mobility was impeded by negative equity lock-in, that is, because selling their home would require them to make substantial cash payments in cases where their house was worth less than their outstanding mortgage balance.

3 However, Fonseca and Liu used data from periods in which far fewer households were locked in. Work by several authors currently underway using more recent data should shed more light on this.

4 Akan et al. (2024).

5 Anenberg and Ringo find that changes in supply (due to fewer sellers listing their homes, for example) tend to have a relatively modest impact on housing market conditions, because those homeowners are not then searching for new homes. This would suggest that lock-in should not have much effect on prices. However, their data only include periods where mortgage lock-in was much less prevalent. So, it is plausible that lock-in could still be keeping prices from falling in the current environment.

6 See, for example, the spring 2019 conference, Distributional Consequences of the Business Cycle and Monetary Policy, held at the Federal Reserve Bank of Minneapolis.

7 FHA-insured mortgages are used disproportionately by low-income buyers because they have looser underwriting criteria; most saliently, these criteria permit more borrowing relative to one's income.

8 See Consumer Financial Protection Bureau (2023). The most recently available HMDA data are from 2022.

9 See, for instance, Albanesi et al. (2022).

10 More than 95 percent of mortgages outstanding at the start of 2024 had fixed rates. (Source: authors' calculations using data from ICE, McDash®.)

11 However, the underwriting requirements for FHA and VA mortgages are less demanding.

12 If the new home they are buying is significantly more expensive than the one they are selling, they might lose some of this benefit because they might need to take out a more expensive second mortgage to make up the difference.

13 Berg et al. (2018) discuss the mortgage finance system in Denmark, which has aspects of both assumability and portability.

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What Explains the Great Resignation?

Quits typically rise in a tight labor market, but analysts were surprised by what happened in 2021.

Ryan Michaels

Economist and Economic Advisor

FEDERAL RESERVE BANK OF PHILADELPHIA

The views expressed in this article are not necessarily those of the Federal Reserve.

During economic booms, more workers quit their jobs. Some transition directly to other employers. Others leave the workforce to return to school or spend time with family, perhaps because they can use the income they gained during the boom to cover their bills while they are not working.

But what happened after COVID-19 took many analysts aback. The quit rate began 2021 at its prepandemic level but kept climbing. By the end of the year, 3 percent of employees were quitting per month–the highest level since current surveying of quits began.[1] In this article, I examine this wave of quits, which came to be called the Great Resignation.

First, I unpack the average quit rate to obtain a fuller picture of quitting patterns. For instance, the average quit rate reflects quits that lead directly to another job as well as (voluntary) transitions out of the workforce. What did each of these components do in the Great Resignation? How did these patterns vary across workers of different ages, races, and educational backgrounds? And did they also vary across industries?

Drawing on these findings, I can then examine why the Great

Resignation happened. For instance, where a worker goes *after* a quit–do they move immediately to another employer or leave the workforce?–sheds light on the factors that led the worker to quit in the first place. And because workers experienced the labor market recovery in different ways, *who* tended to quit reveals the forces behind the Great Resignation.

But first, I must examine how a "quit" is measured in each of my data sources, because these differences in measurement imply somewhat different quitting patterns.

Measuring Quits

The most cited source of data on quits is the Bureau of Labor Statistics' (BLS's) monthly Job Openings and Labor Turnover Survey (JOLTS). The roughly 21,000 establishments surveyed by the BLS employ a little under 250,000 workers, in total, in a typical month. The BLS asks each employer to report that month's worker turnover, including the total number of quits. The BLS defines a quit as a voluntary separation *excluding* retirements and resignations for health reasons. (By contrast, the BLS defines a layoff as an involuntary separation initiated by the employer.)

The JOLTS data show that the average quit rate–that is, the share of employees who quit per month–rose from 2.3 percent in late 2020 to nearly 3 percent one year later, its highest point in the survey's 20-year history (Figure 1). As we will see, other measures do not reach a (meaningfully) new peak in 2021-2022 even though they rose sharply in that period. However, because JOLTS is the standard source for worker turnover data, analysts mark its late-2021 peak as the apex of the Great Resignation.[2] I will generally set the starting date to late 2020, by which point the JOLTS quit rate had recovered to its prepandemic level.

Although JOLTS is my benchmark, it does not identify which *workers* quit, nor does it measure *where* workers went after they quit. To complement JOLTS, I turned to two other data sources.
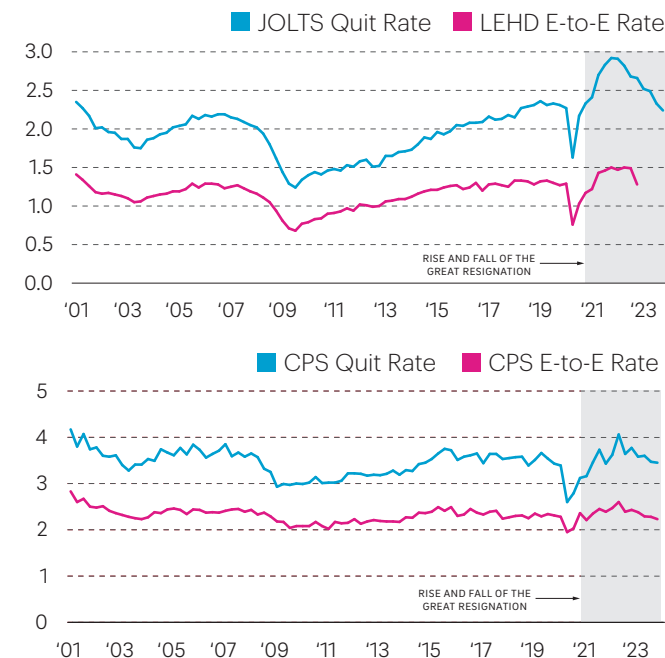
The first is the Longitudinal Employer and Household Dynamics (LEHD) data set, a near-census of workers and firms compiled by the U.S. Census Bureau. The LEHD offers two advantages. First, it reports the number of workers who switch from one employer directly to another. These *employer-to-employer* (E-to-E) transitions are often interpreted as quits, but they are not identified separately from other quits in JOLTS. Second, given the data set's worker- and firm-level detail, I can compute E-to-E transitions by worker attributes–age, sex, and race, for instance–and by the attributes (for example, the industry) of the employer from which the worker resigned and the employer to which the worker moved.

We should not expect the E-to-E rate–that is, the share of employees who transition from one employer directly to another–to move as much as the total quit rate. There are at least two reasons for this. First, E-to-E transitions in the LEHD do not capture *all* quits; some quits include transitions *out of the workforce* (not to other employers). Second, some E-to-E transitions are not quits; they may instead be layoffs, as when a worker given advanced notice lines up a new position before termination. Because some E-to-E transitions are layoffs, and because layoffs tend to fall when quits rise, the measured increase in the E-to-E

The Rate at Which Workers Left Their Jobs Surged During COVID

Percent of nonfarm employees quitting their job for any reason (the quit rate) or quitting for another job (the employer-to-employer rate), quarterly, 2001–2023

Data Sources: The Bureau of Labor Statistics' Job Openings and Labor Turnover Survey (JOLTS), the U.S. Census Bureau's Longitudinal Employer and Household Dynamics (LEHD) data set, and the U.S. Census Bureau's Current Population Survey (CPS)

Note: LEHD data are only available quarterly. Therefore, I express the JOLTS and CPS results as quarterly averages of monthly data, and I divide the LEHD E-to-E transitions by three to express them on a monthly basis.

rate will understate the rise in the overall quit rate.[3]

Consistent with these points, the E-to-E rate in the LEHD rose by about half as much in 2021 as did the JOLTS quit rate. This small an increase only nudges the E-to-E rate to just above its prior peak in the first quarter of 2001. Thus, unlike the quit rate, the E-to-E rate does not reach a new height.

The second source of data is the Current Population Survey (CPS), a monthly survey of roughly 60,000 households. As a household-level survey, it gathers even more extensive demographic data than the LEHD. In addition, the CPS enables me to estimate both total quits *and* its two components: E-to-E transitions and quits to *non*employment, the latter of which means the worker has left the workforce.[4] Quits to nonemployment include unemployed workers who are actively looking for a job, but nearly all (90 percent) of these quits are the formerly employed who do *not* report searching for work. The CPS can identify quits to nonemployment because, unlike the LEHD, it asks for the *reason* for the transition.[5] The CPS's drawback is its small sample size. As a result, its month-to-month variation in samples causes its estimated quit rates to bounce around more than in our other sources.

Despite this "noise" in the CPS-based series, some basic patterns in the data are clear.[6] First, the rates in the CPS-based se-

ries are generally higher than in the other sources. For example, the total quit rate in the CPS is, on average, 1.5 percentage points higher than in the JOLTS series. And the E-to-E rate in the CPS is roughly double the rate in the LEHD. These significant differences are worthy of further research, but discrepancies in the series' *average levels* are less important here than their movements *over time*. The movements in the CPS's quit and E-to-E rates are in fact similar to what we see in, respectively, JOLTS and the LEHD. For instance, each series shows a steep decline during the Great Recession (2007–2009) and then a substantial if gradual recovery. It is worth noting, though, that the CPS series do not set a new peak in 2021–2022—a feature at odds with JOLTS though in line with the LEHD.

Now that I've examined where my three data sources differ and agree, I can zero in on how the E-to-E and total quit rates evolved in the pandemic recovery and varied across workers and industries.

