Economic Insights

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Contents

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About the Cover

The Liberty Bell and Independence Hall

This issue's cover photo depicts the Liberty Bell, long associated with both Philadelphia and the United States of America. The bell was cast for the Pennsylvania State House in 1751 and bears the Biblical inscription, "Proclaim Liberty Throughout All the Land Unto All the Inhabitants thereof." After the American War of Independence, antislavery abolitionists embraced the inscription as their motto. In 1915, the bell was used to rally support in Pennsylvania for women's suffrage. To this day, people around the world celebrate the bell as a symbol of humanity's quest for liberty. The Pennsylvania state capital long ago moved to Harrisburg, and the Pennsylvania State House, visible in reflection in the glass walls around the bell, is now known as Independence Hall.

Photograph by Rich Wood.

Q&A...

with Darcelle Bowrin-Toussaint , a Senior Economic Analyst here at the Philadelphia Fed.

Darcelle Bowrin-Toussaint

After a seven-year stint with the central bank of her home country, Trinidad and Tobago, Senior Economic Analyst Darcelle Bowrin-Toussaint immigrated to the U.S. to join the staff of the Philadelphia Fed, where she studies business conditions in the Third District. Through her research, Darcelle educates the public about our local economy and supports our nation's monetary policy-making.

Where did you grow up?

In Sangre Grande, a small town in Trinidad and Tobago, two islands very close to Venezuela. I was raised in an extended family, with my granny, aunties, cousins, and my mom.

What led you to study economics?

I fell in love with economics back in what we call the fourth form. That is the equivalent of 9th grade. That's when I had my first economics class, and I was engaged from beginning to end. I was like, I want to know more. You have developing countries that seem to have a hard time economically. But then you have global giants like the U.S. and China doing so well. I thought economics would help me understand those differences.

What subfield of economics did you study at the University of the West Indies?

For my master's degree, I looked at how chronic diseases affected the economy of Trinidad and Tobago. In the Caribbean, with our diets and our lifestyles, we have increasing incidences of chronic diseases like diabetes and hypertension, and that's an issue for the economy—both in terms of health care costs for the government and the health and wellbeing of the labor force. I wanted us to pay attention to it. And then we had the COVID-19 pandemic, and we all saw people's health and the economy interact in real time. But thanks to that work, I was still able to learn the more quantitative aspects of economics, which allowed me to get my job at the Central Bank of Trinidad and Tobago.

You were the lead forecaster for economic activity at the Central Bank of Trinidad and Tobago. What did that work entail?

The forecast processing entailed using an existing model and ensuring it worked well. One of the issues we have in the Caribbean is lack of data and lack of credible data sources. We had to get creative and use proxies to fill the gaps in the data. The process allowed me to think ahead to see what measures will affect the economy positively or negatively. Like, are there any exploration efforts by an energy company that can add to our natural gas supply, and how would that affect our economy? These forecasts were then a major input into other areas' planning and budgeting processes for the future year. So, it was a big deal. I had to get it right, or at best be able to justify why I thought this is the forecast.

Why is data harder to come by in Trinidad and Tobago?

We had reliable data from the energy sector, but other sectors, like the agricultural sector and the manufacturing sector, are more decentralized and less regulated. It was those data that were harder to come by.

What led you to immigrate to the U.S.?

I landed my dream job at the Central Bank of Trinidad and Tobago, but then I just felt like I could do a little bit more, and there wasn't much room for advancement at the bank.

What surprised you the most about the U.S.?

Money's a big motivator here and you have to pay for everything. For instance, you rent a U-Haul to move furniture. That's very different from Trinidad where there's always somebody willing to help you.

You've now had two years conducting the Philadelphia Fed's *Nonmanufacturing Business Outlook Survey* and the *South Jersey Business Survey*. How is this work different from the work you did for the Central Bank of Trinidad and Tobago?

I now have direct contact with local businesses. I see how people are dealing with things. I am connected to the community. At the Central Bank of Trinidad and Tobago, I was dealing with the high-level stuff, gross domestic product, and the economic activity index, but not people. Now, I get to be in contact with people and see how things are affecting them. And that's why I became interested in economics in the first place.

Time Use Before, During, and After the Pandemic

Before 2020, we increasingly worked from home, spent time alone, and shared child-care duties. COVID accelerated and reshaped these trends.

Enghin Atalay

Economic Advisor and Economist
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The views expressed in this article are not necessarily those of the Federal Reserve.

A profound transformation is unfolding in how Americans spend their time. Traditional work, family, and societal arrangements–working 9 to 5 in an office, mothers assuming the bulk of child-care responsibilities, meeting with friends and family in person rather than virtually, and so on–are being reshaped and replaced. But exactly how large have these shifts been over the last two decades? Who have they impacted the most? And what are the broader implications of these trends?

To tackle these questions, I examine three major shifts in time use before, during, and after the COVID-19 pandemic. Specifically, I explore trends in the share of work hours spent at home, in time spent alone, and in time engaged in child care. I discuss the existing economic research, and I supplement those findings by analyzing a large nationally representative data set of Americans' time diaries, the American Time Use Survey (ATUS).[1] I have three main findings.

First, working from home was already increasing in the decades leading up to the pandemic. Then, during the first months of 2020, the fraction of work hours that took place at home more

Time Use Before, During, and After the Pandemic
2023 Q4

than doubled. Although that fraction slowly drifted down thereafter, it stabilized at a level much higher than just before the pandemic. Both the beginning-of-sample extent of working from home and its 2003-to-2022 increase were greater for college-educated individuals.

Second, the share of time that people spend alone slowly increased in the decades before the pandemic, shot up in 2020, and then slowly declined to near prepandemic levels. In contrast to trends in working from home, the share of time spent alone increased more for individuals without a college degree.

Finally, between 2003 and 2019, parental responsibilities were becoming more evenly distributed between mothers and fathers, but only for college-educated parents. Beginning with the pandemic, time spent in secondary child care (that is, having children nearby while engaged in some other activity) increased considerably, especially for college-educated parents, and equally for mothers and fathers.

Understanding trends in time use—and how they differ across demographic groups—is critical for ongoing and important debates in economics and finance. The work-from-home (WFH) revolution has reshaped worker productivity and job satisfaction, real estate price trends, local-government budgets, and the geographical distribution of economic activity. Increases in time alone represent a profound challenge for public health. And, finally, the distribution of parental responsibilities is a key determinant of gender equality in the labor market.

Trends in time use depend on several background characteristics, but in this article I focus on education. Recent research argues that "the economy has increasingly come to serve some, but not all Americans…. [A] central division is between those who do and those who do not have a 4-year college degree."[2]

These three trends in time use help us make sense of the growing divide between the educated and the less educated. The opportunity to work from home is uniquely (and recently) available to those with a college degree, and there is a large and growing education gap in the share of adults who are married.[3] Both these disparities are relevant for trends in time spent alone and in time spent parenting.

Trends in Working from Home

Up to the mid-19th century, most Americans worked where they lived (primarily as self-employed farmers). This changed with the rise of industrial factories in the late 19th century and modern offices in the early 20th century.[4] Throughout the 20th century, most Americans spent their work and nonwork hours in two distinct, separate locations. However, these long-running trends have reversed over the past two decades. The boundaries between work and home are slowly disappearing, at least for some workers.

For each year in the ATUS sample, I computed the fraction of work hours that take place at home.[5] I found that the share of work time that takes place at home increased steadily in the years preceding the pandemic, from 6 percent in 2003 to 10 percent in 2019 (Figure 1). But both the initial share and the size of the increase were greater for college-educated workers. For these workers, the share increased from 10 percent to 16 percent. For workers without a college degree, the share increased from just 5 percent to 6 percent.

*See **Data and Measurement.***

At the onset of the pandemic, the share of work hours spent at home dramatically increased as state and local governments restricted in-person activities and individuals avoided exposure to the coronavirus. Working from home peaked in the second quarter of 2020, when 54 percent of work hours were performed at home—74 percent for college-educated workers, 29 percent for everyone else (Figure 2). As the first wave of COVID-19 cases subsided, workers spent fewer work hours at home. By the end of 2020, 29

FIGURE 1

The Share of Work Time That Takes Place at Home Increased Steadily Before the Pandemic

Percent of work hours spent at home, 2003–2019
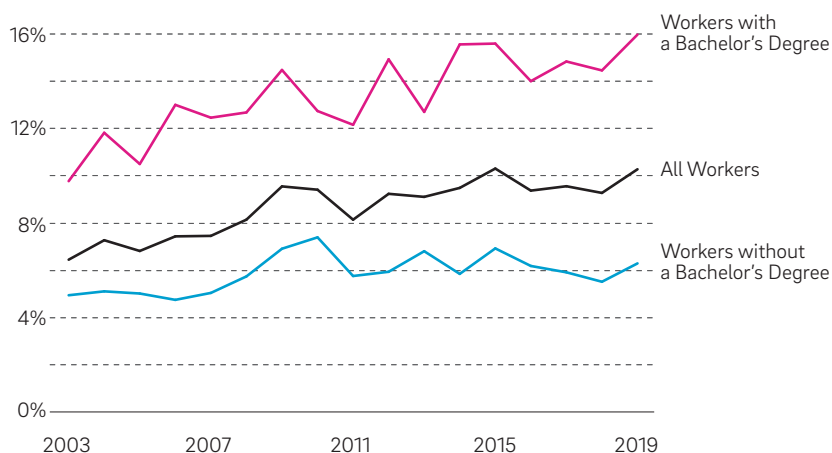
Data Source: American Time Use Survey

Note: The sample includes 75,115 adult ATUS survey respondents who reported at least some time working on the day about which they were surveyed.

percent of work hours were performed at home. This share declined further to 24 percent in the fourth quarter of 2021 and 22 percent in the fourth quarter of 2022. Although these numbers are much lower than during the peak of the pandemic, they're still double their prepandemic level.[6]

Why are workers increasingly working at home? Three factors stand out: First, there is a gradual shift in the types of occupations workers are employed in, away from production activities and toward business services.[7] Second, even accounting for changes in the mix of occupations in which individuals work, advancements in information and communication technologies permit individuals to perform a wider range of tasks from home. Third, workers' and employers' attitudes toward working from home may have changed.

Although technological progress and the economy's occupational mix evolve slowly, attitudes can shift quickly. Faced with temporary health risks associated with COVID-19, workers and firms introduced new work arrange-

ments to facilitate working from home. Initial experiences during the first months of the pandemic improved workers' perceptions of working from home.[8] Workers also gained experience using new communication technologies. And some workers moved further from traditional centers of employment, raising the commuting cost of returning to in-person work arrangements.[9] In sum, the temporary shock of the pandemic

As COVID Hit, Working from Home Dramatically Increased

But even after the crisis subsided, hours worked from home was still double their prepandemic level.

Percent of work hours spent at home, 2020–2022
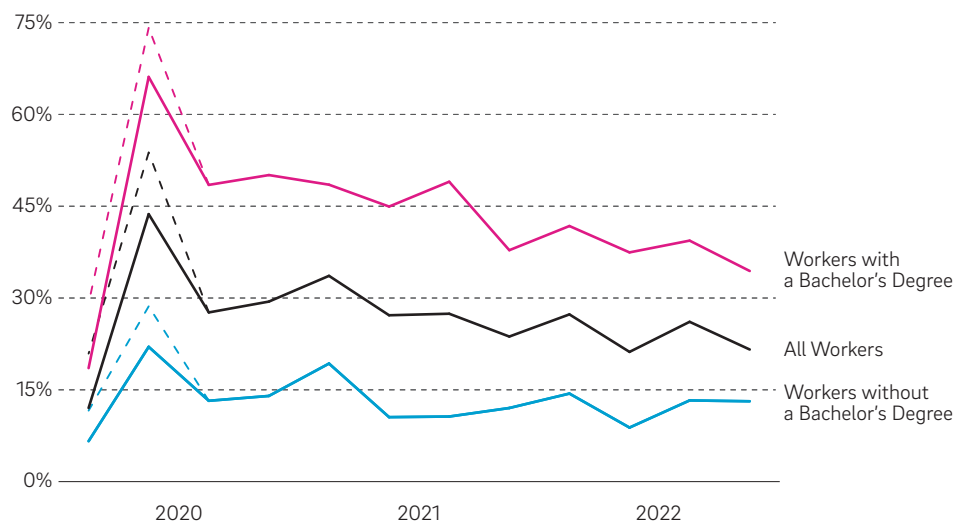
Data Sources: American Time Use Survey and the Google Mobility Trends Database

Note: The sample includes 8,597 adult ATUS survey respondents who reported at least some time working on the day about which they were surveyed. The ATUS survey was not collected between March 18 and May 9, 2020. For 2020Q1 and 2020Q2, the solid lines depict the sample averages for January 1 to March 17, 2020, and May 10 to June 30, 2020, respectively. The dashed lines present quarterly averages, imputing data from March 18 to May 9, 2020. For this period, I apply data from the Google Mobility Trends Database to estimate the share of hours worked from home. These estimates are given by the hollow triangles in Figure A1 of this article's appendix, which can be found at https://www.philadelphiafed.org/the-economy/macroeconomics/time-use-before-during-and-after-the-pandemic#appendix.

likely accelerated the pre-existing trend of increasing time spent working from home.[10]

Whether working from home continues as a trend will matter for labor markets, real estate markets, public finances, and the geography of economic activity. When it comes to the functioning of labor markets, hybrid and fully remote work arrangements improve workers' job satisfaction.[11] The impact on worker productivity, by contrast, is still highly uncertain, with different articles coming to opposing conclusions on whether working from home improves or hinders worker productivity.[12] Finally, shifts to fully remote work arrangements may reduce opportunities for mentoring and hinder career development.[13]

Second, the opportunity to work from home has allowed individuals to move away from the center of large metropolitan areas, and this has dramatically reshaped real estate markets. By one estimate, residential real estate prices increased 30 percent faster (between February 2020 and November 2022) in the exurbs of large metropolitan areas relative to city centers.[14] Another study found significant declines in commercial rents in cities, especially in city centers, and especially in public-transit-oriented cities.[15]

Third, property taxes account for between 20 and 40 percent of a typical municipality's revenue,[16] so the effect of working from home on real estate prices may persistently and substantially affect city budgets.

And, finally, working from home may reshuffle the distribution of economic activity across geographies. In the decades before the pandemic, the largest U.S. cities were hubs of highly educated, high-income individuals working in professional, technical, and managerial occupations.[17] Since 2020, many workers in these professional and technical occupations, now armed with the ability to work remotely, have fled big cities.[18] This may lead to a long-run reduction in income inequality between the largest cities and the rest of the country.

Trends in Alone Time

Americans are increasingly isolated from their communities. The share of Americans reporting having three or fewer close friends nearly doubled–increasing from 27 percent to 49 percent–between 1990 and 2021,[19] and the share of single-person households more than doubled–increasing from 13 percent to 29 percent–between 1960 and 2022.[20] In his influential 2000 book, *Bowling Alone*, political scientist Robert D. Putnam chronicled Americans' declining tendency to form connections either formally (for example, through civic, religious, or volunteer organizations) or informally (for example, by visiting friends' homes).

