CENTER for RETIREMENT RESEARCH at BOSTON COLLEGE

ARE OLDER WORKERS GOOD FOR BUSINESS?

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Abstract

The U.S. workforce is aging, which has raised concerns about the implications of older workers for businesses and the economy. However, little research has been conducted on the quantitative value of older workers in recent years. This paper attempts to fill that gap by linking employee and employer data from the U.S. Census Bureau's *Longitudinal Employer-Household Dynamics*, *Longitudinal Business Database,* and *Business Register*. The analysis finds that in general, older workers are as productive as younger workers, however they do earn higher wages. Furthermore, the relationship between the share of older workers, productivity, and profitability varies substantially by industry.

Introduction

The U.S. workforce is rapidly aging, spurring widespread concern over the implication of older workers for the economy at large, and for businesses in particular. Despite substantial interest from labor economists in the past, little research in the last two decades has examined the quantitative value of older workers to employers in the United States. Widespread discrimination against older workers in hiring, and employer concerns about the high cost of older workers, suggest that employers view this demographic trend as a challenge.[1] Yet, the evidence from before the turn of the century is decidedly mixed, and recent research on older workers in the United States tends to look at anecdotal accounts or soft measures, like employee motivation and engagement, rather than a hard measure of firm performance. Therefore, the productivity and profitability of employing older workers remains an open question.

One challenge in answering this question is data linking employees to their employers. In particular, the data necessary for such an analysis needs to include the age structure of the workforce, the payroll, and the total revenue of different employers. This paper uses restricted Census data linking employers and workers to compare quantitative measures of worker value – the actual productivity (revenue per worker) and profitability (revenue divided by wages) – at firms based on the age distribution of their employees.[2]

The paper includes two analyses. The first is descriptive, just correlating firm performance with the share of older workers at the firm. This approach is valuable given the lack of recent evidence and the mixed nature of the older evidence. However, a concern is that firms that are expected to decline in the coming years are unlikely to attract young workers, leading to a negative bias when trying to estimate the causal effect of older workers on firm outcomes. For this reason, the second analysis supplements the descriptive approach with a two-stage least squares (TSLS) strategy, providing quasi-experimental evidence for the limited but important case of the manufacturing industry. In this design, the changing age structure of each

[1] Neumark, Burn, and Button (2019), for example, show experimental evidence of discrimination against older workers in hiring, while Munnell and Wettstein (2020) show that surveyed employers perceive older workers as more costly.
[2] For measuring revenue per worker with the LEHD, CBR, and LBD, see Haltiwanger et al. (2017).

manufacturing establishment's commuting zone is used to predict changes in the age structure of the establishment's workforce.[3]

The rest of the paper is organized as follows. The next section describes the state of the literature on the business value of older workers. The third section describes the data used in the analysis, while the fourth section describes the methods for the descriptive and TSLS analyses. The fifth section presents the results of the descriptive analysis, while the sixth section lays out the results of the TSLS approach. The final section concludes that the evidence that older workers are less valuable to businesses than young workers is weak.

Background

The share of workers over age 55 has increased dramatically over the past few decades, doubling between 1997 (see Figure 1). Despite this enormous change in the age structure of the workforce, the question of the impact of workforce aging on productivity and firm performance remains largely unsettled.

Currently, most research on the productivity of older workers in the United States is both dated and contradictory. Seminal research on the topic in Haltiwanger, Lane, and Spletzer (1999) and Hellerstein, Neumark, and Troske (1999) reaches conflicting conclusions; the first study finds that having a larger share of workers over age 55 at a firm reduces productivity, while the second study finds (statistically insignificant) evidence that output actually increases with the share of workers over age 55. Potentially more concerning, these estimates have not been updated since Haltiwanger, Lane, and Spletzer (2007), using data running up to 1997, fully two decades ago.

Instead of outcomes measured quantitatively, by output or profit, recent evidence in the U.S. context tends to rely on qualitative assessments or imperfect proxies of productivity such as turnover rates. Finkelstein and Block (2015) document the benefits of older workers' skills, experience, and tenure in small businesses. Aon Hewitt (2015) has similar findings as Finkelstein and Block, but for large businesses. Meta-analyses of studies using similar "soft" measures of performance reach diverging conclusions, with Sturman (2003) finding that

[3] The limitation to manufacturing in this analysis is dictated by the fact that it is an industry with a clear disconnect between where goods are produced and where they are consumed. This means the age structure of the local population is largely irrelevant to the market for the goods produced.

advanced worker age is detrimental in general, while Ng and Feldman (2008) conclude that age is positively associated with most dimensions of work-related performance. Meanwhile, macroeconomic evidence suggests that, at least at the aggregate level, an older workforce is detrimental to productivity. Feyrer (2007, 2008) finds that, across countries, older labor forces are associated with lower productivity at the macro level. Maestas, Mullen, and Powell (2016) find similar results at the state level across the United States.