Breaking Down the Great Resignation

Here I move beyond the average quit rate to reveal a more detailed and richer picture of quitting patterns during the Great Resignation. Specifically, I address three questions: What did workers do *after* they quit? How did quitting patterns vary across different *workers*? And how did quitting patterns vary across different *jobs*?

How Quit Rates Varied by Destination

A quit is the start of a transition in the labor market. But how does it end? By transitioning directly to a new employer? Or by leaving the workforce?

The CPS offers the most direct answers to these questions. E-to-E flows in the CPS represent two-thirds of total quits on average. In addition, variation over time in the E-to-E rate has generally accounted for a significant share of fluctuations in the overall quit rate. In the pandemic recovery, however, move-

ments in the E-to-E rate were subdued relative to the rise in the overall quit rate, which increased around 0.7 percentage point between late 2020 and mid-2022. Therefore, there must have been a significant rise in the rate at which workers quit the workforce altogether. Indeed, the increase in the quit rate to *non*employment throughout 2021–2022 represented around three-quarters of the rise in the overall quit rate.[7]

Because the LEHD does not chart the quit rate to nonemployment, I cannot use it alone to estimate the contribution E-to-E flows made to the rise in total quits. Instead, I use data on the (total) quit rate from JOLTS (while acknowledging that the LEHD is only a proxy for the E-to-E flows embedded in the JOLTS numbers). The E-to-E rate in the LEHD is on average around half the total quit rate in JOLTS. In addition, *changes* in the LEHD's E-to-E rate are typically one-half as large as changes in JOLTS' overall quit rate both before and throughout the 2021–2022 period. Thus, E-to-E flows contributed more to the Great Resignation than suggested by the CPS.

Nevertheless, it's clear that quits to nonemployment must be accounted for in any narrative of the Great Resignation. Based on these data, the rise in the rate at which workers left the workforce likely represented a significant share of the increase in the total quit rate.

How Quit Rates Varied by Demographics

Movements in the average quit and E-to-E rates may mask important variation across different types of workers. Were quits broad-based or concentrated among certain groups? The answer yields additional clues as to what lies behind the rise in the overall quit rate.

I organized the data by four demographic characteristics: age, sex, race, and educational attainment. For each characteristic, I computed the E-to-E rate and overall quit rate in the CPS. Specifically, I zeroed in on how these rates evolved in 2021–2022 (Figure 2).

We can draw a few key conclusions from this exercise. First, the (total) quit rate rose unevenly across demographic groups.

Quit Rates Varied by Demographic Group

Younger, nonwhite, and non-college-educated workers all experienced a sharper increase in quits.

Percentage point change in the quit rate and the employer-to-employer rate, by demographic group, fourth quarter 2020 to mid-2022

Data Sources: JOLTS, LEHD, and CPS

Younger, nonwhite, and non-college-educated workers all experienced a sharper increase in quits.[8] In addition, the quit rate among women rose more than among men. Although groups whose quit rates rose the most also tended to have higher quits on average, the differences were still present (though modest) when I adjusted for the initial level of quits. For instance, the 1.35 percentage point increase in the quit rate among workers under age 35 ("young") was over four times larger than the percentage-point increase among workers over age 35 ("older"). However, the initial, fourth quarter 2020 quit rate among young workers was also substantially higher than among older workers. If we express the subsequent movements *relative* to their initial values, they imply a 30 percent gain in quits among young workers, which is still twice as large as the 15 percent gain among older workers.

Second, among groups whose quit rates rose the most, we see little movement in the E-to-E rate. For instance, the increase in the E-to-E rate among nonwhite workers is negligible. Thus, the results for these groups highlight the higher propensity to quit the workforce as a crucial driver of the rise in the overall quit rate. The rise in the E-to-E rate for the other groups (for example, white workers) was also subdued but larger as a *share* of the increase in their overall quit rate.

Although E-to-E rates tend to move more in the LEHD than in the CPS, differences across demographic groups were limited in both. The increase in the E-to-E rate across all demographic categories lies within a narrow range between 0.25 and 0.5 percentage point. Thus, even if the E-to-E rate is more active in the LEHD, any differences in total quit rates across demographic groups seem to reflect differences in the propensity to quit the workforce rather than the frequency of E-to-E moves.

How Quit Rates Varied by Industry

Just as quit rates vary across different types of workers, they also vary across different types of jobs, as seen by the variation across industries. For this analysis, I turn to JOLTS and the LEHD because there are relatively few observations on quits at the industry level in the CPS.

According to JOLTS, certain industries stood out during the Great Resignation. For example, in 2021 the quit rate rose by over a full percentage point in the retail trade sector and by over 0.8 percentage point in the leisure and hospitality sector, which consists of entertainment, food service, and hotel establishments (Figure 3).

However, quit rates rose in *every* industry. The median increase across industries, which is not affected by the largest or smallest changes, was one-half of a percentage point. Moreover, quit rates in most industries reached their highest recorded levels during the pandemic recovery. Finally, as we saw for demographic groups, several of the industries that reported a large increase already had a high average quit rate. In late 2020, the quit rate in the leisure and hospitality sector was 4.6 percent, so a 0.8 percentage point increase is not especially large *relative* to this initial level. By contrast, the 0.5 percentage point increase in the information sector (which includes publishing and broadcasting) is substantial relative to its initial value of 1.3 percent.

In other words, after I account for differences in initial values, sectors such as retail and leisure no longer stand out, and changes in quit rates are more uniformly distributed across sectors. Thus, in considering the cross-section of quits in the economy, I see more dispersion corresponding to differences in workers (as discussed above) than in jobs.

When I repeat this analysis with the LEHD's data on E-to-E rates, a few results emerge. First, regardless of how changes in the E-to-E rates are measured, they appear to be roughly uniformly distributed across industries.[9] Second, sectors with high quit rates in 2021 did *not* necessarily have high E-to-E rates. A prominent example is the retail trade sector, in which the quit rate rose 1 percentage point but the E-to-E rate climbed by just one-third of a percentage point. In this and several other sectors, such as leisure and hospitality, the change in the overall quit rate seems to have stemmed from an increase in workers leaving the workforce.

Trying to Understand the Great Resignation

I now consider three possible narratives for the rise (and fall) of the Great Resignation. All three may be at work to some degree, as each is grounded in a novel and distinct feature of the pandemic economy. According to the *fast-growth* narrative, the rise in quits was a byproduct of the fast economic recovery in 2021-2022. According to the *telework* narrative, quits rose because more workers transitioned to remote-work occupations. And according to the *wealth* narrative, the sharp increase in household savings during the pandemic enabled workers to spend more time away from paid work, and thereby induced quits. I use the facts presented thus far to assess each narrative.

The Fast-Growth Narrative

The fast-growth narrative builds on two observations. First, the recovery in employment in 2021 was exceptionally fast. In that year alone, the nonfarm sectors added 7 million jobs–and demand for labor was still far from satisfied, with the number of job openings at a record-breaking level. Second, an E-to-E transition is both a quit (from the initial firm) *and a hire* (by the new firm). Therefore, when employers seek to quickly expand, hires via E-to-E transitions rise.[10] In other words, an increase in quits–notably in E-to-E transitions–is a natural byproduct of a boom in hires.[11]

See *An Alternative Explanation for Elevated E-to-E Transitions* ↓

This narrative suggests that, even if the E-to-E rate rose, it did not necessarily rise any faster than the overall hiring rate. Therefore, E-to-E transitions *as a share* of total hires didn't look unusually high. This claim does appear to be true (Figure 4). The E-to-E share in each data set returns to its prepandemic level (except for a third quarter 2022 "blip" in the LEHD's data). This result is consistent with the fast-growth narrative–namely, that the rise in E-to-E transitions reflected a general boom in the demand for labor rather than the presence of some factor that favored E-to-E hires over other hires.

Although the fast-growth narrative explains the E-to-E flows

FIGURE 3

Quits Rose Across all Industries During the Great Resignation

Percentage point change in employer-to-employer rate and quit rate, fourth quarter 2020 to fourth quarter 2021, and for 2020–2021 relative to 2020 level

■ 2020-2021 change relative to 2020 level   ■ Fourth quarter 2020 to fourth quarter 2021

Change in E-to-E Rate   *Change in Quit Rate*

Data Sources: JOLTS, LEHD, and CPS

in the data, there is more to quits than E-to-E moves. Transitions out of the workforce likely played a significant role in the rise in overall quits in 2021-2022. Since the fast-growth narrative assumes that quits become hires, it would interpret these transitions as delays on the way to a new job.

But did total quits, as with E-to-E transitions, really grow in line with (total) hires? JOLTS suggests otherwise. According to the JOLTS data, total quits did rise *relative* to hires. Moreover, this increase is notably not matched by an increase in the E-to-E share; the two series do not generally deviate from one another in the manner observed after the pandemic. In this sense, the 2021-2022 rise in quits does not look like the increase one might anticipate when the economy is strong.[12]

In addition, although the fast-growth narrative views a spell outside the workforce as a brief waystation between jobs, the

CPS data suggest that these quits were not bound for a job in the near term. In the CPS, a large majority of workers who quit the workforce left for reasons that do not suggest an imminent return to employment. Instead, these workers reported that they planned to return to school or spend more time with family.[13]

In short, the fast-growth narrative is best (if imperfectly) applied to E-to-E transitions but unlikely to provide a full account of the pandemic-era rise in *total* quits.

The Telework Narrative

The pandemic lockdowns forced a sudden shift to remote work. However, long after the worst days of the pandemic, around 30 percent of workdays are still done remotely. These remote-work opportunities are not uniformly distributed across the labor

market. The share of jobs with at least some remote work option currently varies from 20 percent in the leisure and hospitality sector to 70 percent in the information sector.[14] In this context, workers who prefer remote work may have to quit to other occupations or industries. This raises the possibility that the burst of quits in 2021-2022 reflected attempts by workers to move into telework-friendly jobs. By this logic, quits receded as workers settled into their new careers.