There is an additional measure of social isolation: the share of time that Americans spend alone (Figure 3). ATUS participants describe who they were with for most activities within their time diary.[21] For activities eligible for measurement, I computed the share of this time that respondents spent alone.

In 2003, Americans spent approximately 42 percent of their time eligible for measurement (4 hours 47 minutes out of a total 11 hours 16 minutes of time eligible for measurement) alone. In 2003, the share of alone time was similar across different educational groups, but between 2003 and 2019, alone time increased much faster for people without a college degree: by 7 percentage points, compared to less than 3 percentage points for those with a college degree and 5 percentage points for the entire population.

Alone time spiked in 2020, peaking in the fourth quarter, which coincided with the pandemic's second wave (Figure 4). During this quarter, Americans spent

FIGURE 3

Alone Time Has Increased Considerably Since 2003

And these increases were much greater for people without a college degree.
The share of eligible time when the survey respondent was alone, 2003–2019
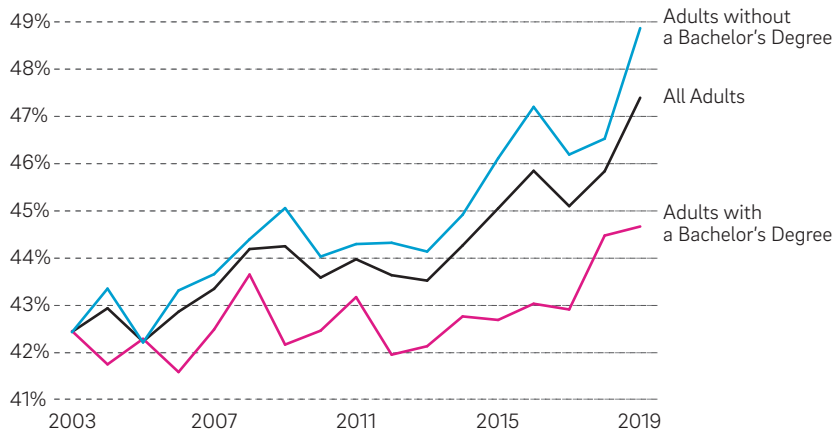
Data Source: American Time Use Survey

Note: Eligible time includes all activities except for work; sleep; washing, dressing, or grooming oneself; and other private/personal activities. The sample includes 201,834 adult ATUS survey respondents who reported at least some time in eligible activities

FIGURE 4

Alone Time Peaked in the Fourth Quarter of 2020, Coinciding with the Pandemic's Second Wave

By the end of 2022, time alone for most adults had stabilized marginally higher than directly before the pandemic.
The share of eligible time when the survey respondent was alone, 2020–2022

Data Sources: American Time Use Survey and the Google Mobility Trends Database

Note: Eligible time includes all activities except for work; sleep; washing, dressing, or grooming oneself; and other private/personal activities. The sample includes 25,357 adult ATUS survey respondents who report at least some time in eligible activi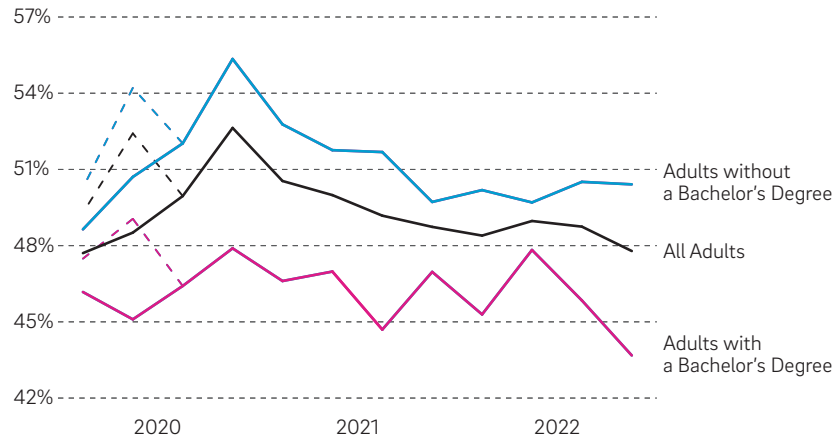ties. The dashed lines present quarterly averages, imputing data from March 18 to May 9, 2020. For this period, I apply data from the Google Mobility Trends Database to estimate the share of eligible time that is spent alone. These estimates are given by the hollow triangles in Figure A2 of this article's appendix, which can be found at https://www.philadelphiafed.org/the-economy/macroeconomics/time-use-before-during-and-after-the-pandemic#appendix.

roughly 53 percent of their time alone. This was 5 percentage points–35 minutes per day–higher than in 2019. This increase had mostly reversed by the end of 2021. By the end of 2022, time alone had stabilized at 48 percent–1 percentage point higher than before the pandemic.[22]

These trends may reflect a shift in the composition of the American population. Older people spend more of their time alone, as do unmarried people. Changes in the shares of Americans who are older or unmarried explain about one-third of the overall increase in alone time.[23]

But even accounting for changes in composition, Americans are spending considerably more time alone than ever before. In a recent paper, I explore some of the reasons behind and implications of this increasing trend toward solitude.[24] Americans are spending significantly less time out of the house and with people from households other than their own. (Time spent with people from one's own household has been constant since 2003.) Part of the increase in time alone can also be explained by virtual socialization: playing video games online and, to a lesser extent, engaging with social media.[25] In addition, Americans are spending significantly more time watching television, and a greater share of their TV time is spent alone.[26]

For some people and in some contexts, spending a greater share of time alone may improve well-being. Certain relationships–an unhappy or abusive romantic relationship, for example–can be harmful for one's emotional and physical well-being. A less-extreme example: Some people find mundane social situations a source of anxiety and stress.

However, on average, greater time alone is associated with a decrease in emotional well-being and life satisfaction. The 2010, 2012, and 2013 editions of the ATUS asked about how respondents felt–how happy, sad, stressed, in pain, or tired–during three randomly chosen activities within their time diary as well as their overall life satisfaction. On average, survey respondents who spent a greater share of their time alone reported lower life satisfaction. And activities that are performed alone were rated as less enjoyable.

Consistent with these patterns from the ATUS, in May of this year the U.S. Surgeon General warned, "Across many measures, Americans appear to be becoming less socially connected over time."[27] Summarizing research from epidemiology, public health, and psychology, the Surgeon General suggested that social isolation may increase the risk of cognitive decline in older adults,[28] depression,[29] and heart disease and stroke.[30] All in all, increases in time spent alone likely represent a deterioration in individuals' living standards and an intensifying public health risk.

FIGURE 5

From 2004 to 2019, Primary Child-Care Time Was More Evenly Distributed Between Mothers and Fathers

Since 2019, time in secondary child care has shot up, especially for college-educated parents.

(Top) Hours per week spent in primary child care, mothers and fathers, by education level, 2004–2022

(Bottom) Hours per week spent in secondary child care, mothers and fathers, by education level, 2004–2022

Data Source: American Time Use Survey

Note: Figure 5 (top) presents the average number of hours per week that parents spent in primary child care: caring for and helping household children; activities related to household children's education; activities related to household children's health; and travel related to children's care, education, or health. Figure 5 (bottom) presents the average number of hours per week that parents spent in secondary child care. Secondary child care includes time with one's own children (under the age of 13), excluding primary child care activities. The sample includes 74,309 parents—30,802 fathers and 43,507 mothers—who were surveyed as part of the ATUS between 2004 and 2022 and who had at least one child under 18 years old in their household.

Trends in Child-Care Time

As the 20th century drew to a close, parents–and especially fathers–were spending more time caring for children. The amount of time men spent in child care more than doubled between 1965 and 2003, from 1.4 to 3.2 hours per week. For women, child care increased by about 30 percent, from 5.6 to 7.5 hours per week.[31] Among all parents, increases in child-care time were larger for parents with more education.[32]

How have things changed since 2003? To answer this question, I consider two separate categories of child care. First, primary child care encompasses time parents are actively engaged in child care: caring for and helping household children; activities related to household children's education; activities related to household children's health; and travel related to children's care, education, or health.
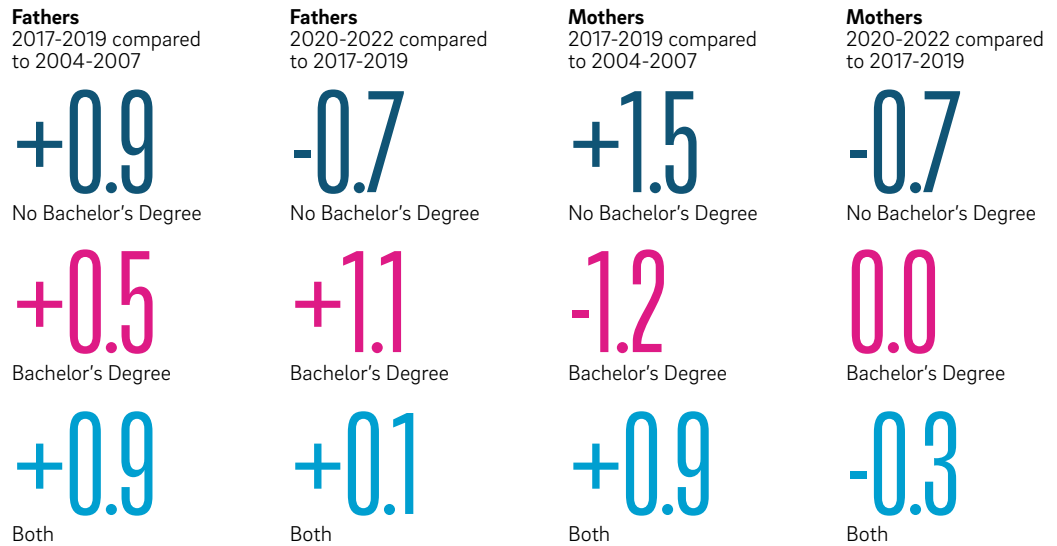
From 2004 to the pandemic, time spent in primary child care increased by nearly one hour per week: from 6.7 to 7.6 hours for fathers and 13.5 to 14.4 for mothers (top half of Figure 5).[33] During the pandemic, there was little overall change in how much time mothers and fathers spent on primary child care.

However, there are important differences across parents' educational backgrounds. Among parents with a college degree, the gap in child-care responsibilities narrowed considerably from 2004 to 2019: Mothers spent 1.2 fewer hours per week in primary child care (a decline from 16.5 to 15.3 hours per week), whereas fathers spent 0.5 hour per week more. As a result, the gap between college-educated mothers and fathers closed by

FIGURE 6

Parents Without a College Degree Spent Less Time in Primary Child Care During COVID, a Reversal of Pre-COVID Trends

Change in number of hours per week spent in primary child care, fathers and mothers, with and without a degree, from average for 2004-2007 to average for 2017-2019, and from average for 2017-2019 to average for 2020-2022.

Fathers 2017-2019 compared to 2004-2007	**Fathers** 2020-2022 compared to 2017-2019	**Mothers** 2017-2019 compared to 2004-2007	**Mothers** 2020-2022 compared to 2017-2019
+0.9 No Bachelor's Degree	**-0.7** No Bachelor's Degree	**+1.5** No Bachelor's Degree	**-0.7** No Bachelor's Degree
+0.5 Bachelor's Degree	**+1.1** Bachelor's Degree	**-1.2** Bachelor's Degree	**0.0** Bachelor's Degree
+0.9 Both	**+0.1** Both	**+0.9** Both	**-0.3** Both

Data Source: American Time Use Survey

FIGURE 7

Parents with a College Degree Spent Many More Hours in Secondary Child Care During COVID, a Reversal of Pre-COVID Trends

Change in number of hours per week spent in secondary child care, fathers and mothers, with and without a degree, from average for 2004-2007 to average for 2017-2019, and from average for 2017-2019 to average for 2020-2022.
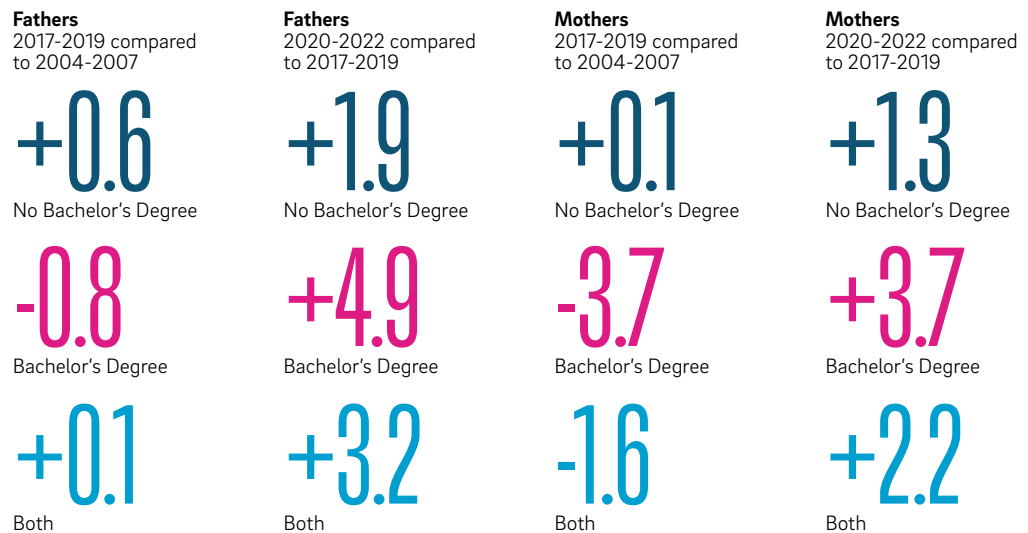
Fathers 2017-2019 compared to 2004-2007	**Fathers** 2020-2022 compared to 2017-2019	**Mothers** 2017-2019 compared to 2004-2007	**Mothers** 2020-2022 compared to 2017-2019
+0.6 No Bachelor's Degree	**+1.9** No Bachelor's Degree	**+0.1** No Bachelor's Degree	**+1.3** No Bachelor's Degree
-0.8 Bachelor's Degree	**+4.9** Bachelor's Degree	**-3.7** Bachelor's Degree	**+3.7** Bachelor's Degree
+0.1 Both	**+3.2** Both	**-1.6** Both	**+2.2** Both

Data Source: American Time Use Survey

about 1.6 hours per week (nearly 20 percent of the beginning-of-the-sample gap). In contrast, time spent with children increased for both fathers and mothers without a college degree, but the gap in responsibilities did not shrink.

Secondary child care includes time spent in activities other than primary child care but with one's own child (under the age of 13) in the parent's presence. This alternate set of activities includes, for example, a parent working from home but with their child nearby (bottom half of Figure 5).

Three results stand out: First, parents spend substantially more time engaged in secondary than primary child care. As of 2004, parents spent roughly 32 hours per week–25 hours for fathers, 38 for mothers–in secondary child care, compared to 10 hours per week on primary child care. Second, in the years leading up to the pandemic, the gap between mothers and fathers shrank. Finally, during and after the pandemic, time with children shot up, especially for college-educated parents, who spent an additional 4.3 hours per week in secondary child care in 2020-2022 relative to 2017-2019. The increase for parents without a college degree was only 1.4 hours per week.