Substantially more work exists in the European context. However, here, too, the conclusions vary widely. Aubert and Crepon (2006) find no evidence that the productivity of older workers is different from that of prime-age workers; Malmberg, Lindh, and Halvarsson (2008) and Borsch-Supan and Weiss (2013) find that older workers are more productive; and Lovasz and Rigo (2013), Vandenberghe (2013), and Ilmakunnas and Maliranta (2016) show that older workers reduce productivity. Given these variations, it is unsurprising that Mahlberg et al. (2013) show that the relationship between age and productivity varies by location and sector, motivating a renewed look at the United States, and underscoring the importance of up-to-date estimates.

Data Linking Employers to Workers

The data for this analysis are drawn from the U.S. Census Bureau's *Longitudinal Employer-Household Dynamics* (LEHD), *Longitudinal Business Database* (LBD) and Census' *Business Register* (CBR). Merging these three databases allows us to track businesses and establishments over time, while observing their revenues, payroll, and the age composition (and other demographic characteristics) of their workforces. The data available for this analysis span the years 1997 to 2014.

The LEHD links state administrative unemployment insurance records, IRS employer tax information, and Census data on establishments to provide an accurate and comprehensive account of employment and earnings at detailed geographical and industry levels. Not all states have elected to participate in this program. For the years included in this analysis, 29 states participate in the LEHD,[4] covering 95 percent of employment in the United States.[5]

The LBD provides information on firm payroll and number of employees. The CBR is a comprehensive census of U.S. businesses and establishments. It contains data on the location and industry of all domestic U.S. business establishments. Linked with the LEHD and LBD, the resulting dataset allows matching of workers to establishments, and calculating the share of each establishment's workers falling in different age categories, young (under 30), prime-age (30-54), and older (55 and over). The linked data further document the industry of each establishment and its precise geographic location. The latter is aggregated up to the commuting-zone level, which is the relevant geography for studying labor markets.

Table 1 shows descriptive statistics for the sample of firms. In this sample, the average revenue per worker is $292, while the average revenue per dollar of payroll is $6.2. The share of workers age 55 and over is 15 percent, while prime-age workers make up 56 percent of the workforce.

Descriptive and Quasi-Experimental Estimation of the Value of Older Workers

The analysis in this paper has two parts. The main analysis estimates the association between the share of a firm's workers age 55 and over and that firm's productivity and profitability, and how these associations vary by industry. The secondary analysis focuses on a limited but important industry, manufacturing, to see whether a more causal analysis in this context sheds a different light on the question.

Descriptive Estimates of the Productivity and Profitability of Older Workers

This analysis aims to estimate the productivity and profitability of workers age 55 and over. Productivity is defined as the total revenues of a firm divided by its employees. Profitability is defined as how much revenue is generated per dollar of payroll.

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[4] The states are: Alabama, Arizona, California, Colorado, Connecticut, Delaware, Indiana, Iowa, Kansas, Maine, Maryland, Nebraska, Nevada, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, Wisconsin, and Wyoming.
[5] The LEHD is a quarterly dataset. However, because the other linked datasets are at an annual resolution, for these quarterly series we take the fourth-quarter values.

This relationship likely varies substantially across different industries, so firms are divided into their two-digit NAICS industries. The exception is that agriculture, mining, utilities, and construction are considered one industry, ensuring that these relatively small industries are broad enough that privacy is maintained for the relevant establishments. Also, public administration is omitted since it is unclear that revenue is a good indicator of productivity in the context of public services.