Within the CPS, we can examine the telework narrative using questions introduced during the pandemic period. The CPS inaugurated a telework question in May 2020. Given its timing, this question linked remote work to the pandemic—that is, survey participants were asked if they worked from home *because* of COVID-19. But as the pandemic receded in 2021, remote work, although it persisted, became less mandatory. As a result, this question may lead us to underestimate the prevalence of remote work. To address this problem, the CPS revised the question in fall 2022 and now simply asks whether the survey participant did any work from home (and if so, the number of days worked from home).

I used the CPS's original, May 2020 remote-work question to look for a link between quits and remote work. This is straightforward for E-to-E transitions because an employed worker's current and past telework status is readily observable. (By contrast, I cannot generally follow workers' labor market activity after they quit into nonemployment.) Specifically, I computed the share of E-to-E moves that involved a transition into a teleworkable job from a position in which no remote work was reported. This share is small: On average, take-up of telework is involved in 5 percent of E-to-E moves, which amounts to 0.1 percentage point of the E-to-E rate. To put this in context, the CPS's overall quit rate rose by 0.7 percentage point in 2021-2022. Thus, by this measure, take-up of telework represents 10-15 percent of the increase in the quit rate. This *understates* the role of telework to the extent that some workers who quit to search for teleworkable jobs first leave the workforce (and so are not captured as E-to-E transitions). At the same time, though, the result *overstates* remote work's role to the extent that some of the transitions that happen to involve the take-up of telework would have occurred even in the absence of a work-from-home option.

Next, I used the CPS's revised question to examine the role of remote work from a different angle. Because the revised question was introduced in October 2022, after the quit rate peaked, I do not link it directly to contemporaneous labor market transitions. Rather, I used the revised question to determine which occupations "stuck" with remote work into 2022-2023. These are the occupations that were most likely to signal to workers in 2021 that they offered long-term telework opportunities. I then computed how the quit rate evolved during the pandemic among those occupations in which work-from-home is common and a second group in which it is not. If the availability of remote work drives quits, we should see an increased propensity to quit from the occupations in which remote work is unavailable. While firm conclusions can be difficult to draw with such noisy data, it seems that more workers generally left jobs in occupations in which telework is uncommon. Between late 2020 and mid-2022, the overall quit rate in these occupations rose 0.3 percentage

point more than in telework-friendly jobs.[15]

A similar exercise could be used to estimate transitions out of jobs in *industries* in which telework is uncommon. Using industry-level data from JOLTS, recent research has indeed found that industries with lower rates of telework experienced higher quit rates in 2021-2022.[16] Together with the findings that use occupation detail from the CPS, this research presents a stronger case for a role for telework in the Great Resignation. The counterargument emphasizes that, in the CPS, we often do not see an individual worker make an E-to-E transition from an onsite-only job to a telework-capable position. Future research should revisit this debate by using more comprehensive data to track the future telework status of all quitting workers.

The Wealth Narrative

Over the first year or so of the pandemic, households accumulated savings at a rate unseen since modern record-keeping began. Between 2019 and 2021, real (inflation-adjusted) checking and savings deposits grew 30 percent, or by $3.3 trillion. This development reflected a surge in federal government income support amounting to over $2 trillion of spending above 2019 levels. In addition, some of the increase in savings was "forced," insofar as access to certain services (such as in-person dining and concert venues) was restricted, limiting spending.

With elevated levels of savings, more workers were able to meet required expenses (such as rent) without having to work. Taking care of family or pursuing further schooling became affordable. Accordingly, the *wealth* narrative predicts a higher propensity to quit the workforce in 2021-2022. As households depleted their stock of wealth in later years, quits should have fallen (as they do in the data).

This is an appealing narrative. First, it addresses the importance of quits to nonemployment. This source of quits is quantitatively important but not necessarily accounted for by the factors driving up E-to-E transitions.

Second, this narrative sheds light on the distribution of quitting patterns across demographic groups. Quit rates rose most prominently among young, nonwhite, and non-college-educated workers. Weekly earnings of these groups tend to be low (compared with their white, middle-aged, college-educated counterparts). However, workers with below-median earnings experienced *faster* wage growth during the pandemic.[17] Why would groups facing higher wage opportunities quit more often? Maybe the growth in *wealth* was also relatively high among low-earnings workers. In fact, data from the J.P. Morgan Chase Institute show that the growth rate of the cash balances of account holders in the bottom quarter of earnings was twice as high as those in the top quarter of earnings.[18] The faster growth in wealth could temper the propensity to work even at higher wages. In fact, the reduction in the labor supply could have contributed to the increase in wages in the first place, a point to which I return below.

Third, the narrative is consistent with other salient facts about the pandemic-era labor market. For instance, as much as hiring grew during 2021, job openings rose (much) faster. Indeed, the number of hires per opening *fell* to historic lows, suggesting that employers were struggling to fill positions. This fact is con-

sistent with the wealth narrative: A higher level of wealth enables a job seeker to spend more time looking for a job they prefer, and thereby slows the rate at which open positions are filled.

One major challenge for this narrative, though, is that the increase in quit rates seems *very* large relative to the increase in wealth. Among the lowest quarter of wage earners, the average checking account balance was $1,200 higher in 2021 than prior to the pandemic, according to J.P. Morgan Chase Institute data. Suppose this induced an increase of just 0.5 percentage point in the quit rate to nonemployment. Even this seemingly modest response runs counter to findings from recent research. For instance, evidence of the willingness to work among lottery winners shows that it takes a windfall roughly *10 times larger* to induce the same reduction in work.[19]

Conclusion

The pandemic recovery ushered in a labor market unlike anything seen in well over a generation. One salient development was the wave of quits in 2021-2022. Higher quit rates were observed for all industries and demographic groups, but the rise in quits was particularly sharp for younger, female, nonwhite, and non-college-educated workers. Many of these workers transitioned directly to another employer, but a majority left the workforce altogether. This suggests that changes in both the supply of labor (as illustrated

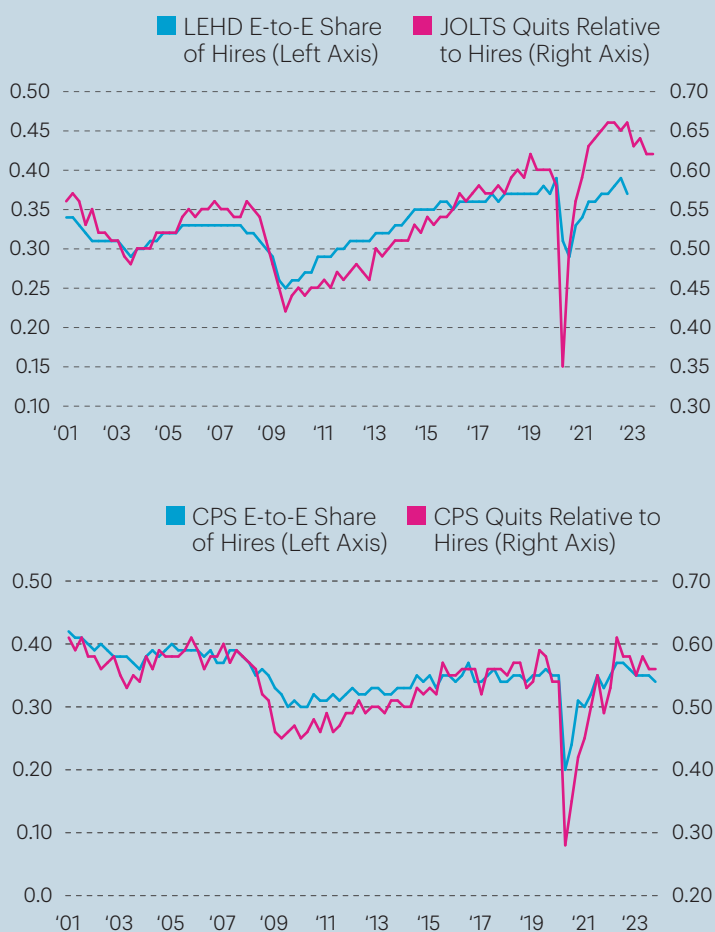## An Alternative Explanation for Elevated E-to-E Transitions

Rather than a rising tide of hires lifting E-to-E transitions, a specific factor could have elevated E-to-E flows without increasing hiring more generally. But if so, we should see hires via E-to-E transitions rise *relative* to other hires. In other words, E-to-E hires *as a share of all hires* should be unusually high. By contrast, the fast-growth narrative stresses that E-to-E hires may grow in line with other hires. Therefore, according to the fast-growth narrative, the E-to-E *share* of hires may look no different in 2021–2022 than it did prior to the pandemic.

To assess these competing perspectives, I looked at the LEHD and the CPS, each of which measures E-to-E transitions and total hires. I then computed the E-to-E share of hires as the ratio of E-to-E transitions to total hires (Figure 4). Notably, the share is *procyclical*: It rises during economic expansions and falls during recessions, in part because, in a weak labor market, there are more unemployed people competing for jobs. As employment grows and unemployment falls, the E-to-E share climbs. This suggests that, *even if there had been no Great Resignation*, we should still expect the E-to-E share to respond to the economic shocks during the pandemic. Indeed, the share fell during the brief 2020 recession and then rebounded.