Two factors explain this large increase. First, especially during the first year and a half of the pandemic, the closure of schools and child-care centers increased demands on parents' time.[34] Second, the availability of WFH arrangements allowed parents to work while supervising their children.[35] College-educated workers are more likely to have jobs that can be done from home, and it is largely for this reason that the time they spent in secondary child care increased especially quickly during the pandemic.

To the extent that child-care responsibilities are shared more evenly over time, gaps between men's and women's experiences in the job market may also narrow.[36] The unequal distribution of child-care responsibilities between mothers and fathers is a key factor behind the "motherhood penalty": The earnings of mothers, but not fathers, fall around the birth of their first child, with little recovery over time. A recent article estimates that the motherhood penalty is as high as 30 percent and concludes that most of the inequality between men's and women's labor market experiences can be traced to differing child-care responsibilities.[37]

Conclusion

Over the last 20 years, we have changed how we spend our time. We spend more hours working from home. We are more often alone. And we share parenting responsibilities (slightly) more equitably. The COVID-19 pandemic accelerated trends in where we work and how much time we spend with other people. It also led to an increase in the amount of time we spend supervising our children while working. These trends differ according to education: College graduates had larger increases in working from home, smaller increases in time spent alone, and an increasingly equal division of child-care responsibilities between mothers and fathers.

Time may be our most precious resource. How we allocate our time–whether at home or in the office; alone or with others; in leisure activities, caring for our children, or working for our employer–shapes our life satisfaction, gender differences in the labor market, the state of city centers, macroeconomic productivity, and countless other economic phenomena. We need to pay close attention to changes in how we spend our time if we are to address issues of pervasive inequality, vulnerable city finances, and increasing social isolation. And by accelerating so many of these time-use changes, COVID-19 has presented us with a unique opportunity to think critically about how we want to spend our time. ▣

Data and Measurement

This article draws on two main data sources: the ATUS and the Google Mobility Trends database.

The ATUS has been conducted by the Bureau of Labor Statistics (BLS) since 2003.[38] Roughly 10,000 adults participate each year. Survey participants are asked to provide a detailed time diary of the previous day. For this 24-hour period, they describe, minute by minute, the activities they were pursuing, whom (if anyone) they were with, and where they were. In addition, the ATUS contains rich detail on the demographics of the survey respondents: their location; their race and ethnicity; their level of education; the number of children and other adults in their household; and a variety of other measures.

However, the BLS was unable to retrieve ATUS time diaries between March 18 and May 9, 2020. Lack of data from this eight-week period is problematic, as working from home and social isolation likely spiked during this initial stage of the pandemic. If I were to omit the weeks during which data were missing, I might understate the increase of working from home and time alone during the first half of 2020. In this article's Appendix, which can be found at https://www.philadelphiafed.org/the-economy/macroeconomics/time-use-before-during-and-after-the-pandemic#appendix, I discuss how I used the Google Mobility Trends Database to fill in this missing data.

Notes

1 Although this article focuses on the U.S., time use patterns in other developed economies are broadly like those here. As in the U.S., in other countries the prevalence and attractiveness of remote work increased in the first years of the pandemic (Aksoy et al., 2022). Also as in the U.S., mothers spend significantly more time on child care than fathers; the gap in child-care responsibilities between mothers and fathers has been shrinking over time; and highly educated parents spend relatively more time on child care compared to less educated parents (Dotti Sani and Treas, 2016). Although there are differences between the U.S. and other countries, too—for example, some evidence suggests that the postpandemic "return to the office" movement is stronger in other countries—many of this article's conclusions likely pertain more broadly.

2 The quote is from Case and Deaton (2022), p. 2. Valletta (2018) and Autor, Dube, and McGrew (2023) document that the gap in incomes between workers with a college degree and those without has stayed relatively constant since 2003. But money isn't everything. Case and Deaton (2022) argue that less educated individuals are at a higher risk from "deaths of despair": accidental drug overdoses, alcoholic liver disease, and suicide.

3 According to the American Community Survey, 69 percent of people aged 25–64 with a college degree were married in 2003. For those without a college degree, the share who were married was 6 percentage points lower, at 63 percent. By 2021, this gap had doubled to 12 percentage points.

4 See Davies and Frink (2014).

5 In this calculation, "home" refers to the survey respondent's own home but not someone else's home. (The results would not be much different if we included time spent in others' homes.) Work activities include those beginning with "0501," using the code list published at https://www.atusdata.org/atus-action/variables/activity#codes_section.

6 Other researchers and surveys find similar results. For instance, the Survey of Working Arrangements and Attitudes (SWAA) collects a wide variety of measures relating to working from home. The fraction of workdays spent at home fell from 61 percent to 29 percent between the SWAA's first edition in May 2020 and the end-of-2022 edition. For more on the SWAA, see Barrero, Bloom, and Davis (2023).

7 Approximately one-tenth of the overall change in working from home is due to the shift in occupations over time. To arrive at this result, I estimate a regression with individuals' WFH shares as the dependent variable, and year fixed effects and detailed-occupation fixed effects as the explanatory variables. This regression suggests that—holding fixed the composition of occupations—WFH shares would have risen by 16.0 percentage points between 2003 and 2022. This is 90 percent of the observed 17.6 percentage point increase in WFH shares over this period.

8 As reported by Barrero, Bloom, and Davis (2023).

9 See Ramani and Bloom (2022).

10 This finding is consistent with the analysis of Bick, Blandin, and Mertens (2022).

11 See Bloom, Han, and Liang (2022).

12 Bloom, Liang, Roberts, and Ying (2015) study the introduction of working from home in the call center of a Chinese travel agency, finding that it led to an increase in productivity. However, more recent research has documented productivity declines in firms adopting remote-only work arrangements. See Emanuel and Harrington (2023).

13 See Bloom, Han, and Liang (2022).

14 See Ramani and Bloom (2022).

15 See Rosenthal, Strange, and Urrego (2022).

16 See Van Nieuwerburgh (2023).

17 See Autor (2019).

18 See Althoff, Eckert, Ganapati, and Walsh (2022).

19 See Cox (2021).

20 See U.S. Census Bureau (2022).

21 Participants were not asked who they were with while sleeping; washing, dressing, or grooming themself; or during other private and personal activities. Only beginning in 2010 were participants asked who they were with while working.

22 Frazis (2023) finds that time spent alone while working increased considerably during the initial year of the pandemic, primarily for college-educated workers. The increase in time spent alone while working reflects an increase in working from home as well as an increase in working alone while at

one's workplace. When pursuing nonwork activities, survey respondents report lower emotional well-being while alone than when with others. This is not the case with work activities. This distinction between work activities and other eligible activities is a second reason, in addition to the lack of data before 2010, why I exclude work activities when computing trends in alone time.

23 Compared to those who are married and younger than 50, the alone time share is 17 percentage points higher for those who are unmarried and younger than 50, 11 percentage points higher for those who are married and 50 years or older, and 39 percentage points higher for those who are unmarried and 50 or older. In a regression-based exercise, I estimate how much alone time would have increased between 2003 and 2022 if the fractions of adults who are young and/or married were the same as in 2003. Instead of increasing by 6.2 percentage points, as we observed, the share of alone time would have increased by 4.0 percentage points. Thus, shifts in marital status and age explain roughly one-third (≈ 2.2/6.2) of the change in alone time shares.

24 See Atalay (2023).

25 The ATUS defines aloneness based on whether one is in the physical presence of another person that the survey respondent knows. So, one can chat via social media or play video games online with friends while still being classified as alone. Whether these activities should be counted as alone time is a hotly debated topic. Although digital interactions provide social support in certain contexts, the predominant view is less sanguine, with depression and loneliness linked to greater social media use. See, for example, Lin et al. (2016) and Twenge, Spitzberg, and Campbell (2019). Moreover, according to the emotional well-being questions described in this article, for computer, e-mail, or gaming (which includes online gaming) activities, ATUS respondents reported being happier if they were in the physical presence of others. So, physical presence matters in and of itself when one is engaged in digital activities.

26 In 2003, Americans spent 1 hour 12 minutes per day alone watching TV, and 8 minutes per day alone pursuing virtual activities (on e-mail, on one's phone, and playing games). By 2022, these numbers increased to, respectively, 1 hour 26 minutes and 19 minutes.

27 Office of the U.S. Surgeon General (2023), p. 12.

28 See Lazzari and Rabottini (2021).

29 See Mann et al. (2022).

30 See Valtorta et al. (2016).

31 See Aguiar and Hurst (2007), who compared time-use diaries from the 1960s to the early 2000s.

32 See Ramey and Ramey (2010).

33 The sample in Figure 5 includes both married and unmarried parents. Nearly 90 percent of parents with a bachelor's degree and 72 percent of parents without a bachelor's are married. The changes depicted in Figure 5 would look similar if one were to focus solely on married parents.

34 During the initial stage of the pandemic, in the final months of the 2019–2020 school year, nearly "90 percent of US school-age children were in school only remotely and most child-care facilities were shuttered" (Goldin, 2022, p. 84; see also Andrew et al., 2020). Simultaneously, in a sample of school districts studied by Jack, Halloran, Okun, and Oster (2023), 35.4 percent of school days were in-person; 41.2 percent were hybrid, where schooling was in-person for only part of the school week; and 20.9 percent were online only. And school closures led parents to increase the amount of time they were working while also engaged in secondary child care (Atalay, Kobler, and Michaels, forthcoming).

35 Per Pabilonia and Vernon (2023), who used the ATUS to compare days when parents are working from home with days when they are not.

36 Measuring parents' time spent in child care should also be relevant for understanding children's development and well-being. But when they summarized the literature as of 2008, Guryan, Hurst, and Kearney found that "the empirical evidence on the relationship between parental time investment and children's outcomes is only moderately convincing" (2008), p. 38.

37 See Kleven et al. (2019).

38 See Hofferth, Flood, and Sobek (2020).

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Measuring the Effects of a Carbon Tax

Climate change poses risks to our economy, but so does the government's response to climate change.

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Climate change poses risks for households and businesses. The physical risks of climate change include, for example, damage caused by floods and wildfires. Less known are transition risks driven by how firms, households, and governments respond to climate change. Central banks in particular are interested in understanding how these transition risks will affect the economy and possibly the financial sector, including how it will affect small banks.

In this article, we quantify how one such transition risk, the enactment of a carbon tax, would affect firms, regional economies, and small banks in the U.S. Specifically, we study a permanent carbon tax of \$100 per metric ton of greenhouse gas emissions (measured in CO_2-equivalent units). This tax rate is similar to the tax rates in Sweden (\$130) and Switzerland (\$125) but is on the low end of the estimates of the tax needed to limit a rise in the global temperature to 2 degrees Celsius.

We find that the effects of a carbon tax are heavily concentrated in a few sectors. Even though we follow emissions down the production chain all the way to the final-demand sector, indus-

tries that generate a large fraction of emissions at the source are still among the most affected. The effects are also highly concentrated in a few regions. The regional effects depend on how much the affected industries dominate the local economy, but the effects are more widespread when low-emitting firms can't easily substitute away from inputs that rise in price because of the carbon tax. A carbon tax would also burden community banks operating in counties with a large share of high-emitting industries.

Our findings provide a framework for assessing the impact of a carbon tax on the corporate sector, the regions where they operate, and small banks in those regions.

How a Carbon Tax Affects Firms' Profits

What does a $100 carbon tax mean for an individual firm's bottom line? We don't know how much carbon any one firm emits, but we do know how much each industry emits, so we use the industry-level emissions to derive emissions for the representative firm in the industry. This allows us to calculate the size of a representative firm's tax bill, industry by industry.

We assume that each firm passes the cost of the tax onto its customers. And because a firm can also be a customer, we must consider the amount of emitted carbon produced by each firm that provides inputs to any one firm. With all this information, we can calculate the carbon tax's effect on each firm's future profits.

With this information, we can finally quantify the transition risk posed by a carbon tax.[1] We discount the stream of a firm's future expected profits to calculate the firm's decline in market value due to the carbon tax. By doing so, we incorporate the risk that the firm may default and fail.[2]

Current estimates suggest that we need a $100 carbon tax to achieve the proposals agreed to in the 2015 Paris Agreement, so for this article we ask, what would happen if the U.S. government imposed a permanent $100 carbon tax (per metric ton of greenhouse gas emissions measured in CO_2-equivalent units)?[3] We assume that a firm's asset value will adjust immediately after the announcement of the tax, because informed investors will understand the likely impact of the carbon tax on firm profits–and thus the firm's stock price should fall to reflect their changed expectations.

However, a firm may also lose value if consumers avoid products with a large carbon footprint, if new technologies further lower the cost of green energy, and if other firms along the production chain default as a result of the carbon tax. With some adjustments, our methodology could capture the effect of these other factors, too.

Using Industry Linkages to Estimate Emissions and Firm-Value Losses

An economy is not just a collection of firms producing final goods for consumers. Many products are inputs for other firms. Therefore, the effect of the carbon tax on firm profits depends on the level of carbon emissions from firms in a particular industry. That's why we use an input-output model to account for interactions between firms that produce final goods and firms that produce inputs for other firms.

More specifically, our estimates of industry-level carbon use combine data on emissions at the source with an input-output table to account for the price effects down the production chain all the way to the final-demand sector.[4]

The input-output table helps us measure who ultimately pays

Production Model and Emission Estimates

We use information from EXIOBASE, a multiregionally extended input-output table, to estimate emissions in the U.S. at the level of the three-digit National American Industry Classification System (NAICS) code. With its data on input-output transactions, labor inputs, energy supply and use, greenhouse gas (GHG) emissions, material extraction, land and water use, and emissions to air, water, and soil, EXIOBASE provides comprehensive up-to-date coverage of the global economy. EXIOBASE defines the GHG footprint of a particular country/product or final-demand sector as the total emissions of GHGs in kilograms of CO_2 equivalents (tCO_2-eq). EXIOBASE includes GHGs such as CO_2, CH_4, and N_2O, and it calculates each GHG's global warming potential (GWP).[11]

By using the input-output table to follow emissions along the entire production chain, from the source industry all the way to the final-demand sector, we capture the life cycle or "footprint" of emissions. This measure captures emissions associated with the production stage (that is, emissions that occur in the supply chain and are embodied in inputs from other sectors) and allocate them according to final demand. The measure also incorporates imports and exports of goods

and services, so the total emissions when production linkages are incorporated do not necessarily equal the sum of emissions at the source. We assume that input suppliers along the production chain will increase their price by the full amount of the tax. In this case, a sector that is a heavy user of an input produced with a high-emission technology bears a relatively large share of the tax.

Recently, economists have developed general equilibrium models, paying particular attention to sectoral heterogeneity and how shocks propagate through production chains. These models are important for understanding the amplification and propagation of shocks via input-output connections while taking seriously sectoral elasticities of the substitution of intermediate inputs.[12] An important insight from the literature on production economies is that local economic shocks and shocks to individual industrial sectors can have significant aggregate effects when elasticities of substitution for intermediate outputs are low. Our framework (via the emission estimates) captures input-output linkages, but it is not as flexible as these models, in which it is possible to evaluate arbitrary elasticities of substitution and returns to scale.

for the tax only if we assume that demand for an emission-producing firm's product is perfectly inelastic–that is, we assume that consumers cannot find a substitute for the firm's product and can't minimize the use of this product, so they end up paying the full cost of the carbon tax. Of course, the real-world economy rarely works so simply. In the real world, firms and consumers eventually substitute away from goods that rise in price.[5] But our model helps us unpack how the carbon tax works its way through the economy.