Since having a retirement plan at the firm could allow marginal older workers to retire, leaving only more productive workers, the analysis controls for plan availability. The analysis also controls for firm size and age, and other demographics of the workforce (shares of women, members of different races/ethnicity, and shares with different educational attainments) to ensure the comparison is between firms with otherwise similar workforces. Finally, the estimated regressions control for geography and secular trends in productivity: fixed effects for each firm's commuting zone are included, as are state-by-year fixed effects allowing for nonparametric time trends that differ arbitrarily across states.[6]

These criteria yield the following equation, estimated by OLS:

$$Y_{f,t} = \alpha + \beta_1 S55_{f,t} + \beta_3 SPA_{f,t} + \beta_4 S55_{f,t} * SPA_{f,t} + \beta_5 X_{f,t} + \varepsilon_{f,t} \qquad (1)$$

Here $Y_{f,t}$ is the productivity or profitability of firm *f* in year *t*. $S55_{f,t}$ is the share of workers in firm *f* in year *t* that were ages 55 and over, while $SPA_{f,t}$ is the share of prime-age workers in the firm-year. $X_{f,t}$ is a vector of other controls described above.[7] Standard errors are clustered by commuting zone, and the regressions are weighted by the number of employees at the firm.

The focus of the analysis is the following thought experiment: how would productivity and profits change if the share of older workers were increased by one percentage point at the expense of reducing the share of workers under age 30 (the omitted group)? This tradeoff between the oldest and youngest workers makes sense since, unlike prime age workers, the more extreme-age workers are more likely to be part time, less likely to be strongly attached to the

[6] The location of a firm is based on the commuting zone that has its modal number of employees.

[7] Specifically, the firm-level controls: size and age of the firm and an indicator for whether it offers a retirement plan; the demographics of its workforce: share female, Black, Asian, Pacific Islander, mixed-race, Hispanic, those with some college and those with a college or postgraduate degree; and the commuting zone and state-by-year fixed effects.

employer, and generally have more elastic labor supply.[8] In conducting this thought experiment, it is important to account for possible complementarity between older and younger workers.[9]

The estimated relationship between older workers and firm outcomes thus depends on the existing share of prime-age workers who might be complemented or substituted by these older workers. The object of interest is, therefore, $\beta_1 + \beta_4\overline{SPA_{f,t}}$, where $\overline{SPA_{f,t}}$ is evaluated at the industry mean of prime-age workers for the firm's industry.

Quasi-Experimental Evidence of the Productivity of Older Workers in Manufacturing

While the regression above will show the correlation between the share of older workers and the productivity and profitability of the firm, controlling for observable characteristics and retirement plan coverage, it will not yield a causal estimate of the effect of older workers on productivity. For example, if firms with low productivity tend not to hire new workers, the estimate will show that older workers reduce productivity when, in fact, it is low productivity that leads to an older workforce. To provide a different perspective on the question of how older workers affect firm productivity, the paper turns next to a TSLS approach, using the age of the labor market the firm occupies as an instrument.

The TSLS is based on the intuition that firms are simultaneously facing two markets: a market for products, in which firms are the supplier, and a market for inputs, in which firms are the consumer. To the extent that these markets are not simultaneously determined, changes in the supply of labor a firm faces may be distinguishable from changes in the demand for products the firm sees in the product market. Furthermore, some industries, particularly manufacturing, do not seem to have a clear link between their geographical location and their product market. In contrast, labor is relatively immobile, and firms must draw their workers from the local labor market of their establishments.

Building on these assumptions, the TSLS approach will restrict attention to single-establishment manufacturing firms and consider their commuting zones. The first stage predicts the age structure of establishments based on the age structure of their commuting zone; meanwhile the second stage estimates the correlation of predicted age structure with establishment productivity and profitability. In this way, the variation in firm age structure is

[8] Fiorito and Zanella (2012).
[9] Backes-Gellner and Veen (2013).

driven by the variance in availability of workers of different ages, rather than changes in the demand for the firm's product. The regressions estimated in this stage will mirror those above, except that they will not control for the share of prime-age workers and $S55_{f,t}$ will be replaced by $\widehat{S55_{f,t}}$, the predicted share of workers over age 55 based on the following first-stage regression:

$$S55_{f,t} = \gamma + \delta_1 CZ55_{f,t} + \delta_2 X_{f,t} + \theta_{f,t} \qquad (2)$$

Where $CZ55_{f,t}$ is the share of the firm's commuting zone's population over age 55. In these regressions, standard errors will be clustered at the commuting-zone level, and results are weighted by employment. $X_{f,t}$ here includes all of the controls in equation (1), except for the relative shares of young and prime-age workers.