FIGURE 4

Quits to Other Employers Make Up a Larger Share of Hires in Good Times

But this share wasn't unusually high during the Great Resignation.
Employer-to-employer share of hires and quits relative to hires, 2001–2023

Data Sources: JOLTS, LEHD, and CPS

by the wealth narrative) and the demand (as illustrated by the fast-growth narrative) contributed to the rise in quits.

A next step in the analysis of the Great Resignation would look at its broader implications for labor market dynamics. Consider the behavior of wages. Over the course of 2021 and into 2022, wage inflation accelerated. It's probably not a coincidence that this overlaps with the Great Resignation. The rise in quits was fueled by both stronger labor demand and weaker labor supply—a combination that should put upward pressure on wages. The acceleration in wage inflation appears to have in turn fed into higher price inflation.[20] This nexus of quits, wages, and prices will likely interest researchers in the years ahead.[21] ▣

NOTES

1 At that rate, up to 40 percent of the workforce would turn over during a calendar year. Of course, quits did not stay so high for that long; the quit rate began descending in the spring of 2022.

2 Federal Reserve Bank of Chicago Senior Economist and Economic Advisor Bart Hobijn notes that, in an older survey of manufacturers, quit rates above 3 percent were not uncommon in a strong labor market. That survey was discontinued at the end of 1981. A detailed comparison of the two surveys is beyond the scope of this article. See Hobijn (2022).

3 A final concern is that the LEHD excludes transitions away from jobs that start and end within a quarter. The effect of this omission on the E-to-E rate is mitigated because these jobs are also excluded from measured employment, that is, they are excluded from the denominator of the rate. Therefore, the measured E-to-E rate is understated only if short-term jobs are more likely to end via an E-to-E transition than via a movement out of the workforce.

4 When employed workers report to the CPS that they have switched employers, the CPS counts it as an E-to-E transition. Due to a change in survey administration, I use an adjusted and methodologically consistent estimate of the E-to-E rate. See Fujita et al. (forthcoming) for a description of the method. The data can be accessed at https://www.philadelphiafed.org/surveys-and-data/macroeconomic-data/employer-to-employer-transition-probability.

5 The unemployed, who are by definition actively searching for work, are asked simply if they "quit" or were "laid off." Those who do not search—the labor force nonparticipants—are asked why they left their last job. I judge workers to have quit if they left to return to school, to spend time with family, or because the conditions of their last job were "unsatisfactory." See Graves et al. (2023) for details on the construction of CPS quit rates.

6 Whereas the BLS and Census publish seasonally adjusted data from, respectively, JOLTS and the LEHD, calculations from the CPS require seasonal adjustment. I use the implementation of the X-13-ARIMA-SEATS algorithm written by Yvan Lengwiler for MATLAB.

7 In keeping with my dating of the Great Resignation, I calculate changes in CPS quit rates starting from late 2020. When examining the CPS, though, I use mid-2022 as the ending date because the rates did not

peak until then. Because of differences in the timing of (total) quit and E-to-E series, choosing an earlier starting date implies a bigger role for E-to-E transitions for certain demographic groups.

8 This result echoes Hobijn's 2022 analysis of the CPS.

9 This similarity could be overstated if the measurement error differs across sectors—for example, if the LEHD "misses" more E-to-E transitions in sectors in which the true E-to-E rate rose more. See footnote 3 for more on the potential measurement error in the LEHD.

10 The employer losing a worker via an E-to-E transition will often seek to replace that worker, perhaps by poaching from still another firm. In this sense, an initial E-to-E transition kicks off a "hiring chain," with one firm after another making hires. The chain stops when a job opening is filled by a nonemployed worker. For theoretical models of hiring chains, see Mercan and Schoefer (2020), Elsby et al. (2023), and Clymo et al. (2023).

11 One driving factor behind the general boom in hiring appears to have been a sharp rise in new business formation in 2021. Ryan Decker and John Haltiwanger show that, across U.S. states, higher rates of business formation went together with higher E-to-E rates.

12 Once again, though, the analogous variable in the CPS does not reach a new high in 2021–2022. I generally defer to the JOLTS series but a reconciliation of these sources should be a high priority for future research.

13 Unfortunately, it is not possible in the CPS to track the future labor market outcomes of quits who leave the labor force. The identification of a "quit" is based on questions asked to a subsample of workers who are not followed over the subsequent months.

14 These estimates are from Barrero et al. (2021).

15 E-to-E dynamics may account for as much as half of this difference in total quit rates, but the contribution of E-to-E transitions depends heavily on the exact dates used to measure the change in transition rates.

16 This analysis is reported by Bagga et al. (2023).

17 See Autor et al. (2023) for a review of real wage trends in the pandemic. These authors also report on the link between E-to-E rates and wages. They find that, in 2021–2022, a non-college-educated worker with a relatively low wage became more likely to make an E-to-E move relative to a higher-wage worker also in the noncollege group. This result is not necessarily at odds with an increased propensity to quit the workforce for the noncollege group as a whole.

18 See Wheat and Deadman (2023) for an analysis of the J.P. Morgan Chase data.

19 See Cesarini et al. (2017), whose results are based on a sample of lottery winners in Sweden. By contrast, the cross-sectional correlation of initial wealth and labor force outcomes suggests that higher wealth has a (much) bigger impact on the propensity to quit. See for instance Algan

et al. (2003). However, the lottery studies better capture the abrupt increase in wealth experienced in the pandemic period.

20 The annualized growth in the Employment Cost Index rose from 3.4 percent in the fourth quarter of 2020 to 5.5 percent in the first quarter of 2022. The simultaneous rise in (price) inflation was broad-based and specifically observed in the services sector, where labor is a large share of overall costs. Inflation in core personal consumption expenditures services (excluding housing) rose from 2.5 percent to 5 percent.

21 This work has already begun. See Moscarini and Postel-Vinay (2023), who present a theory of how a higher E-to-E rate fuels a rise in wages and, therefore, prices.

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Regional Spotlight

Wage Inequality Across the U.S.

Wage inequality dipped after COVID, but longer-term regional inequality trends remain unchanged.

Kevin Curran
Senior Economic Analyst
FEDERAL RESERVE BANK OF PHILADELPHIA

The Great Recession and the COVID-19 pandemic were two of the most significant economic disruptions since the Great Depression, and each altered the dynamics of wage inequality. After the Great Recession, wage inequality grew, continuing the decades-long trend of a widening wage gap between high and low earners. But the unique economic conditions brought on by the COVID-19 pandemic led to a slight decline in wage inequality.

An important aspect of these differing effects is the wide variation in wage inequality across U.S. metro areas. Large urban areas tend to have higher wage inequality, driving much of the growth in wage inequality for the nation.[1] This growth accelerated in the years immediately following the Great Recession but declined slightly after the pandemic. Although wage inequality continued to rise after the pandemic for many large, often coastal cities where wage inequality had already been highest, smaller cities away from the coasts saw wage inequality decline, which led to the slight, nationwide decline in wage inequality.

These regional and metro-level differences in wage inequality

are creating diverging economic outcomes not only for households within regions but also between regions throughout the country. Recognizing this divergence can help us formulate public policies to better address inequality. To further our understanding of these regional differences, I first explore the long-term trend in rising wage inequality. I then show how wage inequality rose across the country after the Great Recession and examine where and how wage inequality declined after COVID.
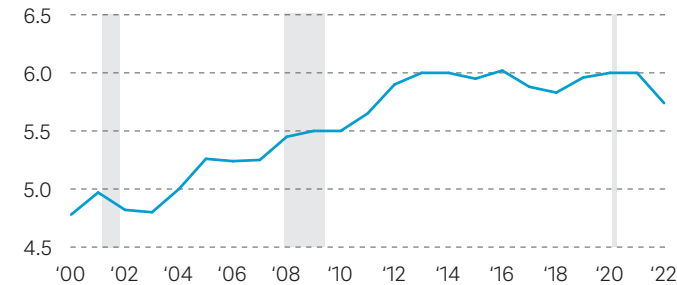
The Long-Term Trend

Rising wage inequality is not a recent phenomenon. The demand for highly skilled workers has increased significantly since the 1980s as globalization and the adoption of technology have boomed, driving disproportionately strong growth in wages for highly skilled workers.[2] These factors have also led to an increase in *job polarization*—an increase in employment in low- and high-skill occupations relative to mid-skill occupations. Because low-skill jobs tend to be low-paid, and high-skill jobs highly paid, job polarization concentrates employment toward the extreme ends of the wage distribution, which contributes to the rise in wage inequality.

One way to measure this trend, and a common measure of wage inequality, is to look at the ratio of the 90th percentile wage to the 10th percentile wage, or the 90/10 ratio. In 2005 the 90/10 ratio in the U.S. was 5.3 (Figure 1). This means a worker in the 90th percentile earned 5.3 times as much as a worker in the 10th percentile.[3] By 2022, the 90/10 ratio had risen to 5.7. For comparison, between 1980 and 2000 the 90/10 ratio rose from 4.2 to 4.8.