In summary, when we measure the exposure of firm revenues to the carbon tax, we account for both the rise in price that the firm charges customers and the rise in price that the firm pays to the suppliers of its inputs.

The market value losses we estimate are significant for some of the industries that account for a nonnegligible share of emissions (Figure 1). We find that even though our estimates consider industry linkages, several industries that account for a large fraction of emissions at the source are still at the top of our estimates. For example, we estimate that utility firms would see their value decline by 34.1 percent. Utilities account for about 43.2 percent of emissions at the source but only 19.4 percent of emissions when industry linkages are considered.[6]

High-Emission Industries Would See the Biggest Drop in Market Value Due to a Carbon Tax

Top 10 industries by industry losses

- Air Transport
- Apparel Mfg.
- Food Mfg.
- Gas Stations
- Petroleum/Coal Products Mfg.
- Pipeline Transport
- Printing/Related Support
- Specialty Trade Contractors
- Textile Product Mills
- Utilities

Share of Total Emissions / Market Value Losses
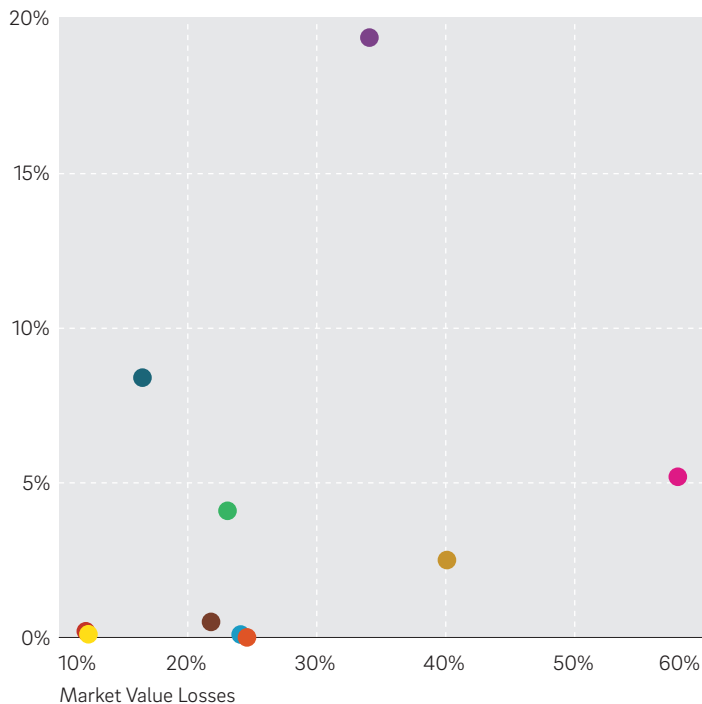
Data Sources: EXIOBASE, S&P Global Market Intelligence Compustat Data, and authors' calculations

Note: "Market Value Losses" correspond to our estimate of losses due to a $100 carbon tax. "Share of Total Emissions" refers to the fraction of total emissions accounted for by each industry. Compustat data copyright © 2021, S&P Global Market Intelligence (and its affiliates, as applicable). Obtained via Wharton Research Data Services (WRDS). No further distribution and or reproduction permitted.

How a Carbon Tax Affects the Rest of the Economy

To evaluate the effect of a carbon tax, we must consider regional differences in the economy (Figure 2). Regions heavily reliant on high-emission industries, such as manufacturing and fossil fuel extraction, would likely face increased costs, leading to shifts in employment and economic activity. For example, a county in the Texas oil patch is more likely to be heavily affected than a state capital and university town like Austin, TX.

To measure the transition risk at the regional level, we calculate how much the carbon tax would affect the value of all firms operating in each county, and we weight industry losses by the share of each industry's employment in each county.[7] Specifically, we calculate the effect of the carbon tax on the value of a hypothetical firm that has the same employment composition as the county it is in. This approach does not capture the migration of firms or workers across regions after the implementation of the tax. Nor does it consider local policies that encourage firms to shift toward new technologies, or national policies that mitigate the impact of a carbon tax. However, our approach is a good approximation of how a national carbon tax would affect the economy if stock prices respond quickly and correctly to news about the policy, and if it takes time for workers to relocate to different industries or regions and for firms to adjust their production processes.

In the real world, reduced profits would lead to further effects, such as declines in employment and the value of commercial real estate in regions where emitting firms have a large presence. We abstract from these considerations. Nonetheless, the methodology could be extended to evaluate how this tax would affect a county's employment, real estate prices, and other variables.

We find that, across counties, firms would lose on average 4.3 percent of their value (the median loss is 4.0 percent), but there is significant dispersion, with values in some counties dropping by more than 10 percent (Figure 3). The most impacted counties tend to be highly exposed to the most affected industries. Many of these counties host sizable employment at gasoline stations, in utilities, as specialty trade contractors, and in food manufacturing. Even though these estimates consider production linkag-

16   Federal Reserve Bank of Philadelphia
Research Department   Measuring the Effects of a Carbon Tax
2023 Q4

Regional Estimates

To estimate the regional impact of the carbon tax, we use the distribution of employment across counties at the three-digit NAICS level provided by the U.S. Bureau of Labor Statistics (BLS). We use the fraction of employees in a county that work for an industry as a proxy for that county's exposure to that industry. Then, we estimate the county-level exposure to the carbon tax by combining the county's industrial exposure with our estimates for industry-level value losses.

As we consider linkages across industries, we find that losses are broad in terms of geographical coverage: In about 91 percent of counties, the representative firm experiences a market value loss larger than 2 percent.[13] About 25 percent of those counties experience a loss larger than 5 percent.

FIGURE 2

A Carbon Tax Causes Losses Across the U.S.
The impact of a $100 carbon tax on a representative firm in each county
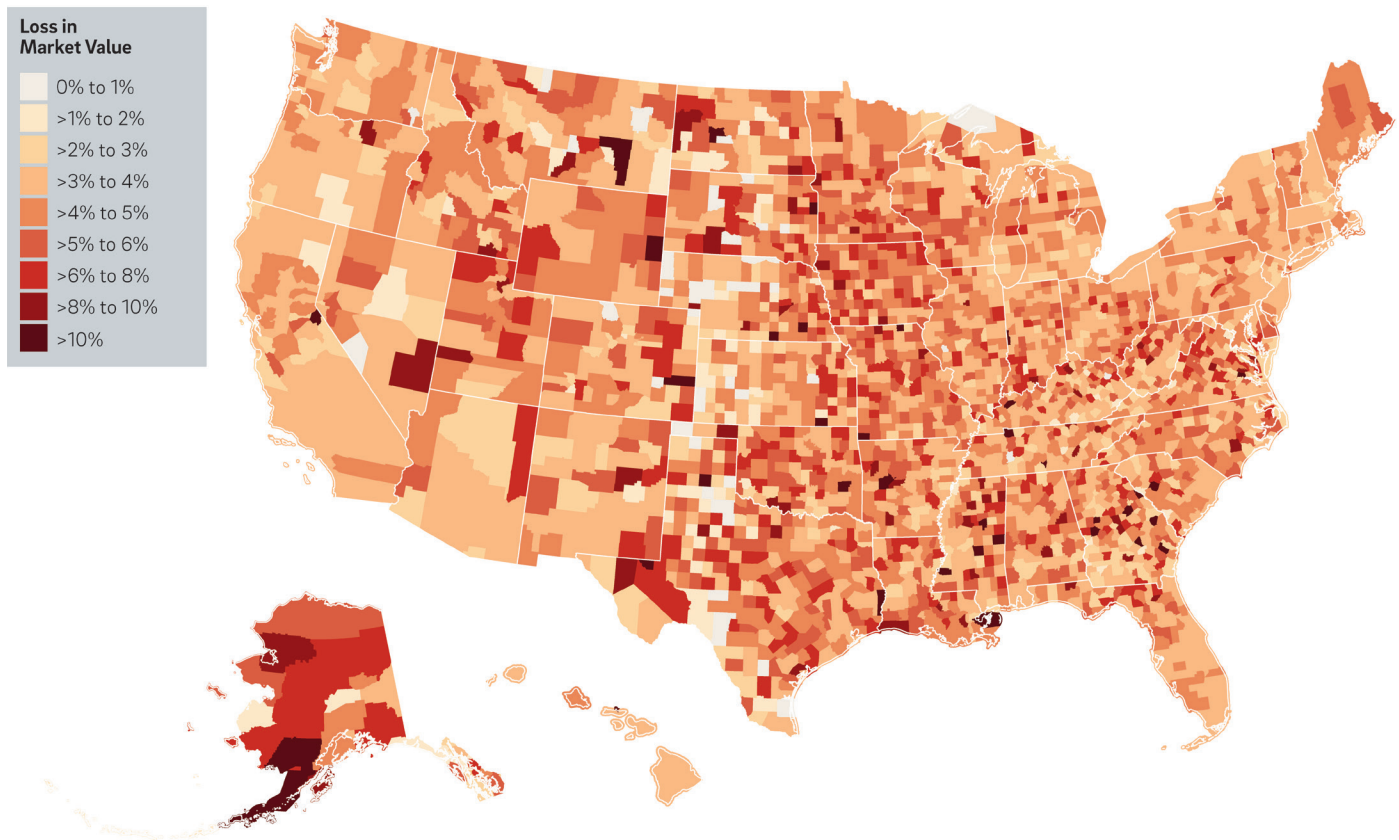
Loss in Market Value
- 0% to 1%
- >1% to 2%
- >2% to 3%
- >3% to 4%
- >4% to 5%
- >5% to 6%
- >6% to 8%
- >8% to 10%
- >10%

Data Sources: EXIOBASE, S&P Global Market Intelligence Compustat Data, U.S. Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW), and authors' calculations

Note: A representative firm has the same employment composition as the county that it is in. Compustat data copyright © 2021, S&P Global Market Intelligence (and its affiliates, as applicable). Obtained via Wharton Research Data Services (WRDS). No further distribution and or reproduction permitted.

es, most of the most-affected counties are relatively small, and all of them are below the median level of employment of 6,595.

How a Carbon Tax Affects Community Banks

In the U.S., community banks typically operate in one or just a few counties, so an oil patch community bank would be affected in ways that an Austin bank wouldn't be.[8] Although a community bank with branches spanning Texas might have a more diverse

investment portfolio, enabling it to navigate a carbon tax more effectively, we anticipate a strong correlation between the regional economic impact of the carbon tax and the performance of smaller banks predominantly rooted in a specific area.

We use each bank's geographical footprint to capture the effect that the decline in the regional economy would have on that bank's portfolio. Because we want to focus on local assets, we
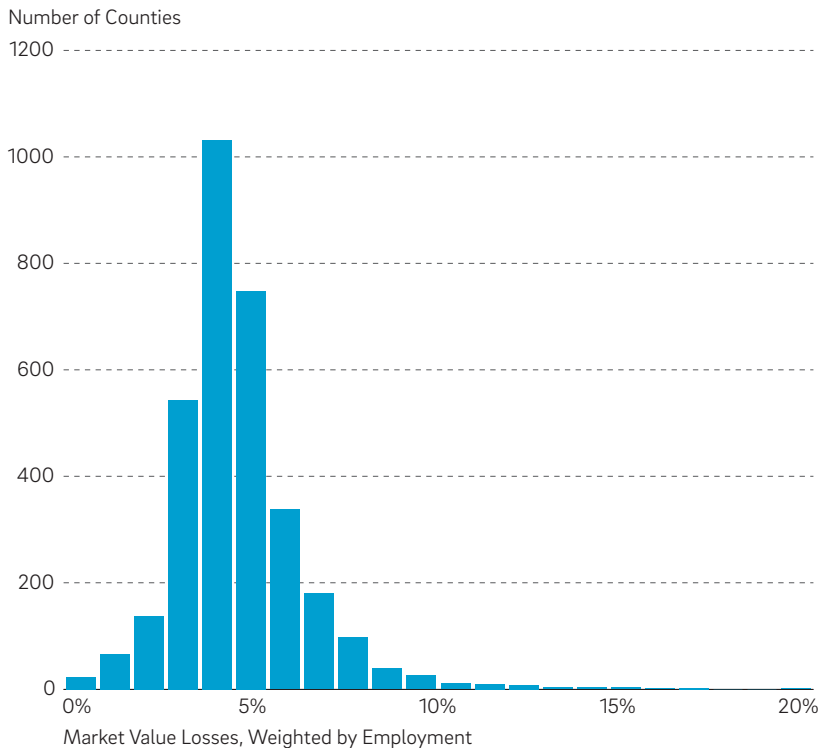
FIGURE 3

Across Counties, Firms Lose on Average 4.3 Percent of Their Value Due to a Carbon Tax

But there is significant dispersion.

Number of counties by market value losses (weighted by employment) due to a carbon tax

Number of Counties

Market Value Losses, Weighted by Employment

Data Sources: EXIOBASE, S&P Global Market Intelligence Compustat Data, U.S. Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW), and authors' calculations

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scale the shock to each bank by its loan-to-asset ratio. This exercise is not a climate stress test but rather a rough measure of how the shock to the regional economy might affect different small banks.

To capture how a carbon tax affects community banks, we first use the location of bank branches to identify where each bank operates. We then weight the changes to the value of firms in a county by the share of the bank's deposits in that county. We use deposits to weight these market value losses at the county level because there is no comprehensive data to capture the regional coverage of the loan portfolio of small banks. We conclude by summing firm-value losses in all the counties in which each bank operates.[9]

To better understand this process, imagine that each county is a mutual fund comprising firms with operations in that county. We use the number of a firm's employees in the county to weight the firm's presence in this imaginary mutual fund portfolio. In turn, each bank owns shares in all the mutual funds (that is, counties) in which it operates. The carbon tax affects the value of all the firms in each mutual fund, and we measure the losses relative to the size of the bank's loan portfolio.[10]

*See **Estimating the Effects of Transition Risk on Small Banks***

We find that the impact of a $100 carbon tax on banks' portfolio losses accounts for about 2.5 percent of community bank assets, on average. That is, when we use the loan-to-asset ratio to scale the regional losses to which banks are exposed, a community bank experiences only a moderate loss.

Conclusion

For this article, we quantify the effects of one climate transition risk–a carbon tax–at the industry and regional levels. We then assess how a carbon tax would affect community banks in the U.S.

Initially, a carbon tax would fall more heavily on high-emission industries, but these industries might transmit some of these costs to final demand via production chains. To estimate the shock to each firm's value, we consider the linkages across industries and how emissions are transmitted from the source to final demand.

By leveraging these firm value shocks and considering the industry distribution of employment across geographical locations, we estimate the regional (county-level) consequences of a carbon tax. We find that, across counties, a $100 carbon tax leads to an average decline in firm value of 4.5 percent.