While TSLS can estimate causal effects, it relies on strong assumptions. In this case, the assumption is that the age structure of an establishment's commuting zone has no effect on productivity except through its effect on the establishment's available workforce. While the focus on manufacturing attempts to ensure that the local age structure does not affect the product demand faced by the firm, potential sources of bias still exist. For example, firms may select where to locate their establishments due to the age structure of the local population.[10]

Descriptive Estimates of the Value of Older Workers

The main purpose of this analysis is to provide industry-specific estimates of the association between the age structure of the firm and firm performance. Table 2 shows the share of prime-age workers by industry. Meanwhile, Figure 2 displays the estimates of $\beta_1 + \beta_4 \overline{SPA_{f,t}}$ for the different industries for revenue per worker (a measure of productivity), while Figure 3 does the same for revenue per wages (a measure of profitability).[11]

Figure 2 does not show a clear pattern of a negative relationship with an older workforce. Excluding finance, which is a clear outlier (for both productivity and profitability of older workers), other industries are roughly evenly distributed around 0, with those displaying a

[10] A further threat to identification is that older commuting zones may be served by local governments with a smaller tax base, or with higher public health expenses, leaving fewer resources for production-enhancing public goods such as infrastructure. The state-year and commuting zone fixed effects partially control for such differences but cannot completely eliminate them.

[11] For full regression results, see Appendix Table 1.

negative relationship with age (such as "other [non-public] services") generally more than counterbalanced by industries displaying a positive relationship (such as retail).[12]

In particular, manufacturing, retail, and management all have estimates of the association of increased older worker share and productivity exceeding $100 per worker (all significant at the 5-percent level). In other words, given the share of prime-age workers in these industries and the complementarities of older and prime-age workers in the industries, increasing the share of older workers at the expense of younger workers is associated with an increase of more than $100 per worker in firm revenues. Conversely, only other services and finance display losses of revenue-per-worker of around $100 or more from increasing the share of older workers (none of the other negative estimates are statistically significant at the 5-percent level, either).[13]

The picture on profitability is more lopsided, with the estimates generally indicating that a larger share of older workers is associated with lower profits. The magnitude of the relationship is substantial; for many industries, a 1-percentage-point increase in the share of older workers is associated with a $1 or more decline in revenue to payroll, of which information, finance, real estate, arts, and other services are significant at the 5-percent level (see Figure 3), while the mean ratio of revenue to payroll is $6.2 (see Table 1). The only industry displaying a significantly positive relationship between the share of older workers and profits is Accommodations (and the magnitude of the relationship is modest, at 72 cents per dollar of wages for every 1-percentage-point increase in the share of older workers).

Furthermore, considering a more comprehensive measure of compensation beyond payroll is likely to aggravate this relationship: older workers are likely to cost more in health insurance premiums and in deferred compensation such as defined benefit pension costs or employer matches to defined contribution plans. This pattern is consistent with a large body of empirical evidence that wages continue to increase with tenure even after productivity growth has flattened out. Many theories seek to explain this pattern, but the consensus is that older workers get paid more than their younger counterparts for reasons beyond simple productivity.[14]

All in all, older workers appear as productive as younger workers, but they cost more. However, a concern with all these estimates is that a declining firm may have a large share of

[12] Other non-public services is a broad category including disparate services such as automotive repair, personal care, pet care, and religious organizations.
[13] Real estate shows a loss of close to $100, but it is not significant at the 5-percent level.
[14] For a review of this literature see de Hek and van Vuuren (2011).

older workers because young workers do not wish to enter it. If that is the case, we would find a negative association between the share of older workers and firm performance, but this association would not reflect the causal impact of an increasingly older workforce. The next section shows the results of the TSLS estimation aimed at addressing this concern.

TSLS Estimates of the Value of Older Workers in Manufacturing

Firms must draw their workers from the labor markets surrounding their establishments. While this geographical link may have weakened with pandemic work-form-home flexibility, in the relevant years workers would generally work in person. Furthermore, in the manufacturing industry working from home is particularly challenging. Thus, the age composition of local labor markets in large part determines the age of workers available to local manufacturing establishments. This intuition underlies the identification strategy adopted here.

Table 3 shows the first stage of the TSLS. The share of the commuting zone population age 55 and over is indeed predictive of the share of older workers in the commuting zone's manufacturing establishments. Thus, the analysis proceeds to use the share of the population age 55 and over as the basis for estimating the firm's older-worker share.