One Common Measure of Wage Inequality Shows a Rising Trend

The ratio of the 90th percentile real wage to the 10th percentile real wage in the U.S., 2000–2022

Data Source: U.S. Census Bureau's American Community Survey (ACS)

Note: Wages have been adjusted using the Personal Consumption Price Index.
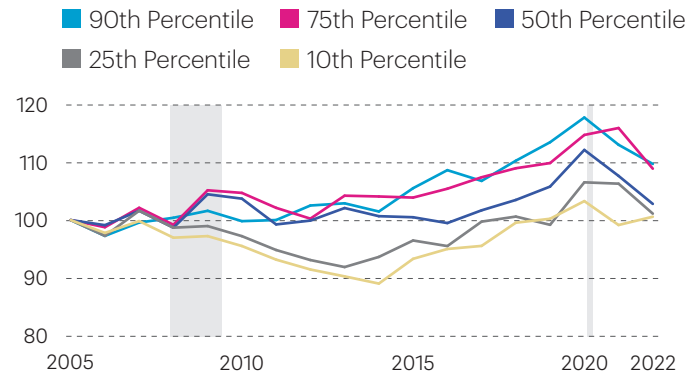
However, changes in the 90/10 ratio show that wage inequality did not rise at a constant pace from 2005 to 2022. In the years immediately following the Great Recession, real wage growth was relatively modest for the median worker and those in the top half of the wage distribution, whereas real wages at the bottom of the distribution declined through 2013, driving the 90/10 ratio higher (Figure 2). As of 2013 the 90/10 ratio was 6.0.

But from 2014 to 2018, the 90/10 ratio shrank slightly as those

Real Wage Growth Was Modest for the Median and Higher-Paid Workers After the Great Recession

But real wages at the bottom of the distribution declined, driving the 90/10 ratio higher.

Real wages of full-time workers by percentile, indexed to 2005, 2005–2022

Data Source: U.S. Census Bureau's American Community Survey (ACS)

Note: "Full-time" is defined as working at least 40 hours a week and at least 50 weeks a year.

toward the bottom of the wage distribution experienced accelerating growth in real wages. By 2018 the ratio was back down to 5.8.[4]

Then, in the years leading up to the pandemic, the 90/10 ratio rose again, reaching 6.0 in 2020. So, despite the occasional decline in the 90/10 ratio, the overall trend has been toward growing wage inequality over the past 40 years.[5]

Regional Differences During and After the Great Recession

Wage inequality rose almost everywhere in the U.S. during and after the Great Recession, but the level of inequality varied widely throughout the country. To show these regional differences and examine where inequality rose most, I calculated and compared the 90/10 ratios for full-time workers in more than 200 consistently defined metropolitan statistical areas (MSAs) for 2005 and 2019.[6] I found that wage inequality tended to be higher in larger urban areas.[7] Many of the MSAs where the ratio was highest were in the Northeast, on the West Coast, in Texas, and in Florida (Figure 3). These regions have large concentrations of occupations in traditionally high-skill and high-wage industries like tech and finance, as well as low-skill and low-wage industries (Figure 4).[8]

Meanwhile, MSAs in the Rust Belt tend to have greater wage *equality*. Although some MSAs within this region have been impacted in recent decades by the declining importance of manufacturing, by automation, and by the agglomeration of high-skill jobs in the nation's largest cities, manufacturing remains important in many MSAs, and accounts for a much larger share of employment than in the nation overall.[9] This concentration of jobs in a single, traditionally middle-wage sector leads to a flatter

FIGURE 3

MSAs with a Large Concentration of Highly Skilled Workers Have a Higher 90/10 Ratio

Many of these cities are in regions with many tech and finance jobs, which tend to require high skills.

The 90/10 ratio, by metropolitan statistical area (MSA), 2019

Data Source: Author's calculations based on U.S. Census Bureau's ACS

90/10 RATIOS, 2019
- <5.1
- 5.1 - 6.0
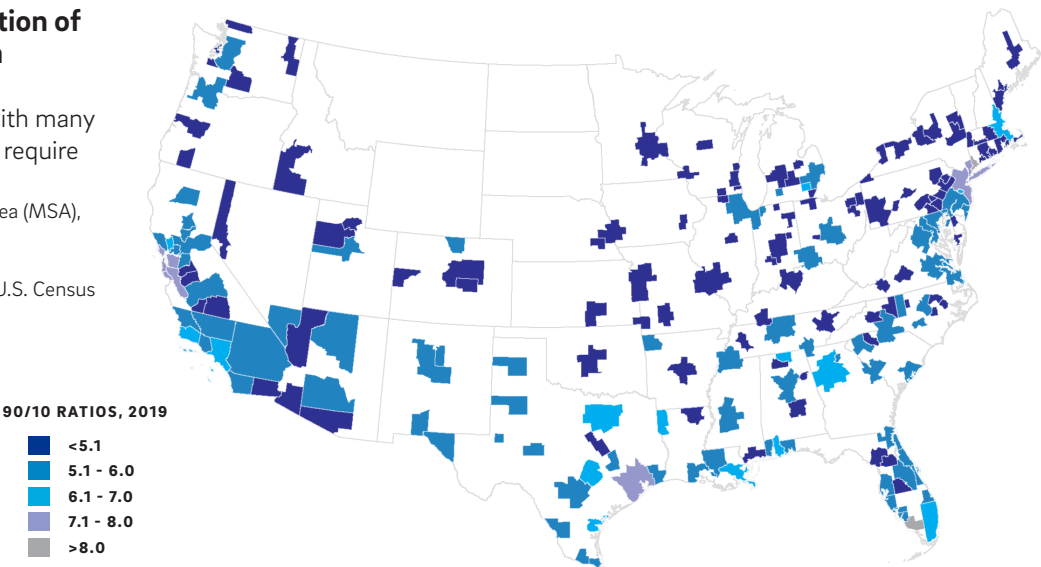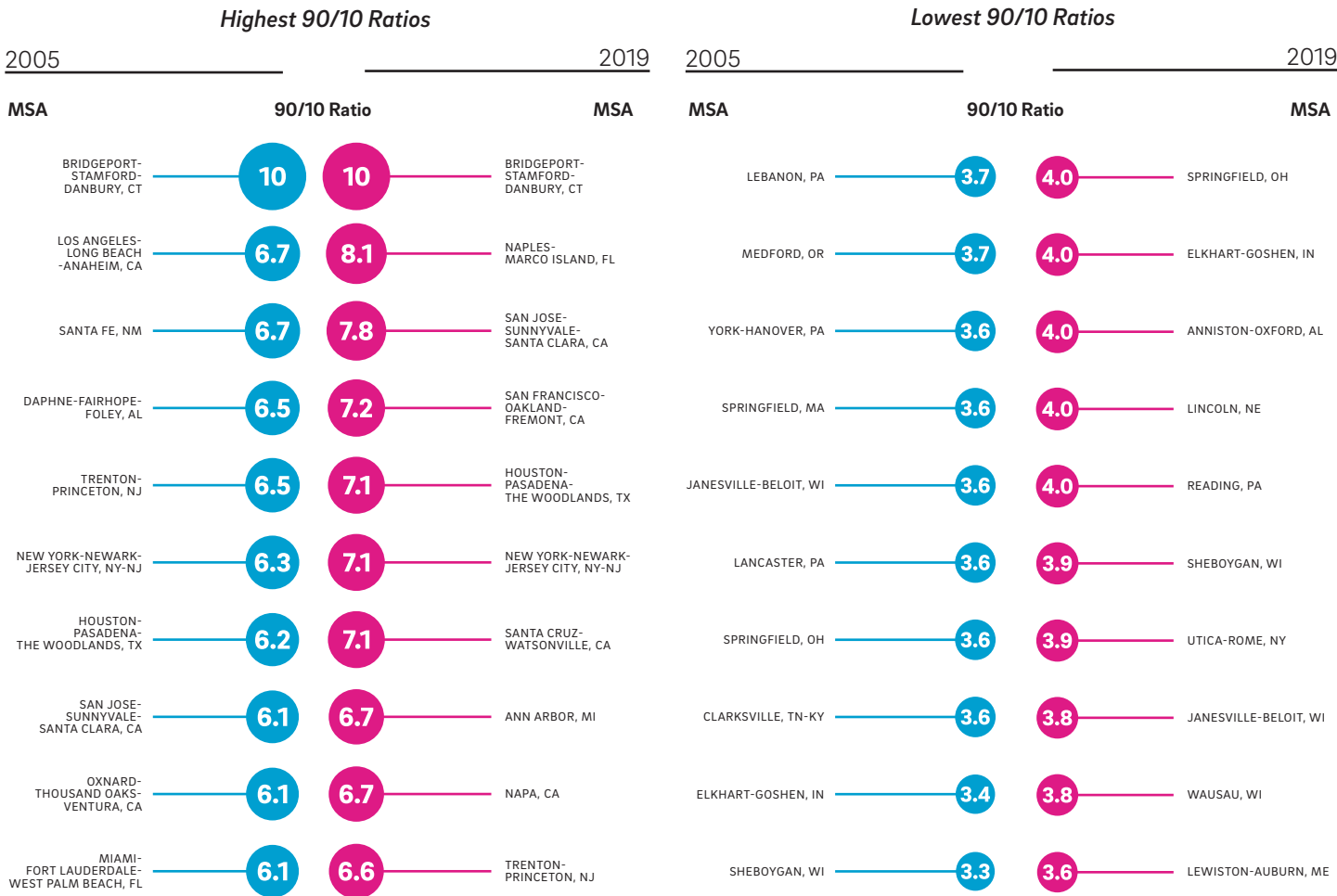- 6.1 - 7.0
- 7.1 - 8.0
- >8.0

FIGURE 4

Rust Belt and Midwest MSAs Tend to Have Greater Wage Equality

Some of these MSAs still depend on the traditionally middle-wage industry of manufacturing, which flattens their wage distribution.