The county-level estimates of the shock to firm value allows us to estimate the potential effect of the tax on bank portfolios. We estimate that a $100 carbon tax results in losses to firm value that represent on average 2.5 percent of community bank assets. ▣

18   Federal Reserve Bank of Philadelphia
Research Department   Measuring the Effects of a Carbon Tax
2023 Q4

Estimating the Effects of Transition Risk on Small Banks

To proxy for a bank's lending footprint, we use data on a bank's branch deposits, which we obtained from the Federal Deposit Insurance Corporation's (FDIC's) Summary of Deposits as of June 2019. The Summary of Deposits summarizes the results of the FDIC's annual survey of branch office deposits for all FDIC-insured institutions, including insured U.S. branches of foreign banks. All institutions with branch offices are required to submit the survey; institutions with only a main office are exempt.

Given our estimates for the county-level transition risk, we estimate the bank-level transition risk within its lending footprint. That is, for any given bank, we take the average of county-level losses across the counties where the bank operates and weight each county by the size of the deposit base of the bank in that county.

Once we have these bank-level estimates of market value losses, we quantify the potential impact on a community bank's operation by multiplying a bank-level estimate for the transition risk by a bank's loans, which we then scale by total assets.

Climate Stress Tests

Our exercise is not a climate stress test. However, there is a growing literature about—and central banks are becoming interested in—the link between financial stability and climate change.

In some ways, climate stress tests are different from the standard stress tests (that is, the tests that focus primarily on capital and liquidity levels during stress scenarios) performed by macroprudential supervisors. But in other respects, they are very similar.

A standard stress test is generally conducted for a horizon of two to three years, evaluates an extreme stress scenario, and uses detailed loan-level information. The bank must be able to meet capital and liquidity requirements under stressful conditions. A standard stress test also informs a bank's management about risks.

A climate transition risk stress test focuses on a much longer horizon of 10 years, and the scenarios often begin with a projection of future emissions. Common climate scenarios, provided by the Network for Greening the Financial System (NGFS), range from Current Policies to the most ambitious scenario: Net Zero 2050, which aims to limit global warming to 1.5 degrees Celsius through stringent climate policies and reaches net zero CO_2 emissions around 2050.

Because the primary goal of these exercises is to quantify the risks to financial institutions with different mixes of industry exposure, the next step is to link the aggregate outcomes to sectoral or regional effects. One approach expands the macroeconomic model to incorporate an input-output structure that provides sectoral effects.[14] The alternative approach, which goes directly from the increase in the carbon tax to either asset value or credit risk, evaluates the impact of these policies on each industry or region using a financial model.[15] When constructing these links, a key input is the estimates of carbon emissions at the industry level.

The final step in evaluating how the transition risk affects financial institutions is to establish a link between the industry or regional effects and the portfolios of these institutions. A direct approach can be used if loan-level data with industry information are available. If these data are not available, the researcher needs to infer the loan composition and the exposure of the loan portfolio to industry or regional losses.

Thus far, most central banks' climate stress tests have been informational—for the central bank to learn about climate risks and for firms to learn how to measure and control climate risks in their portfolios. They do not affect bank capital requirements.

Notes

1 See Berlin, Byun, D'Erasmo, and Yu (2022) for a detailed description of the methodology.

2 We use data on public firms to estimate the parameters of a standard asset pricing model—see Merton (1974)—as implemented by Bharath and Shumway (2008).

3 Analysts estimate an appropriate carbon tax based on different paths of CO_2 emissions required to keep global temperatures from rising above 2 degrees Celsius.

4 The input-output table describes the flow of products between industries as well as to final demand. We use the EXIOBASE input-output table and its direct-emissions estimates to calculate emissions. Direct emissions include only those emissions generated in the production stage. Our measure incorporates direct emissions for final demand and emissions generated in the production of the firm's inputs.

5 Consistent with our approach, elasticities of demand for inputs tend to be quite low. See Atalay (2017) for estimates of demand elasticities in a production economy. At the other extreme, we could assume that the carbon tax is levied on the emissions at the point of production, and final-goods producers face perfectly elastic demand. If this were the case, the profits of the final-goods producers would fall one-for-one with the tax, there would be no price effects along the production chain, and the effect of the tax could be measured using emissions directly at the

source alone. See Berlin, Byun, D'Erasmo, and Yu (2022) for a comparison of these two approaches.

6 "Utilities" encompass a wide range of energy-generation industries, but fossil fuel electric power generation accounts for most of the utility industry's emissions.

7 Of course, employment composition is not the only determinant of how climate change or climate policies affect a county or region. Cruz and Rossi-Hansberg (2022) argue that the costs of climate change are extremely heterogeneous across locations due to different local temperature effects; differential effects on amenities, productivity, and natality; differential costs of migration; and trade across regions.

8 We adopt the definition of a community bank for year 2019 presented in the FDIC December 2020 Community Banking Study.

9 Because many small banks operate in only one county, the link between the regional impact and the performance of the bank as derived from the deposit base may not be as strong as it first seems. In our sample, about 92 percent of community banks operate in only one state and 42 percent operate in only one county. When we perform a robustness exercise using information on residential mortgage originations, we find similar results. (For the robustness exercise, we used the public version of the Home Mortgage Disclosure Act data for 2019, available from https://ffiec.cfpb.gov/.)

10 We assign the effects of the carbon tax to the bank's loan portfolio—not the asset portfolio as a whole—because the value of cash and securities is not sensitive to local economic shocks.

11 The GWP was developed to allow comparisons of different gases' impact on global warming. CO_2, by definition, has a GWP of 1 regardless of the period used, because it is the gas being used as the reference. Methane (CH_4) is estimated to have a GWP of 28–36 over 100 years. As in most of the literature, we focus on CO_2-equivalent emissions using GWP 100.

12 Some important examples in this literature include Horvath (2000), Atalay (2017), Baqaee and Farhi (2020), and Miranda-Pinto and Young (2022). See Devulder and Lisack (2020) for an example of a transition risk.

13 A representative firm has the same employment composition as the county where it operates.

14 See Vermeulen, Schets, Lohuis, et al. (2021) and Banque de France (2021).

15 Reinders, Schoenmaker, and van Dijk (2020) and Grippa and Mann (2020) estimate the value added for each industrial sector and assign a tax on carbon emissions.

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Photo: Denis Tangney Jr

Regional Spotlight
Homicides and Poverty

In the public imagination, homicides and poverty are tightly linked—but are they?

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According to conventional wisdom, there is a clear and positive relationship between poverty and crime. Indeed, many social scientists have found such a correlation.[1] This conversation comes up particularly often in relation to Philadelphia, which is often called the poorest big city in America.[2] But this relationship is not as straightforward as it might seem. As sociologists Patrick Sharkey, Max Besbris, and Michael Friedson wrote in 2016, "It is less clear that this relationship is causal or that higher levels of poverty in a neighborhood, a city, or a nation, necessarily translate into higher levels of crime." To support this claim, they cited the 1979 observation of fellow sociologists Lawrence E. Cohen and Marcus Felson that "during the 1960s, when poverty and racial inequality were declining in American cities, the crime rate was rising." They also noted that, during and for years after the Great Recession, the rise in poverty and sustained unemployment did not lead to a remarkable rise in crime. More recently, the data show that during the pandemic recession in 2020, the homicide rate rose disproportionately high (though not to the highest level on record) relative

to the change in the poverty rate, especially considering that–after adjusting for transfer payments–the poverty rate fell.

Understanding patterns in poverty and crime is critical for addressing urban problems, so I examined the trends in poverty and homicides–a proxy for serious crimes–over a 32-year period (Figure 1). To determine how poverty and homicides interact,

and to unpack some of the nuance of this relationship, I also quantified the correlation between them in the Philadelphia metropolitan statistical area (MSA),[3] and, for comparison, in six MSAs close in population to the Philadelphia MSA, and in the U.S. as a whole. This will allow us to isolate what if anything is unique about the Philadelphia MSA.

Homicide and Poverty Rates Differ Markedly Among Large Metro Regions
But rates tend to move in tandem during the sample period.
Homicide rate (per 100,000 persons) and poverty rate in seven MSAs and the U.S., 1989–2021
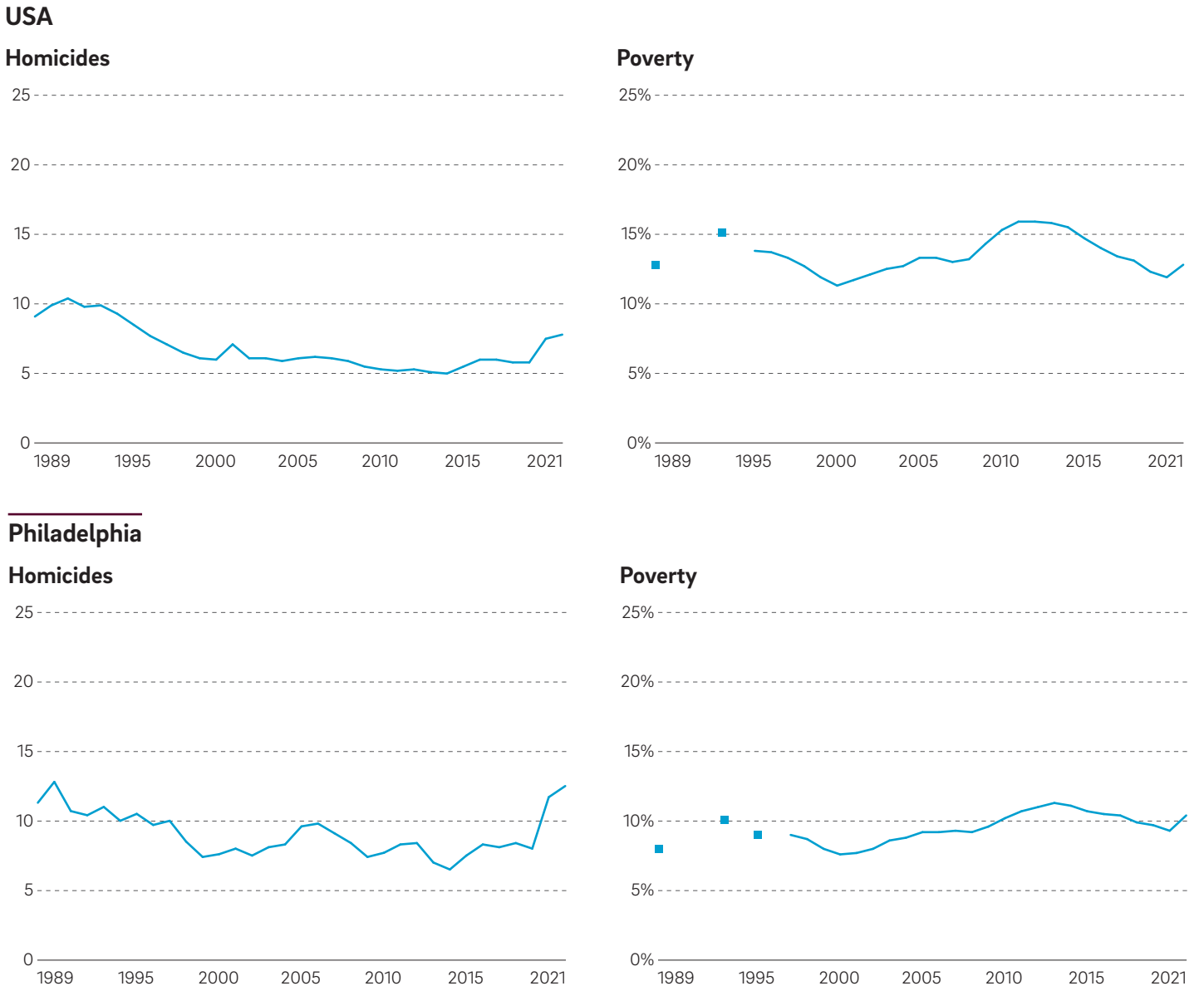
Although the evidence clearly shows that homicides are concentrated in poor counties, the aggregate data hides this county-level variation. Indeed, at the MSA level, I find that poverty and crime are negatively correlated over the period 1989 to 2021. For instance, although the Philadelphia and Chicago MSAs have the lowest poverty rates in this sample,[4] these regions also have the highest homicide rates. Further, I find that poverty and crime are not positively correlated consistently during times of economic growth and recessions. Nonetheless, the concentration of poverty and crime in specific areas within the MSAs provides opportunities for lawmakers and policymakers to craft policies and target resources more effectively.

The Poverty Rate

Poverty rates[5] differed markedly among the MSAs in my sample. From 1989 to 2021, the poverty rate in the Philadelphia MSA averaged 9.5 percent.[6] Only the Chicago MSA had a lower average poverty rate, at 9.0 percent. Conversely, the Phoenix MSA had the highest average poverty rate, at 14.8 percent. Phoenix is followed closely by the Miami and Los Angeles MSAs, each of which had an average poverty rate of 13.9 percent. The nation's average poverty rate was slightly lower, at 13.5 percent.