Table 4 shows the TSLS results alongside equivalent OLS estimates. Columns 1 and 2 display the results for revenue per worker, while columns 3 and 4 show the parallel results for revenue per dollar of payroll. The OLS results here differ from the results presented in the previous section for manufacturing for two reasons: these regressions no longer control for the share of prime-age workers, and they encompass only single-establishment firms. Nevertheless, the share of workers age 55 and over is still not related to firm productivity or profitability under these conditions when estimated with OLS (columns 1 and 3).

This lack of systematic relationship between the share of older workers and firm outcomes holds in the TSLS estimation as well. Column 2 indicates that the share of older workers is not statistically significantly related to productivity, while Column 4 shows the same null result for profitability. Thus, in this causal analysis, we find no evidence that older workers are harmful to firm performance.

Conclusions

As the working population ages, a prevalent worry is that these demographic trends will undermine prospects for economic prosperity. From the narrower perspective of employers, workforce aging raises the possibility that productivity and profitability will be set back. The evidence of age discrimination in hiring suggests that some employers are being influenced by these fears in practical management decisions. And advocates for longer working lives must contend with the fact that only quite limited evidence exists on whether such fears have any basis in fact.

The current analysis lays out evidence based on the most recent available data, for the largest possible sample, covering the vast majority of US employment. The findings give reason to hope that, in general, workforce aging is not a major cause for concern regarding firm productivity and profitability. While estimates vary by industry, as a whole we find little evidence that older workers are systematically associated with lower productivity as compared to very young workers. Furthermore, a secondary analysis aimed at addressing issues of reverse causality similarly finds no evidence that older workers causally reduce productivity or profitability in the limited but important manufacturing sector.

Together with results from previous work in this series of papers, the results here are cautiously optimistic. The previous papers found that – when surveyed – employers perceive older workers to be costlier but more productive than younger workers. Other findings from the previous papers suggest that older workers face a reasonably broad selection of job openings, albeit with a relative dearth of fringe benefits, so that robust demand for older workers is not likely to be reversed by the shifting landscape of occupations in the U.S. economy over the next decade. The analysis here finds that, for their part, employers should not be hesitant about employing older workers – we find little evidence that these workers are less valuable to their employers than younger workers.