Top 10 and bottom 10 MSAs by 90/10 ratio, 2005 and 2019

Highest 90/10 Ratios

2005 MSA	90/10 Ratio (2005)	90/10 Ratio (2019)	2019 MSA
BRIDGEPORT-STAMFORD-DANBURY, CT	10	10	BRIDGEPORT-STAMFORD-DANBURY, CT
LOS ANGELES-LONG BEACH-ANAHEIM, CA	6.7	8.1	NAPLES-MARCO ISLAND, FL
SANTA FE, NM	6.7	7.8	SAN JOSE-SUNNYVALE-SANTA CLARA, CA
DAPHNE-FAIRHOPE-FOLEY, AL	6.5	7.2	SAN FRANCISCO-OAKLAND-FREMONT, CA
TRENTON-PRINCETON, NJ	6.5	7.1	HOUSTON-PASADENA-THE WOODLANDS, TX
NEW YORK-NEWARK-JERSEY CITY, NY-NJ	6.3	7.1	NEW YORK-NEWARK-JERSEY CITY, NY-NJ
HOUSTON-PASADENA-THE WOODLANDS, TX	6.2	7.1	SANTA CRUZ-WATSONVILLE, CA
SAN JOSE-SUNNYVALE-SANTA CLARA, CA	6.1	6.7	ANN ARBOR, MI
OXNARD-THOUSAND OAKS-VENTURA, CA	6.1	6.7	NAPA, CA
MIAMI-FORT LAUDERDALE-WEST PALM BEACH, FL	6.1	6.6	TRENTON-PRINCETON, NJ

Lowest 90/10 Ratios

2005 MSA	90/10 Ratio (2005)	90/10 Ratio (2019)	2019 MSA
LEBANON, PA	3.7	4.0	SPRINGFIELD, OH
MEDFORD, OR	3.7	4.0	ELKHART-GOSHEN, IN
YORK-HANOVER, PA	3.6	4.0	ANNISTON-OXFORD, AL
SPRINGFIELD, MA	3.6	4.0	LINCOLN, NE
JANESVILLE-BELOIT, WI	3.6	4.0	READING, PA
LANCASTER, PA	3.6	3.9	SHEBOYGAN, WI
SPRINGFIELD, OH	3.6	3.9	UTICA-ROME, NY
CLARKSVILLE, TN-KY	3.6	3.8	JANESVILLE-BELOIT, WI
ELKHART-GOSHEN, IN	3.4	3.8	WAUSAU, WI
SHEBOYGAN, WI	3.3	3.6	LEWISTON-AUBURN, ME

Data Source: Author's calculations based on U.S. Census Bureau's ACS

wage distribution—and thus lower wage inequality—throughout much of the Rust Belt.

From 2005 to 2019, increasing wage inequality in the high-ratio MSAs was driven by a combination of rising real wages for already highly paid workers, mostly stagnant real wages for low-paid workers, and a rise in job polarization. In most high-ratio areas, wage growth at the bottom of the wage distribution was mostly flat or even declining while wages grew sharply in the top half of the distribution. By contrast, MSAs with the lowest 90/10 ratios in 2019 usually had a relatively flat wage distribution. As in other MSAs, lower-earning workers in these areas experienced modest or flat wage growth from 2005 to 2019, but because these MSAs did not have the high concentration of highly paid jobs found in the largest MSAs, the top half of their distribution did not experience a sharp rise in wages.

*See **Wage Inequality Across the Third District***

Wage inequality tends to rise faster in larger cities for several reasons. First, larger cities tend to have an agglomeration of high-skill jobs. As technology matures, firms' need to fill these jobs increases faster than the supply of highly skilled workers.[10] With demand exceeding supply, wages for these workers increase.

Second, firms in larger cities tend to be more productive, at least in part due to labor market pooling, input sharing, and knowledge sharing among the many highly skilled workers concentrated there.[11] And more-productive workers are usually paid more.

Third, high-skill workers have migrated toward larger cities, drawn by their high wages and better amenities.[12] As a result, smaller cities and rural areas lose potentially higher-wage workers.

Fourth, large cities tend to attract low-wage workers due to immigration patterns, better access to public transportation, and extreme skill complementarity.[13]

And fifth, automation and international trade have pushed urban non-college-educated workers into lower-skilled jobs, leading to lower wages for these workers.[14]

Wage Inequality After COVID

Despite the large labor market disruptions at the start of the COVID-19 pandemic—particularly for the bottom of the wage distribution—wage inequality declined, with the country's 90/10 ratio dipping from 6.0 in 2019 to 5.7 in 2022. This decline was primarily driven by weakening real wage growth for the highest earners as well as a declining supply of and increasing competition for low-paid workers, which together flattened the wage distribution.[15]
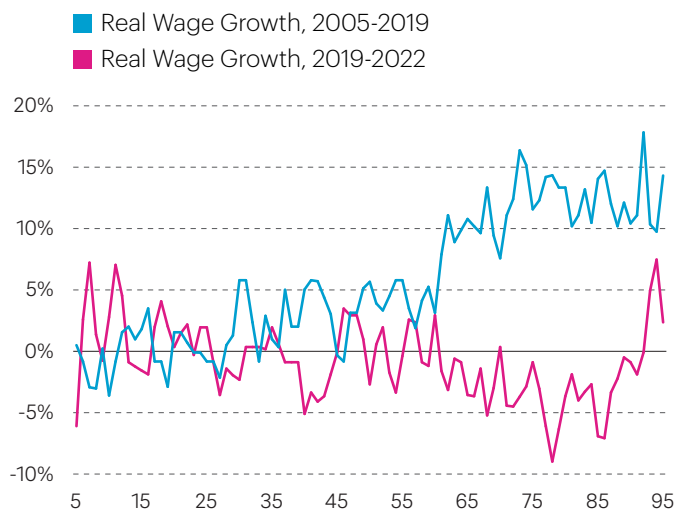
Workers in the top 40 percent of the distribution experienced flat or declining real wage growth from 2019 to 2022 (Figure 5). This compares to real wage growth of between 10 and 15 percent from 2005 to 2019. For low-wage workers, an inverse pattern prevailed. Although low-wage workers were especially impacted by job losses early in the pandemic, the inability of firms to find low-wage labor once demand recovered created upward wage pressure for low-wage jobs. This led to modest real wage growth

Higher-Paid Workers Experienced Flat or Declining Real Wage Growth During the Pandemic

The inability of firms to find low-wage labor created modest wage growth for lower-paid workers.

Real wage growth by wage percentile, 2005–2019 and 2019–2022

Data Source: U.S. Census Bureau's American Community Survey (ACS)

Note: "Full-time" is defined as working at least 40 hours a week and at least 50 weeks a year. Wages have been adjusted using the Personal Consumption Price Index.

for workers in the bottom quarter of the distribution. From 2019 to 2022, their real wages grew as much as they had from 2005 to 2019.

Just as wage inequality rose unevenly across the U.S. during and after the Great Recession, wage inequality fell unevenly during and after COVID. To show these differences I calculated the MSA-level 90/10 ratios for 2022 and compared them to the ratios for 2019. Most MSAs saw their 90/10 ratio decline from 2019 to 2022 (Figure 6). The Daphne-Fairhope-Foley, AL, metro area experienced the largest decline, falling from 6.5 in 2019 to 5.2 in 2022, followed by the Ann Arbor, MI, and Prescott, AZ, MSAs, where it fell from 6.7 to 5.5 and 5.1 to 3.9, respectively.

Why did these three MSAs see the biggest decline in their 90/10 ratio? Ann Arbor may be an outlier: It has a much larger-than-average share of employment in educational instruction and library occupations. Many of these well-paid jobs were likely impacted by the University of Michigan's salary freeze in the 2020-2021 fiscal year, contributing to the slower wage growth experienced at the top of the wage distribution. This slower growth, combined with modest to strong wage growth at the bottom of the wage distribution, led to a large decline in Ann Arbor's 90/10 ratio.[16]

The situation in the Daphne-Fairhope-Foley, AL, and Prescott, AZ, MSAs may be more indicative of national trends. Both of these MSAs have a larger-than-average share of total employment in the traditionally low-wage food services industry.[17] According to the Bureau of Labor Statistics (BLS), accommodation and food services firms were the most likely to increase pay

in 2021 and increase starting pay to attract new hires in 2022.[18] These increases likely drove the rise in real wages experienced at the bottom of the wage distribution in these two MSAs.
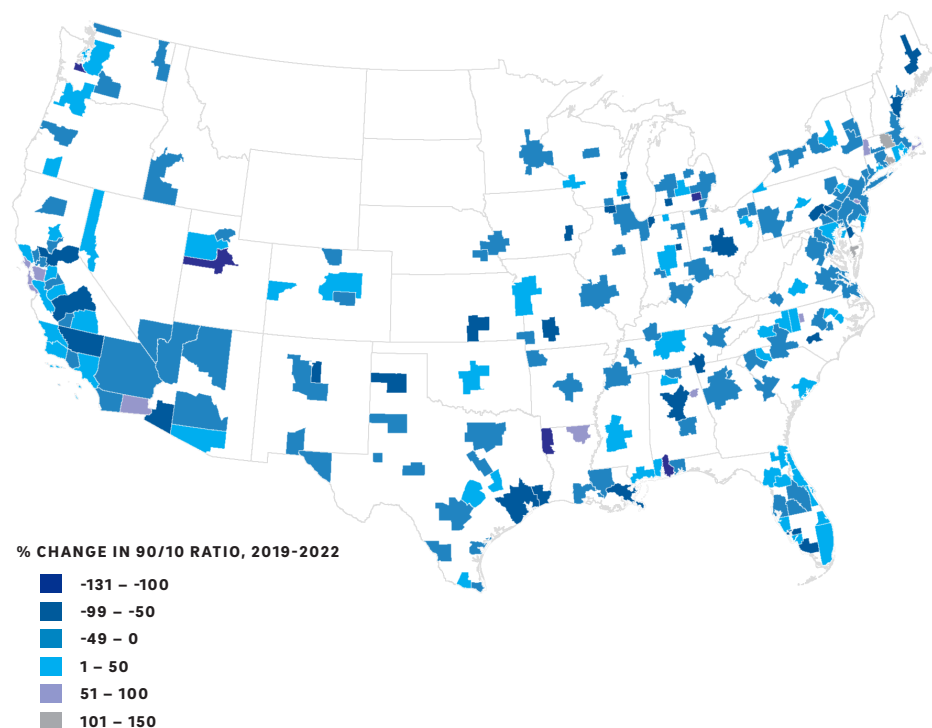
However, inequality did not decline in all MSAs. In 77 MSAs, the 90/10 ratio *rose* from 2019 to 2022. Increases in the 90/10 ratio were most concentrated in the West, the Northwest, and Florida—all three of which had high wage inequality prior to the pandemic. In all three, wage inequality seems to have spilled out of the biggest cities, perhaps because high-earning workers were moving into surrounding communities to take advantage of remote-work opportunities. Overall, MSAs that experienced an increase in wage inequality were concentrated in regions that already had higher wage inequality.