Despite these differences, poverty rates in these MSAs and the nation tended to move in the same direction over time. In the nation overall, the poverty rate was lowest in 2000 at 11.3 percent; it peaked at 15.9 percent in 2011 and 2012, shortly after the Great Recession (2007-2009); it fell consistently to 11.9 percent in 2020; and it
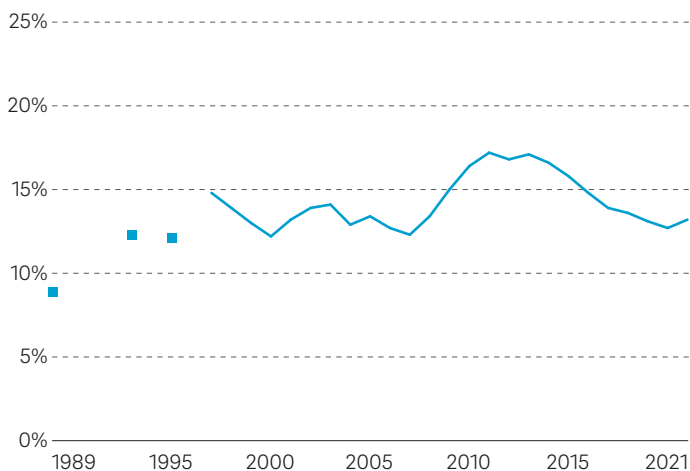
*See **Measuring Homicides*** ↘
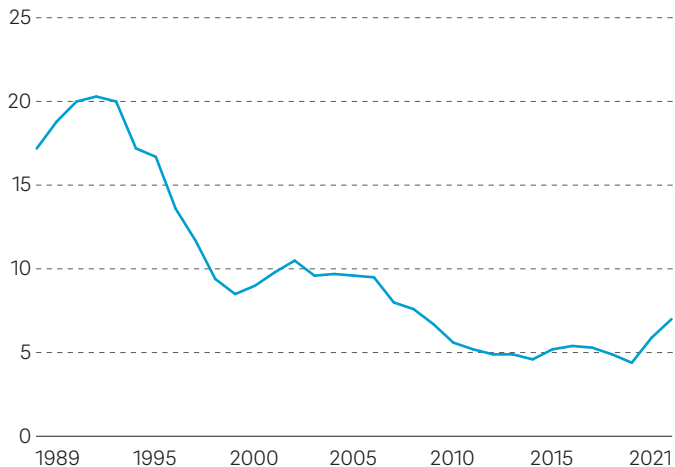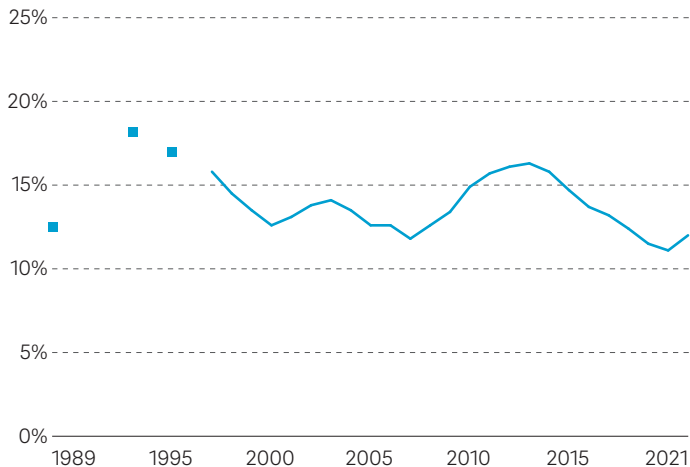
Miami

Homicides
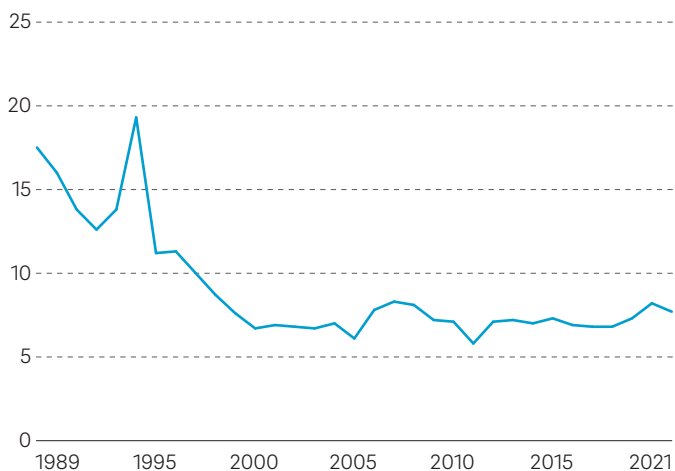
Poverty

Los Angeles

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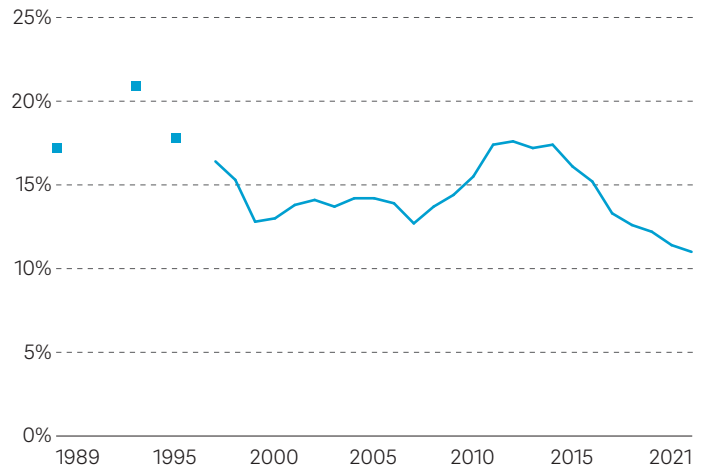

Poverty

Phoenix

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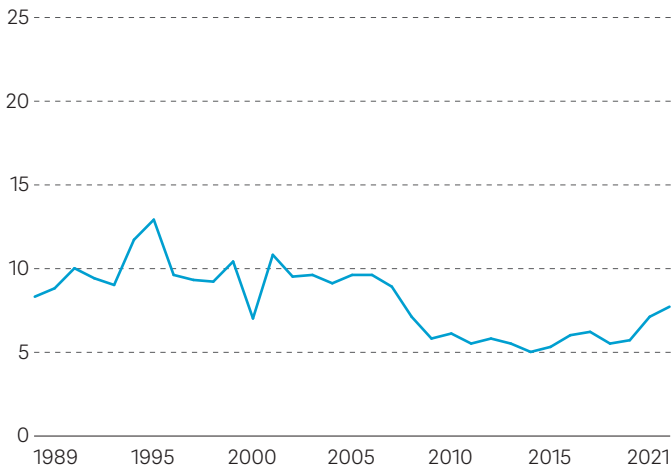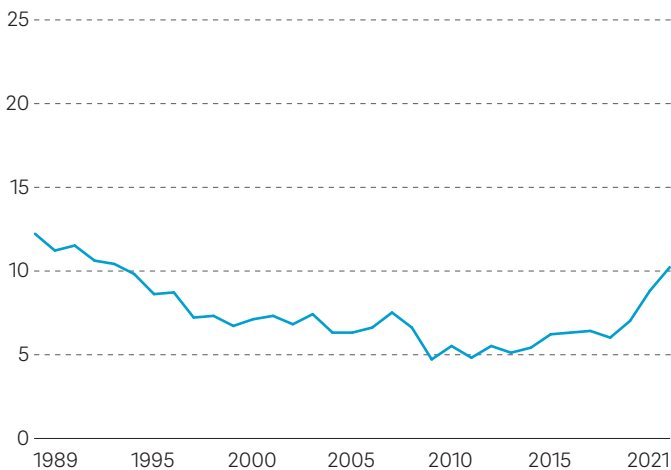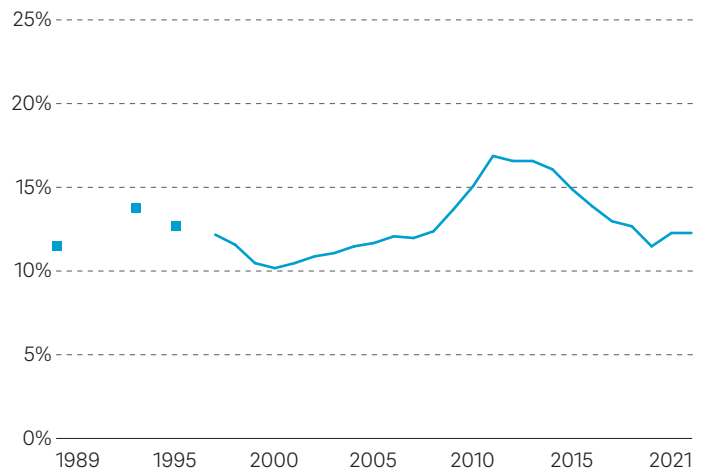

Poverty

Atlanta

Homicides

Poverty

ticked up again during the COVID-19 pandemic, to 12.8 percent in 2021. These movements are mirrored in the Philadelphia, Chicago, Miami, and New York MSAs. (The only MSA in which the poverty rate remained steady from 2020 to 2021 was Atlanta, whereas it ticked down in the Phoenix MSA.)

The Homicide Rate

Just as with poverty rates, homicide rates differ markedly among my MSAs and the nation.[7] Of the seven MSAs in my sample, Chicago and Los Angeles had the highest average homicide rates while Philadelphia was tied with Miami for third place.

Several MSAs shared the distinction of having the year's highest homicide rate at least once throughout our sample period. The Chicago MSA has generally had a higher homicide rate, recording the highest homicide rate in our sample of MSAs in 13 out of the 32 years studied. This high rate is largely associated

with Chicago's gang culture,[8] competition for the crack cocaine market, and easy access to illegal guns.[9] The Phoenix MSA came close to Chicago in both 1999 and 2001, recording each year's second-highest homicide rate—10.4 in 1999 and 10.8 in 2001. From 2010 to 2013, the Philadelphia MSA recorded the highest homicide rate, ranging from 7.7 to 8.4. From 2014 to 2021, Chicago recorded the highest homicide rate, with the Philadelphia MSA close behind. Overall, Los Angeles had the highest homicide rate from 1990 through 1996; Chicago from 1997 through 2003, and again from 2014 through 2021; and Philadelphia from 2006 through 2012. (Miami and Phoenix posted the highest rate in the remaining years.)

The New York MSA, however, had a relatively low homicide rate across my sample period. Up until 1993, the New York MSA's homicide rate ranged from 14 to 15.8, usually putting it in the top five MSAs in my sample. But since then, the homicide rate in the New York MSA has trended downward, reaching

just 5.2 in 1998 before edging up to 5.5 in 2000. In their 2002 working paper, economists Hope Corman and Naci Mocan attributed this decline to several factors: the 35 percent increase in the number of police officers in New York City in the 1990s; the increased incarceration rate; demographic changes (mainly a drop in the number of youths); and the economic boom of the 1990s.[10] As I found in my own research, these factors confound the sometimes simplistic argument that poverty causes crime.[11]

Although homicide rates differed among MSAs and the nation, they–like poverty rates–tended to move in tandem. In most of my sample's MSAs and the nation, homicide rates were higher in the 1980s; they declined in the 1990s and 2000s; and they have inched back up since the 2010s, except in the New York MSA.

See **Homicides in Philadelphia** ⬊

Homicide rates spiked in six of the seven MSAs in my sample[12] and in the U.S.[13] from 2019 to 2020 and have inched up further in 2021. Although it is still unclear why homicides rose dramatically in 2020, the Pew Research Center has pointed
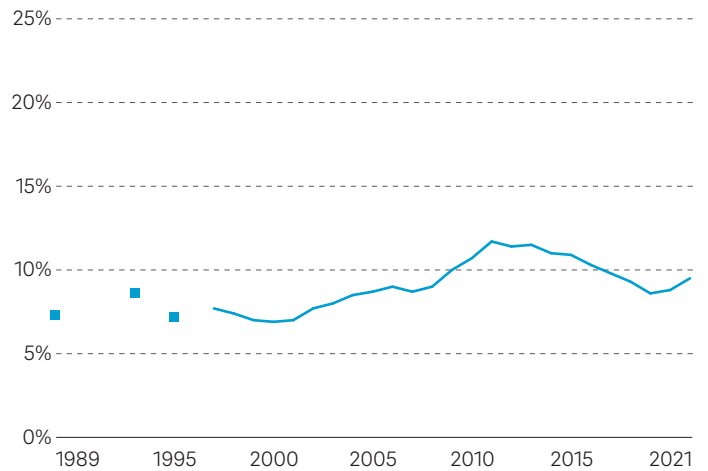
Chicago

Homicides
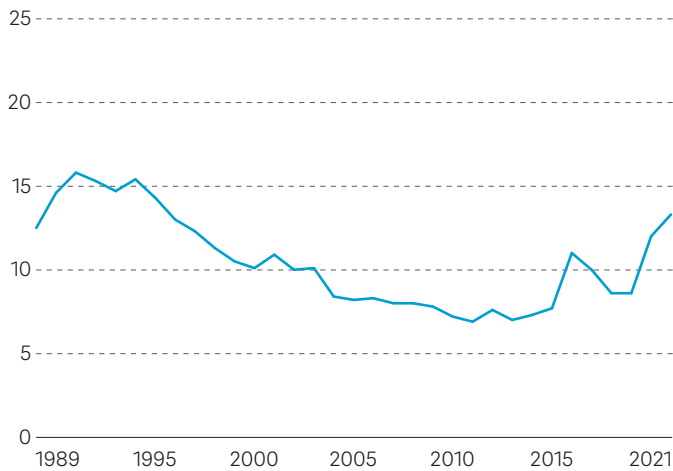
Poverty

New York

Homicides
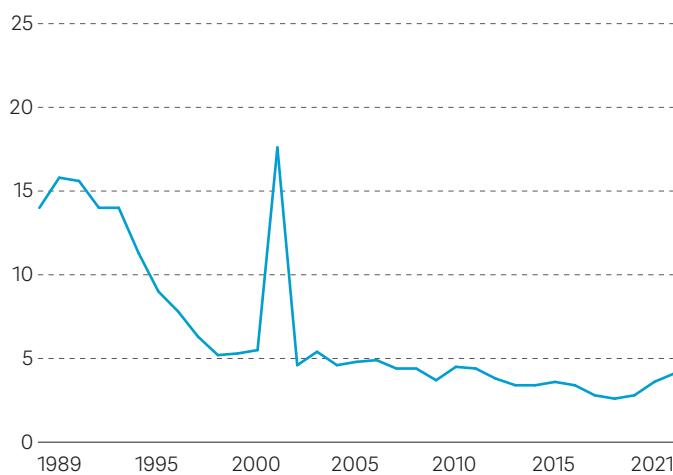
Poverty
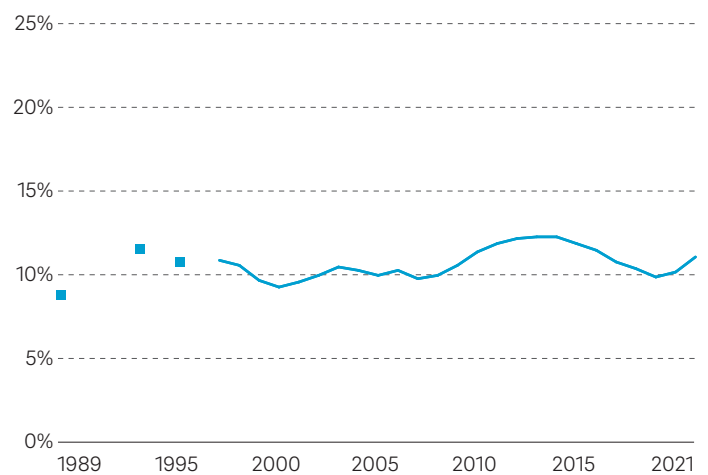
Data Sources: Homicide data from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System, Mortality on CDC WONDER Online Database; poverty data from the American Community Survey's 5-year estimates via https://www.census.gov/programs-surveys/saipe/data/datasets.2000.List_1743592724.html#list-tab-List_1743592724

Note: Homicide data are from the Multiple Cause of Death Files, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Co-operative Program. The poverty rate is defined as the percentage of the population with incomes below a threshold level. In the U.S., these thresholds are determined by the Census Bureau and vary by family size and composition. They do not vary geographically but are updated for inflation, so the poverty rate is always reported in current dollars.

to economic and societal changes brought on by the COVID-19 pandemic and changes in police/community relations after the murder of George Floyd in Minnesota in 2020.[14]

Poverty and Crime: No Consistently Positive Correlation

In keeping with the literature that finds that the relationship between poverty and crime is complicated, poverty and homicides are not positively correlated consistently across my sample of MSAs. Over the period 1989 to 2021, the Los Angeles, Miami, and Phoenix MSAs had, on average, the highest poverty rates, while the Chicago, New York, and Philadelphia MSAs had the lowest. Meanwhile, the MSAs with the highest homicide rates were Chicago, Los Angeles, Miami, and Philadelphia, while the Atlanta, New York, and Phoenix MSAs had the lowest. Only in the Los Angeles MSA do we see a positive relationship between poverty and homicides.