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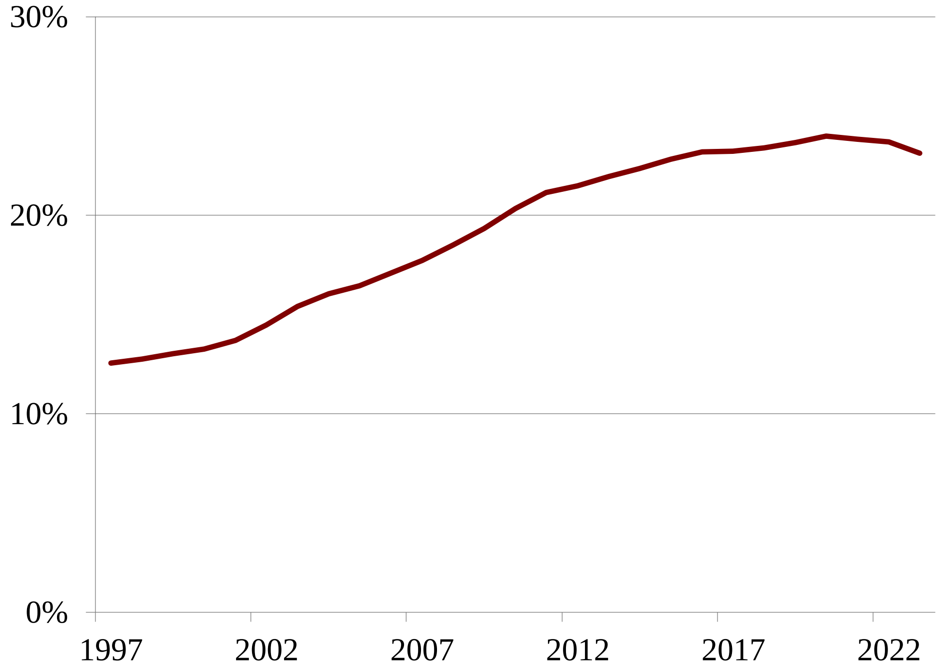
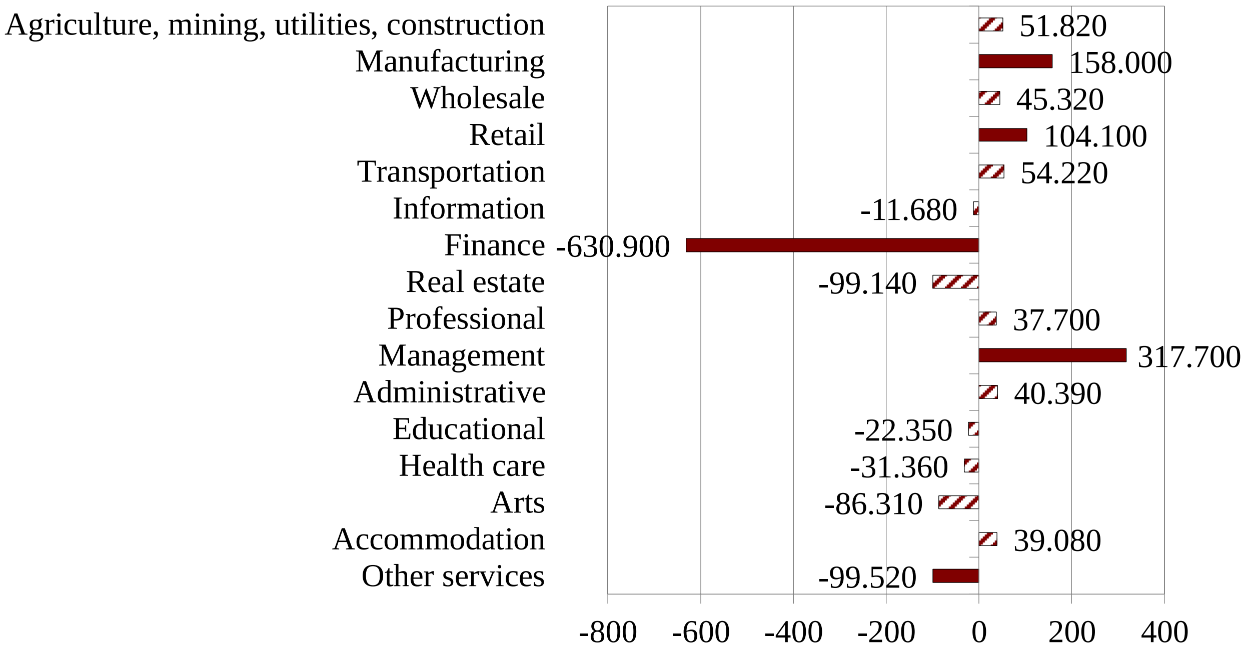
Tables and Figures

Figure 1. *Share of Workers Ages 55 and Over, by Year*



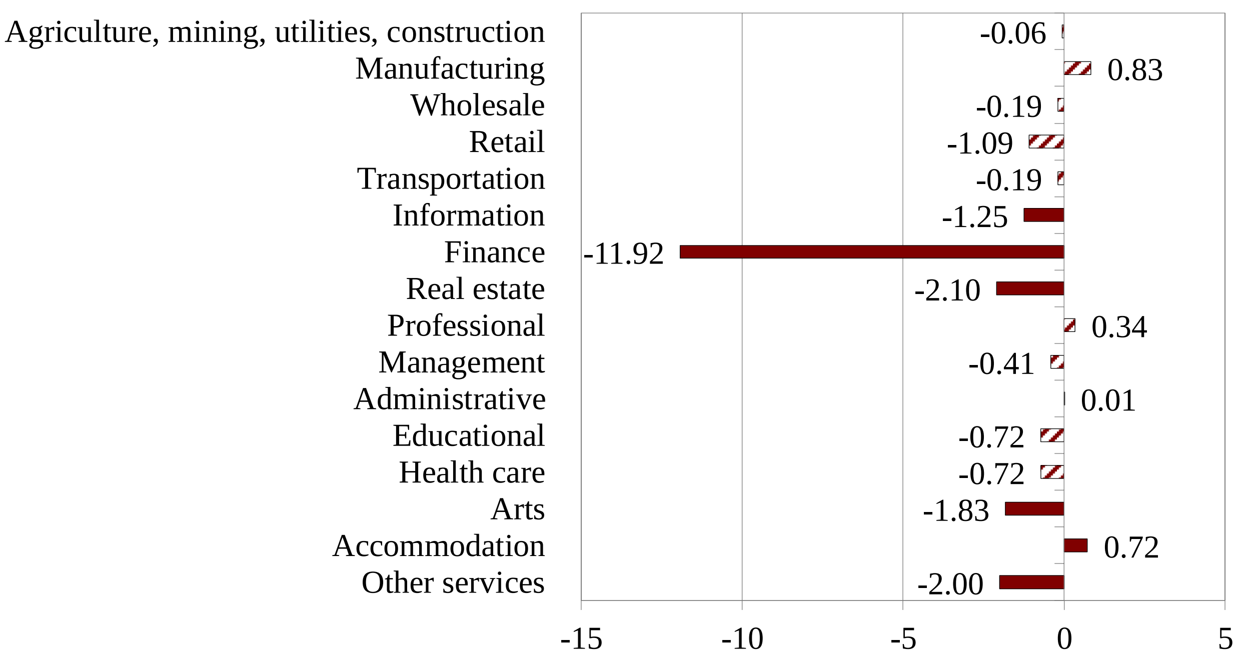
Source: Authors' calculations from the *Current Population Survey* (1997-2023).