Wage Inequality Did Not Decline Uniformly Across the U.S. During and After COVID

MSAs where wage inequality increased were concentrated in regions that already had higher wage inequality.
Change in the 90/10 ratio by MSA, 2019–2022

% CHANGE IN 90/10 RATIO, 2019-2022

- -131 – -100
- -99 – -50
- -49 – 0
- 1 – 50
- 51 – 100
- 101 – 150

Data Source: Author's calculations based on U.S. Census Bureau's ACS

Wage Inequality Across the Third District

As is true in the U.S., wage inequality grew in the Third District after 2005. In aggregate, the Third District's 90/10 ratio rose from 4.8 in 2005 to 5.2 in 2019, before declining to 4.9 in 2022.[20] Despite the District's small size, wage inequality varies widely across the region (Figure 7).

The Trenton–Princeton, NJ, metro area had the highest 90/10 ratio among Third District MSAs, at 7.5 in 2022, well above the Atlantic City–Hammonton, NJ, and Philadelphia–Camden–Wilmington, PA-NJ-DE-MD, metro areas, which were the next highest, at 5.6 and 5.5, respectively.[21] The Lebanon, PA, metro area's 90/10 ratio of 3.7 was the lowest in the district.

Of the 16 MSAs in the Third District where data are available, 12 saw their 90/10 ratio increase from 2005 to 2022. However, in only five metro areas (Trenton–Princeton, NJ, Atlantic City–Hammonton, NJ, Philadelphia–Camden–Wilmington, PA-NJ-DE-MD, Erie, PA, and State College, PA) did the ratio rise more than it did in the U.S. Four of the MSAs (Dover, DE, Johnstown, PA, Scranton–Wilkes-Barre, PA, and Reading, PA) saw their inequality ratios decline over the same period. In 11 MSAs in the Third District, wage inequality declined from 2019 to 2022, and in five of those areas the 90/10 ratio fell more than it did in the U.S.
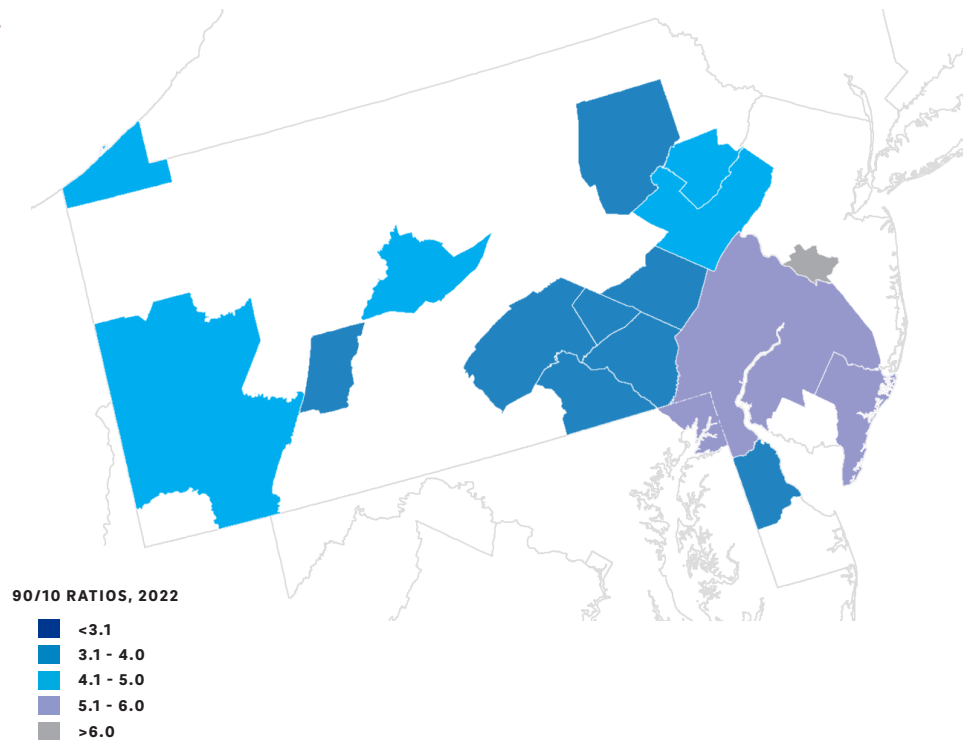
The Philadelphia–Camden–Wilmington, PA-NJ-DE-MD, MSA ranked as the 46th most unequal metro area in 2022, with a 90/10 ratio of 5.5. This was up from 4.7 in 2005, when it ranked 89th.

FIGURE 7

Wage Inequality Varies Widely in the Third District Despite Its Small Size

The 90/10 ratio of Third District MSAs, 2022

Data Source: Author's calculations based on U.S. Census Bureau's ACS

90/10 RATIOS, 2022

- <3.1
- 3.1 - 4.0
- 4.1 - 5.0
- 5.1 - 6.0
- >6.0

Conclusion

The Great Recession and the COVID-19 pandemic were two of the largest labor market disruptions in history. Concurrently, wage inequality, as measured by the 90/10 ratio, rose in the U.S. and across most metro areas. However, this rise was not linear. During and immediately after the Great Recession, real wages were flat or declined for the lowest-paid workers while real wages grew faster for the highest paid. This accelerated the increase in wage inequality. During the pandemic, it was real wages for those at the bottom of the wage distribution that increased faster. As a result, wage inequality slightly declined immediately after the pandemic.

However, this decline did not benefit all low-wage workers. Total income inequality, which includes taxes and transfers in addition to wage income, rose again in 2022 as stimulus payments and temporary expansions of tax credits expired.[19] Low-wage workers were also more likely to lose their jobs early in the pandemic. They thus missed out on wages and possible wage gains. And wage inequality remained largest in the more-populous metro areas, particularly those with a high concentration of tech and finance occupations.

The unique economic conditions brought on by the COVID-19 pandemic and the elevated inflation environment that led to a decrease in wage inequality may soon dissipate. Furthermore, the ever-growing demand for highly skilled workers and increasing adoption of new technologies mean that the long-term increase in wage inequality may reemerge.

The increase in wage inequality is leading to diverging economic outcomes for households between and within U.S. metro areas. When shaping policy decisions, policymakers need to account for the magnitude of wage inequality and the regional differences associated with it. If they don't, the continuing divergence of economic outcomes will make it increasingly hard to implement policies that work for everyone ▣.

Notes

1 See Baum-Snow and Pavan (2013).

2 See Acemoglu and Autor (2011).

3 All 90/10 ratios throughout this article incorporate the 90th percentile real wage and the 10th percentile real wage of full-time workers only. "Full-time" is defined as working at least 40 hours a week and at least 50 weeks a year. All wage data are from the U.S. Census Bureau's annual American Community Survey (ACS) and have been adjusted using the Personal Consumption Price Index.

4 Autor, Dube, and McGrew (2023) show more significant wage gains for lower-wage earners over this period, but their sample includes part-time workers, who tend to earn less than full-time workers.

5 The U.S. Department of Commerce (2023) also shows that geographic income inequality (defined as the variation in average income across all places in the nation) has risen more than 40 percent over the same period.

6 MSAs are delineated by the U.S. Office of Management and Budget.

7 This confirms what Baum-Snow and Pavan (2013) found: The growth of inequality in larger cities explains over one-quarter of the rise in inequality nationwide from 1980 to 2007.

8 A couple of smaller MSAs with the highest 90/10 ratios are "college towns." These MSAs tend to have a high level of wage inequality because university staff are typically better paid than other residents. See the U.S. Bureau of Labor Statistics' Occupation Employment and Wage Statistics (OEWS).

9 See the U.S. Bureau of Labor Statistics' OEWS.

10 See Abel and Deitz (2019).

11 See Rosenthal and Strange (2004), Baum-Snow, Freedman, and Pavan (2018), and Davis and Dingel (2019).

12 See Diamond (2016).

13 See Albert and Monras (2022), Glaeser, Kahn, and Rappaport (2008), and Eeckhout, Pinheiro, and Schmidheiny (2014). Extreme skill complementarity refers to the complementary relationship between high- and low-skill workers. For example, high-skill (and thus higher-wage) workers' demand for amenities and services creates demand for low-skill (and thus lower-wage) employment in the local service sector.