To further corroborate these observations, I used correlation analysis to investigate whether changes in the poverty rate are associated with changes in the homicide rate. In Los Angeles, I found a moderately positive relationship between the poverty and homicide rates: That is, an uptick in poverty is associated with a moderate uptick in homicides. For each of the other MSAs and for the U.S., I found negative correlations (some weak, some moderate, and some strong) between the poverty and homicide rates. In these other MSAs and in the U.S., an uptick in the poverty rate is not associated with an increase in the homicide rate. In short, I do not find a correlation between the poverty and homicide rates in these MSAs or in the U.S. over the period 1989 to 2021.

However, economic conditions changed during this period. Homicides have since fallen from the recorded highs of the 1990s, but so too has poverty, which fell consistently until the onset of the Great Recession. (The poverty rate then rose briefly before falling again until 2020.) As such, I thought it useful to examine the relationship between poverty and homicides during periods of economic expansion and contraction for these MSAs and the U.S. overall.

During the period 1992-2000, following the early 1990s recession, the correlation between poverty and homicides for the Philadelphia, Chicago, Los Angeles, New York, and Atlanta MSAs, and for the U.S. overall, ranged from strong to very strong. Only in the Phoenix MSA was the relationship positive but weak. Thereafter, the bursting of the dot-com bubble caused a recession in the early 2000s. From 2002 to 2006, while the economy was returning to a path of growth, the correlation between the poverty and homicide rates was very strong in the Philadelphia MSA, strong in the New York MSA, and moderately strong in the U.S. and the Los Angeles MSA. Meanwhile, the Atlanta, Chicago, and Phoenix MSAs all recorded moderately to strongly negative correlations over this period.

During the Great Recession (2007-2009) and the period of economic growth that followed until the COVID-19 recession, all MSAs and the U.S. overall recorded negative correlations–except for the Los Angeles and New York MSAs, which recorded posi-

Measuring Homicides

The two most detailed systems to track homicides in the U.S. are the Supplementary Homicide Reports (SHR), which are part of the Uniform Crime Reporting Program administered by the Federal Bureau of Investigation since 1930, and the Centers for Disease Control and Prevention's Fatal Injury Reports, which are developed from the National Vital Statistics System (NVSS) and maintained by the National Center for Health Statistics. The Fatal Injury Reports include data derived from the registration of births and deaths at the state and local level; this system dates to 1933.

When comparing statistics, the NVSS consistently shows a higher number and rate of homicides in the U.S. than does the SHR. This is most likely due to the differences in coverage and scope and the mandatory reporting required under the NVSS versus the voluntary nature of the data collection under the SHR. Because the NVSS data are more comprehensive, this article references statistics from the NVSS Fatal Injury Reports.

Photo: GummyBone

Homicides in Philadelphia

On an annual basis, the Philadelphia MSA's homicide rate was 11.3 in 1989. It ticked up to 12.8 in 1990 and then fell to 10.4 in 1992. Homicides then ebbed and flowed before recording a low of 7.4 in 1999. This decline in the 1990s may be due to a combination of the Philadelphia Police Department's implementing the CompStat program[21] and hiring more police officers, and the end of the crack epidemic. After 2000, the trend reversed, and the homicide rate continued to grow, peaking at 9.8 in 2006. The lowest homicide rate over this period was 6.5 in 2014. The homicide rate then reached 8.3 in 2016 and remained at (roughly) 8.3 until 2019. The homicide rate rebounded strongly to 11.7 in 2020 and continued to grow in 2021 to 12.5 as the MSA continued to grapple with gun violence. The 2021 homicide rate was almost as high as in 1990, reversing all the progress made over the last three decades, with provisional homicide records for 2022 showing only a minor dip in homicides, to 12.2. However, as of November 7, 2023, homicides in the city of Philadelphia are down 30 percent compared with 2022.[22]

tive correlations from 2010 to 2019. Miami was the only MSA in this sample that showed a negative correlation between poverty and homicides irrespective of the period.

One overarching reason why poverty and crime are not always positively correlated is the motivations for crime.[15] For instance, in 2022, John Jay College emeritus professor of criminal justice Barry Latzer wrote that "crimes of violence are usually motivated by quarrels, personal grudges, perceived insults, and similar interpersonal conflicts, not by economic necessity. Consequently, a decline in one's financial condition is not likely to cause violent criminal behavior. This explains why an economic recession or depression does not invariably produce a crime spike."

Photo: Denis Gavrilov

From Concentration to Opportunity

As Hanna Love and Tracy Hadden Loh of the Brookings Institution wrote in 2023, while the spike in homicides was widespread for the nation, its toll was not distributed evenly. Instead, increases in homicides were largely concentrated in disadvantaged neighborhoods that already had high rates of gun violence, along with significant histories of public and private sector disinvestment. Although this concentration of poverty and crime is worrying, it gives regional and local lawmakers and policymakers the opportunity to craft targeted solutions to address poverty and crime. The benefits of these interventions can be meaningful for the communities and the economy at large. In 2016, economists Raj Chetty, Nathaniel Hendren, and Lawrence F. Katz found that exposure to a better environment during childhood is a key determinant of an individual's long-term outcomes. And earlier this year, my colleague Bryan Stuart found that public investments in lower-income children have the potential to not only improve outcomes for those children but also benefit government budgets and the economy in general.

There is a growing body of research about Moving to Opportunity (MTO) experiments, in which families with children, teenagers, and young adults are allowed to participate in randomized housing mobility experiments. Under these experiments, families are offered housing vouchers that allow them to relocate from high-poverty to low-poverty areas.[16] Researchers then compare the long-run outcomes of these children with a control group of children who remained in the disadvantaged areas.

Research shows that children who move to low-poverty areas generally exhibit reduced violent behaviors; there are also substantial reductions in violent-crime arrests for experimental group males, and displaced children are more likely to be employed and earn more in young adulthood.[17] Although these experiments help relatively few families due to limited resources and individual concerns,[18] and although they have not been replicated nationally, MTO still reduces the concentration of poverty while providing positive outcomes.

Opportunity also exists for minimizing the concentration of homicides, since crime is geographically clustered to a remarkable degree.[19] Homicides were concentrated in the most populous county of each MSA – most likely in specific, high-crime neighborhoods. Over the period on average, at the lower end of the spectrum, one-quarter of all homicides in the New York MSA were committed in Kings County, 44 percent of homicides in the Atlanta MSA were committed in Fulton County, and 58 percent of homicides in the Miami MSA were committed in Miami-Dade County. Meanwhile, in the Philadelphia MSA, 69 percent of homicides were committed in Philadelphia County, while more than 90 percent of homicides were committed in Maricopa County and Los Angeles County in the Phoenix and Los Angeles MSAs, respectively. With this information, policymakers could funnel resources into hot spots–for example, by increasing police presence through more frequent patrols, raids, and arrests of lawbreakers.

Conclusion

Whereas the literature generally finds a strongly positive relationship between poverty and crime, I find that poverty and crime are not positively correlated consistently in these seven MSAs and the U.S. However, the underlying concern remains that poverty and homicides are concentrated and persistent, and they affect the quality of life in many neighborhoods, cities, counties, and MSAs, as well as nationally. This presents an opportunity for lawmakers and policymakers at both the regional and local levels to direct resources and create programs to target and reduce the concentration of poverty and crime in these areas.

Although I examined the direct link between poverty and crime, this link "may be spurious," as Sharkey, Besbris, and Friedson wrote, "or it may be mediated by other processes related to labor force attachment, family structure, or connections to institutions like the military or the labor market."[20] As such, we need more research into the variables that explain the persistence of both poverty and homicides in these MSAs, as well as research that helps us understand how different channels–for instance, the labor market– influence the dynamics between poverty and crime.

Notes

1 See Lieberman and Smith (1986); Hsieh and Pugh (1993); and Golash (2005).

2 Flora (2021) shows that poverty in the Philadelphia region is consistently lower than in the nation and lower than in other metropolitan areas, despite ongoing reports that of the 10 largest cities, Philadelphia has the highest rate of deep poverty (Lubrano 2015).

3 An MSA is a geographic region designated by the U.S. Office of Management and Budget. By "Philadelphia MSA," I mean the Philadelphia–Camden–Wilmington MSA. Because of data limitations, I focus on homicide rates and not overall crime statistics, which include property crimes.

4 The sample includes the Philadelphia–Camden–Wilmington MSA and six MSAs that bracket the Philadelphia MSA in size: three that are larger than Philadelphia (New York–Newark–Jersey City, Los Angeles–Long Beach–Anaheim, and Chicago–Naperville–Elgin), and three that are smaller (Atlanta–Sandy Springs–Alpharetta, Miami–Fort Lauderdale–Pompano Beach, and Phoenix–Mesa–Chandler).

5 Official poverty thresholds do not vary geographically, so adjusting for cost of living from MSA to MSA could cause poverty to be higher than official records indicate, complicating the analysis.

6 The poverty rate is defined as the percentage of the population with incomes below a threshold level. For example, in 2023 a family of four with two children would be in poverty if the family income fell below $30,000, up from $26,500 in 2021. In the U.S., these income thresholds are determined by the Census Bureau and vary by family size and composition. Official poverty thresholds do not vary geographically but are updated for inflation using the Consumer Price Index (CPI-U), so the poverty rate is always reported in current dollars.

7 All homicide rates are per 100,000 persons.

8 See Ali (2014).

9 See Ander (2021).

10 The CompStat program, they argue, was less important.

11 The homicide rate in the New York MSA rose to 17.6 in 2001, but this includes the victims of the terrorist attacks on September 11, 2001, and will be ignored for the sake of this analysis. In 2002, New York recorded a homicide rate of 4.6 and remains the MSA with the lowest homicide rate.

12 The exception is the Miami MSA, in which homicides fell in 2021 but remained higher than in 2019. This fall was attributed to the Miami–Dade Police Department's Operation Summer Heat. In the Phoenix, Los Angeles, and New York MSAs the rate was still lower than in the early 2000s, whereas in the Atlanta, Philadelphia, and Chicago MSAs the rate was higher.

13 The FBI's crime statistic estimates for 2022 show that nationally, the number of violent crimes decreased by an estimated 1.7 percent in 2022 compared with 2021 estimates, while murders and nonnegligent manslaughter recorded a decrease of 6.1 percent compared with the previous year.

14 See Gramlich (2021).

15 See Latzer (2022).

16 The most common reason families gave for volunteering for the program was that they wanted their children to be able to avoid the risks from crime, violence, and drugs in their origin neighborhoods. See Kling, Lieban, and Katz (2007).

17 See Sciandra, Sanbonmatsu, Duncan, et al. (2013); Ludwig, Duncan, Hirschfield (2001); and Chyn (2018).

18 Only about half of the eligible participants used the voucher, in part because of difficulties in moving and in securing apartments in lower-poverty neighborhoods. See Sampson (2008).

19 See Sampson (2012).

20 See Sharkey, Besbris, and Friedson (2016).

21 CompStat—short for Computer Statistics—is a computerization and quantification program used by police departments. It was first set up by the New York City Police Department in the 1990s. The CompStat model involves collecting, analyzing, and mapping crime data and other essential police performance measures on a regular basis to ensure that police officers are in the areas where they are most needed. It also allows for the evaluation of the success of crime-fighting strategies to make informed decisions.

22 See the Philadelphia Police Department's Crime Maps & Stats webpage, https://www.phillypolice.com/crime-maps-stats.

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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.

The views expressed in these papers are solely those of the authors and should not be interpreted as reflecting the views of the Federal Reserve Bank of Philadelphia or Federal Reserve System.

The Role of Bank-Fintech Partnerships in Creating a More Inclusive Banking System

Fintech firms are often viewed as competing with banks. Instead, more recently, there has been growth in partnership and collaboration between fintech firms and banks. These partnerships have allowed banks to access more information on consumers through data aggregation, artificial intelligence/machine learning (AI/ML), and other tools. The authors explore the demographics of consumers targeted by banks that have entered into such partnerships. Specifically, the authors test whether banks are more likely to extend credit offers (by mail) and/or credit originations to consumers who would have otherwise been deemed high risk either because of low credit scores or lack of credit scores altogether. The analysis uses data on credit offers based on a survey conducted by Mintel, as well as data on credit originations based on the Federal Reserve's Y-14M reports. Additionally, the authors analyze a unique data set of partnerships between fintech firms and banks compiled by CB Insights to identify the relevant partnerships. The results indicate that banks are more likely to offer credit cards and personal loans to the credit invisible and below-prime consumers—and are also more likely to grant larger credit limits to those consumers—after the partnership period. Similarly, the authors find that fintech partnerships result in banks being more likely to originate mortgage loans to nonprime homebuyers and that they increase the mortgage loan amounts that banks grant to nonprime buyers as well. Overall, the authors find that these partnerships could help to move us toward a more inclusive financial system.

WP 23-21. Alan Chernoff, Rutgers University; Julapa Jagtiani, Federal Reserve Bank of Philadelphia.

Institutional Housing Investors and the Great Recession

Before the Great Recession, residential institutional investors predominantly bought and rented out condos, but then they increased their market share of rental houses from 17 percent in 2001 to 28 percent in 2018. Along with this change, rental survey data show that the annual house operating-cost premium of institutional investors relative to homeowners fell from 44 percent in 2001 to 28 percent in 2015. To measure how these reduced costs affected the housing bust of 2007–2011, the author builds a heterogeneous agent model of the housing market featuring corporate investors and two types of dwellings: condos and houses. A transition experiment intended to replicate the Great Recession yields three results. First, house prices would have fallen by 1.6 percentage points more without the corporate-cost reduction. Second, the corporate-cost reduction can explain the fall in the homeownership rate. Third, the cost reduction produced a welfare gain of 0.4 percent for homeowners and 0.6 percent for individual investors.

WP 23-22. Dick Oosthuizen, Federal Reserve Bank of Philadelphia.

Social Capital and Mortgages

Using comprehensive mortgage-level data, we discover that the social capital of the community in which households live positively influences the likelihood of the approval of their mortgage applications, the terms of approved mortgages, and the subsequent performance of those mortgages. The results hold when conditioning on extensive household and community characteristics and a battery of fixed effects, including individual effects, data permitting, and when employing instrumental variables and propensity score matching to address identification and selection concerns. Concerning causal mechanisms, evidence suggests that social capital enhances lender screening and monitoring of borrowers and increases the social costs to borrowers of defaulting on their debts.

WP 23-23. Xudong An, Federal Reserve Bank of Philadelphia; Sadok El Ghoul, University of Alberta; Omrane Guedhami, University of South Carolina; Ross Levine, Stanford University and NBER; Raluca A. Roman, Federal Reserve Bank of Philadelphia.

Can Everyone Tap into the Housing Piggy Bank? Racial Disparities in Access to Home Equity

This paper documents large racial disparities in the ability of homeowners to access their housing wealth without moving. During the 2018–2021 period, Black homeowners' mortgage equity withdrawal (MEW) product applications were rejected at almost double the rate of White homeowners (44 percent versus 23 percent), while Hispanic and Asian homeowners also experienced significantly higher denial rates (32 percent and 30 percent, respectively). These racial disparities in denials are much larger than those associated with purchase and rate/term refinance mortgage applications. Controlling for loan and borrower characteristics commonly used in the underwriting process significantly reduces the MEW disparities, with the Black–White denial rate gap falling by approximately 83 percent, and the Hispanic–White gap falling by 73 percent. Credit scores and debt-to-income ratios are the most important factors explaining the racial gaps, while differences in loan-to-value ratios contribute only modestly. Large disparities remain after controlling for underwriting factors, and these "residual" disparities vary significantly across lenders. While there are numerous potential drivers of the residual disparities, the paper shows that they tend to be larger in geographic areas characterized by more racial animus, which suggests that discriminatory forces may play a role.

WP 23-25. James N. Conklin, University of Georgia; Kristopher Gerardi, Federal Reserve Bank of Atlanta; Lauren Lambie-Hanson, Federal Reserve Bank of Philadelphia.

Climate Shocks in the Anthropocene Era: Should Net Domestic Product Be Affected by Climate Disasters?

The monetary costs of weather and climate disasters in the U.S. have grown rapidly from 1980 to 2022, rising more than 5 percent in real terms annually. Much of this real growth in costs is likely due to climate change. Regardless of its cause, these costs imply a faster depreciation of real assets. We argue that the expected depreciation from these events could be included in the consumption of fixed capital, leading to lower levels, and slightly lower growth rates, for net domestic product (NDP). We use Poisson pseudo-maximum-likelihood regressions to estimate this expectation and to generate our experimental measure of costs. An alternative calculation of depreciation and NDP might be derived from the time series of costs incurred rather than from the far smoother expectation. This latter series might be more appropriate for a national income satellite account. We also investigate the parametric distributions of the annual average-cost and total-cost data.

WP 23-24. Leonard Nakamura, Federal Reserve Bank of Philadelphia; Brian Sliker, Bureau of Economic Analysis.

Did Fintech Loans Default More During the COVID-19 Pandemic? Were Fintech Firms "Cream-Skimming" the Best Borrowers?

A growing portion of consumer credit has recently been devoted to unsecured personal installment loans. Fintech firms have been active players in this market, with an increasing market share, while the market share of banks has declined. Studies of fintech lending have shown that their digital access and ability to leverage alternative data have increased accessibility in underserved areas, enabled consumers with thin credit files to obtain credit, and provided a lower cost alternative to long-term credit card financing. This paper exams three questions: (1) Do proprietary loan-rating systems accurately predict the likelihood of default; (2) Can a proprietary loan-rating system, leveraging alternative data that was developed in a favorable economic period, continue to perform well under adverse economic conditions (such as the COVID-19 pandemic); and (3) Have fintechs been "cream skimming," i.e., underpricing the cost of credit to top-tier customers? This study uses data from LendingClub, one of the largest fintech lenders in the personal loan market. We find that LendingClub's loan-rating system is superior to traditional measures of credit risk when predicting the likelihood of default and that the loan-rating system continued to perform well during the pandemic period. Finally, we find no evidence of cream skimming.

WP 23-26. Julapa Jagtiani, Federal Reserve Bank of Philadelphia; Catharine Lemieux, Federal Reserve Bank of Chicago (Retired); Brandon Goldstein, Federal Reserve Bank of Philadelphia.

CMBS Market Evolution and Emerging Risks

We study the evolution of the private label CMBS market from one dominated by broadly diversified long-term, fixed-rate conduit securitizations to one dominated in 2021–2022 by undiversified short-term, floating-rate single-asset, single-borrower (SASB) securitizations. Twenty-five years of stable bond returns and exceptionally low losses help explain the growth and standardization of the SASB market following the Global Financial Crisis. Historically low interest rates and pandemic-era uncertainties help explain the recent dominance of short-term, floating-rate SASBs. Factors contributing to their strong performance have weakened considerably recently, exposing them to emerging risks, making their recent dominance unsustainable.

WP 23-27/R. Xudong An, Federal Reserve Bank of Philadelphia; Larry Cordell, Federal Reserve Bank of Philadelphia; Nicholas Smith, Federal Reserve Bank of Philadelphia.

California Wildfires, Property Damage, and Mortgage Repayment

This paper examines the impact of wildfires on mortgage repayment using novel data that combine property-level damages and mortgage performance. We find that 90-day delinquencies were 4 percentage points higher and prepayments were 16 percentage points higher for properties that were damaged by wildfires compared to properties 1 to 2 miles outside of the wildfire perimeter, which suggests higher risks to mortgage markets than found in previous studies. We find no significant changes in delinquency or prepayment for undamaged properties inside a wildfire boundary. Prepayments are not driven by increased sales or refinances, suggesting insurance claims drive prepayment. Almost 40 percent of affected households receive insurance settlements lower than the estimated replacement costs that define coverage limits. This underpayment and the resulting deficits imply that households receive about $200,000 to $300,000 less than their entitled amount under California law.

WP 23-05/R. Siddhartha Biswas, Federal Reserve Bank of Philadelphia; Mallick Hossain, Federal Reserve Bank of Philadelphia; David Zink, Federal Reserve Bank of San Francisco.

The Opioid Epidemic and Consumer Credit Supply: Evidence from Credit Cards

To identify causal effects, we employ instrumental variables, propensity score matching, and contiguous counties techniques and control for varying local economic conditions and demographics. We find that banks contract credit supply to consumers in counties highly exposed to opioid abuse by offering higher interest rates, lower credit card limits, and fewer rewards and reducing credit offers overall. Further analyses using the supervisory Federal Reserve Y-14M credit card data set confirm these effects. What is more, the credit contraction disproportionately impacts riskier consumers, minorities (particularly Black people), low-income consumers, and younger individuals. Our examination of various state-level antiopioid abuse legislation shows that opioid supply-oriented laws are somewhat helpful in curbing opioid overdoses or mitigating the credit supply contraction, but demand-oriented laws are not. Finally, we uncover the real effects associated with the opioid abuse-induced credit contraction: Local consumer spending significantly declines in the highly affected areas, with important macro-policy implications.

WP 23-28. Sumit Agarwal, National University of Singapore; Wenli Li, Federal Reserve Bank of Philadelphia; Raluca Roman, Federal Reserve Bank of Philadelphia; Nonna Sorokina, The Pennsylvania State University.

Who Bears Climate-Related Physical Risk?

This paper combines data on current and future property-level physical risk from major climate-related perils (storms, floods, hurricanes, and wildfires) that owner-occupied single-family residences face with data on local economic characteristics to study the geographic and demographic distribution of such risks in the contiguous U.S. Current expected damage from climate-related perils is approximately $19 billion per year. Severe convective storms and inland floods account for almost half of the expected damage. The central and southern parts of the U.S. are most exposed to climate-related physical risk, with hurricane-exposed areas on the Gulf and South Atlantic coasts being the riskiest areas. Relative to currently low-risk areas, currently high-risk areas have lower household incomes, lower labor market participation rates, and lower education attainment, suggesting that the distribution of climate-related physical risk is correlated with economic inequality. By 2050, under business-as-usual emissions, average expected damage is projected to increase monotonically with current average expected damage, which implies that long-term policies that aim to mitigate climate-related physical risk are likely to be progressive.

WP 23-29. Natee Amornsiripanitch, Federal Reserve Bank of Philadelphia; David Wylie, Federal Reserve Bank of Philadelphia.

Decomposing Gender Differences in Bankcard Credit Limits

Using linked mortgage application and credit bureau data, we document the existence of unconditional and conditional gender gaps in the distribution of total bankcard limits. We estimate that male borrowers have approximately $1,300 higher total bankcard limits than female borrowers. This gap is primarily driven by a large gender gap in the right tail of the limit distribution. At the median and in the left tail of the total limit distribution, women have larger limits than men. Results from a Kitagawa–Oaxaca–Blinder decomposition show that 87 percent of the gap is explained by differences in the effect of observed characteristics, while 10 percent of the difference is explained by differences in the levels of observed characteristics. The gap is persistent across geographies but has varied over time. Overall, these gender gaps are small in economic magnitude and have changed over time favoring women.

WP 23-30. Nathan Blascak, Federal Reserve Bank of Philadelphia; Anna Tranfaglia, Federal Reserve Board.

Climate Risks in the U.S. Banking Sector: Evidence from Operational Losses and Extreme Storms

Using supervisory data from large U.S. bank holding companies (BHCs), we document that BHCs suffer more operational losses during episodes of extreme storms. Among different operational loss types, losses due to external fraud, BHCs' failure to meet obligations to clients and faulty business practices, damage to physical assets, and business disruption drive this relation. Event study estimations corroborate our baseline findings. We further show that BHCs with past exposure to extreme storms reduce operational losses from future exposure to storms. Overall, our findings provide new evidence regarding U.S. banking organizations' exposure to climate risks with implications for risk management practices and supervisory policy.

WP 23-31. Allen Berger, University of South Carolina; Filippo Curti, Federal Reserve Bank of Richmond; Nika Lazaryan, Federal Reserve Bank of Richmond; Atanas Mihov, University of Kansas; Raluca A. Roman, Federal Reserve Bank of Philadelphia.

Debtor Income Manipulation in Consumer Credit Contracts

We show that forcing insolvent consumer debtors to repay a larger fraction of debt causes them to strategically manipulate the data they report to creditors. Exploiting a policy change that required insolvent debtors to increase debt repayments at an arbitrary income cutoff, we document that some debtors reduce reported income to just below this cutoff to avoid the higher repayment. Those debtors who manipulate income have a lower probability of default on their repayment plans, consistent with having access to hidden income. We estimate this strategic manipulation costs creditors 12 percent to 36 percent of their total payout per filing.

WP 22-35/R. Vyacheslav Mikhed, Federal Reserve Bank of Philadelphia; Sahil Raina, Alberta School of Business; Barry Scholnick, Alberta School of Business; Man Zhang, National University of Singapore.

Extreme Wildfires, Distant Air Pollution, and Household Financial Health

We link detailed wildfire burn, satellite smoke plume, and ground-level pollution data to estimate the effects of extreme wildfire and related smoke and air pollution events on housing and consumer financial outcomes. Findings provide novel evidence of elevated spending, indebtedness, and loan delinquencies among households distant from the burn perimeter but exposed to high levels of wildfire-attributed air pollution. Results also show higher levels of financial distress among renters in the burn zone, particularly those with lower credit scores. Financial distress among homeowners within the fire perimeter is less prevalent, likely owing to insurance payout. Findings also show out-migration and declines in house values in wildfire burn areas. The adverse smoke and pollution effects are salient to a substantial geographically dispersed population and add appreciably to the household financial impacts of extreme wildfires.

WP 24-1. Xudong An, Federal Reserve Bank of Philadelphia; Stuart A. Gabriel, UCLA Anderson School of Management; Nitzan Tzur-Ilan, Federal Reserve Bank of Dallas.

Housing Speculation, GSEs, and Credit Market Spillovers

In 2021, the U.S. Treasury reduced the exposure of government-sponsored enterprises (GSEs) to speculative mortgages. As a result, GSE purchases of these loans fell by about 20 percentage points. The consequent decline in credit to speculators, however, was mitigated both by entry of corporate investors and because banks began holding more of these loans. By increasing bank exposure to local risk, this move reduced banks' willingness to supply both jumbo mortgages and small business loans. Our empirical design fully accounts for risks at the balance sheet level. Banks thus manage credit not only in a macro sense — the focus of most research — but also market by market.

WP 24-2. Natee Amornsiripanitch, Federal Reserve Bank of Philadelphia; Philip E. Strahan, Boston College and NBER; Song Zhang, University of Delaware; Xiang Zheng, University of Connecticut.

Livingston Survey: Stock Prices

The Philadelphia Fed collects, analyzes, and shares useful data about the Third District and beyond. Here's one example.

In 1946, journalist Joseph Livingston began asking economists he knew to share their forecasts for key economic variables. Their answers became the basis of his biannual column for the *Philadelphia Record*, then for the *Philadelphia Bulletin*, and finally for the *Philadelphia Inquirer*. Livingston was eventually overwhelmed by requests from readers for his source data, so in 1978 the Philadelphia Fed agreed to input his records into its computers and share the data with interested researchers. Upon Livingston's death in 1989, the Philadelphia Fed took over the survey and continues to conduct it to the present day.

When we last featured the Livingston Survey in our first-quarter 2021 issue of *Economic Insights*, we focused on one of the Survey's most important variables, Total Private Housing Starts, or the number of privately owned new homes on which construction has started. This is still an important variable–arguably even more so today, thanks to the dynamic housing market–but stock prices often loom even larger in the public imagination.

The Livingston Survey asks economists to predict the value of Standard and Poor's 500 (the S&P 500), an index of the 500 largest companies listed on stock exchanges in the U.S. (The S&P 500 is compiled by S&P Dow Jones Indices, a Division of S&P Global–a public company with various products and services powering global markets.) By spanning multiple industries and indexes, the S&P 500 reflects broad measures of economic activity and may even anticipate them. According to the June 2023 Livingston Survey, panelists predict that the S&P 500 will reach a higher level than they had previously anticipated, and will continue to grow through 2024. This may sound like good news, but as N. Bulent Gultekin found in his 1983 study of the survey, "expected stock returns rose point-for-point with rises in expected inflation."[1] Thus, the panelists' revised upward trajectory for the S&P 500 may reflect their anticipation of higher inflation for another year and a half.

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Dean Croushore. "The Livingston Survey: Still Useful After All These Years," Federal Reserve Bank of Philadelphia *Business Review*, March/April 1997, pp. 1–13.

FIGURE 1

Stock Prices (S&P 500) Index Level
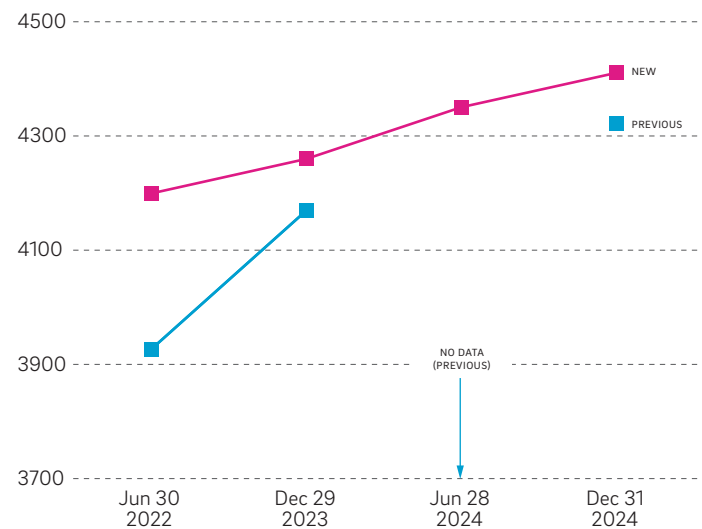
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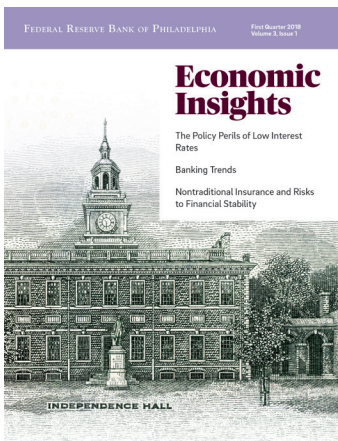
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