14 See Autor (2019).

15 See Autor, Dube, and McGrew (2023).

16 For data on the shares of employment, see the U.S. Bureau of Labor Statistics' OEWS. For more on the wage freeze, see Stocking (2021)

17 See U.S. Bureau of Labor Statistics' OEWS.

18 See Bureau of Labor Statistics' Business Response Survey (2021, 2022).

19 See Creamer and Unrath (2023).

20 These 90/10 ratios cover 16 Third District MSAs where data were available.

21 Trenton-Princeton, NJ, is another example of an MSA with a high level of wage inequality in part due to a large population of university staff who are typically better paid than other residents.

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Research Update

These papers by Philadelphia Fed economists, analysts, and visiting scholars represent preliminary research that is being circulated for discussion purposes.

Navigating Higher Education Insurance: An Experimental Study on Demand and Adverse Selection

We conduct a survey-based experiment with 2,776 students at a nonprofit university to analyze income insurance demand in education financing. We offered students a hypothetical choice: either a federal loan with income-driven repayment or an income-share agreement (ISA), with randomized framing of downside protections. Emphasizing income insurance increased ISA uptake by 43 percent. We observe that students are responsive to changes in contract terms and possible student loan cancellation, which is evidence of preference adjustment or adverse selection. Our results indicate that framing specific terms can increase demand for higher education insurance to potentially address risk for students with varying outcomes.

WP 24-7. Sidhya Balakrishnan, Jain Family Institute; Eric Bettinger, Stanford University and NBER; Michael S. Kofoed, University of Tennessee at Knoxville and Federal Reserve Bank of Philadelphia Consumer Finance Institute Visiting Scholar; Dubravka Ritter, Federal Reserve Bank of Philadelphia Consumer Finance Institute; Douglas A. Webber, Board of Governors of the Federal Reserve and Federal Reserve Bank of Philadelphia Consumer Finance Institute Visiting Scholar; Ege Aksu, Jain Family Institute; Jonathan S. Hartley, Stanford University.

The Effect of Student Loan Payment Burdens on Borrower Outcomes

Rising student loan debt and concerns over unaffordable payments provide a rationale for the broad class of "income-driven repayment" (IDR) plans for federal student loans. These plans aim to protect borrowers from delinquency, default, and resulting financial consequences by linking payments to income and providing forgiveness after a set repayment period. We estimate the causal effect of IDR payment burdens on loan repayment and schooling outcomes for several cohorts of first-time IDR applicants using a regression discontinuity design. Federal student loan borrowers who are not required to make payments see short-run reductions in delinquency and default risk, but these effects fade or reverse in the longer run as some borrowers become disconnected from the student loan repayment system when not required to make payments.

WP 24-8. Tomás E. Monarrez, Federal Reserve Bank of Philadelphia Consumer Finance Institute; Lesley J. Turner, University of Chicago and Federal Reserve Bank of Philadelphia Consumer Finance Institute Visiting Scholar.

How Much Does Racial Bias Affect Mortgage Lending? Evidence from Human and Algorithmic Credit Decisions

We assess racial discrimination in mortgage approvals using confidential data on mortgage applications. Minority applicants tend to have significantly lower credit scores and higher leverage, and are less likely than White applicants to receive algorithmic approval from race-blind government-automated underwriting systems (AUS). Observable applicant-risk factors explain most of the racial disparities in lender denials. Further, we exploit the AUS data to show there are risk factors we do not directly observe, and our analysis indicates that these factors explain at least some of the residual 1–2 percentage point denial gaps. Overall, we find that differential treatment has played a more limited role in generating denial disparities in recent years than suggested by previous research.

Bankruptcy Lawyers and Credit Recovery

The author studies how bankruptcy law firm advertisements affect credit recovery of households in financial distress. Exploiting the border discontinuity strategy associated with the geographic unit in which local TV advertisements are sold, the author empirically uncovers bankruptcy filings and credit recovery related to exogenous variations in bankruptcy law firm advertisements. The author first documents a significant advertising effect on filing rates and shows that advertising-induced filers are similar to existing filers. The author then finds a positive effect of advertisements on credit outcomes including credit score, new homeownership, and foreclosure. The author interprets these findings as evidence that lawyers address information frictions in households' assessment of the bankruptcy option.
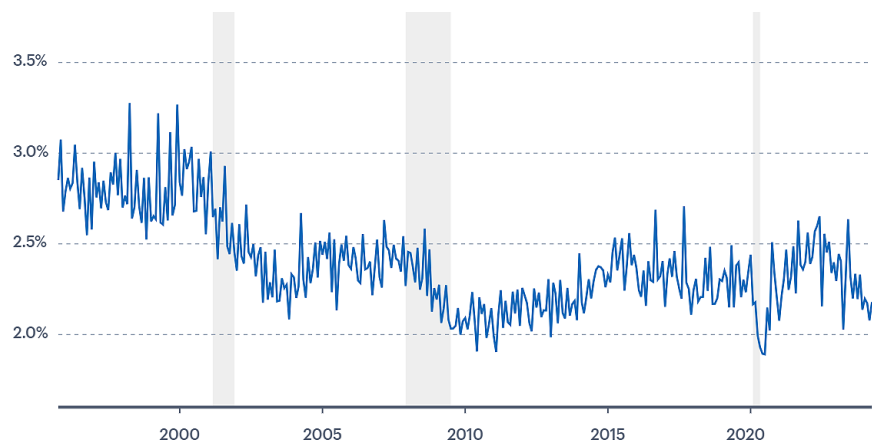
Data in Focus

Fujita, Moscarini, and Postel-Vinay Employer-to-Employer (E2E) Transition Probability

Every month, millions of workers change their labor market status. Some transition from employed to unemployed after losing their job, while others move in the opposite direction, landing a new job after a lengthy job search. Some workers decide to rejoin the labor force after being a stay-at-home parent. Some retire and leave the labor force. And some transition from one employer to another without any interruption. Collectively, these individual experiences shape the U.S. labor market.

When workers move directly from one employer to another, their earnings tend to increase because they often find a job for which they are a better match and can be more productive. If we are to assess the overall health of the U.S. labor market, we need to accurately measure the economywide pace of these transitions. The Philadelphia Fed's new data product, the Fujita, Moscarini, and Postel-Vinay Employer-to-Employer (FMP E2E) Transition Probability, serves this very purpose and does so in a timely manner through its monthly updates.

Transition Probability (%), Seasonally Adjusted

Source: Federal Reserve Bank of Philadelphia.

Notes: The series uses the data available on May 10, 2024. Shaded areas indicate NBER recessions.

The series is based on the work of *Shigeru Fujita* of the Federal Reserve Bank of Philadelphia, Giuseppe Moscarini of Yale University, and Fabien Postel-Vinay of University College of London. Together, these economists developed a statistical model that reliably imputes nonresponses to the Current Population Survey's question about a change in the respondent's employer.[1]

The Philadelphia Fed will update the series and its accompanying visualization tool on the second Friday of each month. ▣

1 To learn more about this methodology and their extensive analyses of the data, see their forthcoming article in the *American Economic Journal: Macroeconomics* and their Philadelphia Fed working paper, "Measuring Employer-to-Employer Reallocation" (2021), https://www.philadelphiafed.org/the-economy/macroeconomics/measuring-employer-to-employer-reallocation.

From Philadelphia, Pennsylvania, the birthplace of American finance, comes *Economic Insights*.
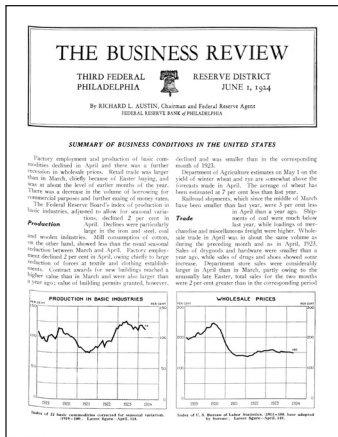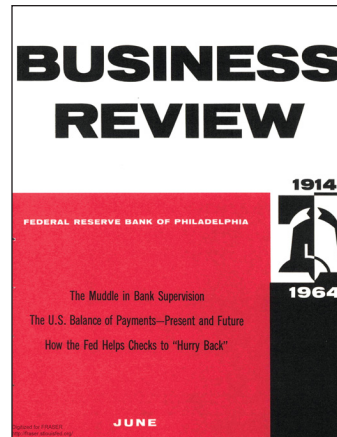Continuing our 100-year tradition of sharing cutting-edge research with the general public.
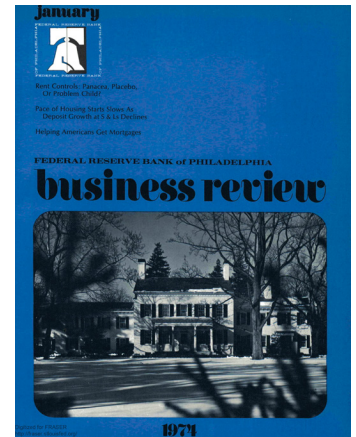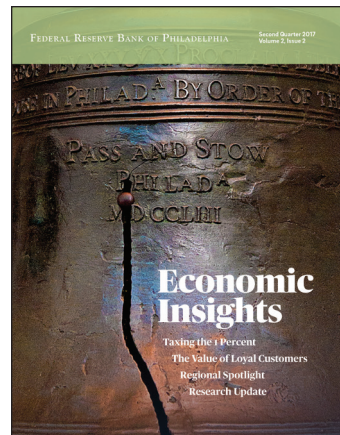
1920s

1950s

1960s

1970s

1980s

2010s

2020

2023