Figure 2. *Estimated Effect of Increasing the Share of Workers Ages 55 and Over on Revenue per Worker, by Industry*



Note: Solid bars are statistically significant at least at the 5-percent level.
Source: Authors' calculations based on the *Longitudinal Employer-Household Dynamics* (LEHD) (1997-2014).

Figure 3. *Estimated Effect of Increasing the Share of Workers Ages 55 and Over on Revenue Per Wages, by Industry*



Note: Solid bars are statistically significant at least at the 5-percent level.
Source: Authors' calculations based on the LEHD (1997-2014).

Table 1. *Summary Statistics at the Firm Level*

	Mean	Standard deviation
Revenue / wages	6.20	46.71
Revenue / workers	292.10	755.00
Revenue	29,120,000	68,430,000
Wages	4,238,000	7,070,000
Workers	123,600	266,800
Firm age	27.92	7.11
Has plan	78.16%	41.32%
Age >= 55	15.31	18.25
Prime age	56.20	24.42
Female	42.34	28.26
Black	10.25	14.09
Asian	3.39	8.00
Pacific Islander	0.20	1.26
Two+ races	1.42	3.48
Hispanic	9.75	14.33
Some college	31.12	17.28
Bachelor's+	31.61	25.68
Age >= 55 in commuting zone	20.31	3.65

Sources: Authors' estimates from the LEHD, *Longitudinal Business Database* (LBD), and Census' *Business Register* (CBR) (1997-2014).

Table 2. *Share of Prime-age Workers by Industry*

Industry	Share prime age
Agriculture, mining, utilities, construction	60%
Manufacturing	63
Wholesale	62
Retail	46
Transportation	60
Information	60
Finance	61
Real Estate	56
Professional	60
Management	56
Administrative	56
Educational	56
Health Care	58
Arts	47
Accommodation	38
Other services	54
Overall	56

Source: Authors' calculations from the *Current Population Survey* (1997-2014).

Table 3. *TSLS First Stage*

	Share age >= 55
Share age >= 55 in commuting zone	0.846**
	(0.414)
Has plan	-0.017***
	(0.00385)
Firm size	3.51E-07**
	(1.59e-07)
Firm age	0.00119***
	(0.000188)
Female	-0.0471***
	(0.0117)
Black	-0.0829***
	(0.0236)
Asian	-0.0821***
	(0.0236)
Pacific Islander	-0.185***
	(0.0515)
Two+ races	0.0446
	(0.132)
Hispanic	-0.115***
	(0.0152)
Some college	-0.00175
	(0.0174)
Bachelor's+	0.0806***
	(0.0239)
Constant	-0.00481
	(0.0940)
Observations	2,050,000

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05.
Source: Authors' estimates from the LEHD, LBD, and CBR (1997-2014).

Table 4. *TSLS and OLS Equivalents*

	(1)	(2)	(3)	(4)
	OLS revenue per worker	IV revenue per worker	OLS revenue per wages	IV revenue per wages
Has plan	8.948	25.22	0.0864	0.263
	(7.325)	(18.18)	(0.0972)	(0.204)
Age >= 55	-15.66	939.7	-0.0381	10.31
	(24.46)	(869.6)	(0.261)	(9.429)
Firm size	0.000268	-0.0000636	-0.000000308	-0.0000039
	(0.000203)	(0.000427)	(2.47e-06)	(4.36e-06)
Firm age	6.005***	4.868***	0.0571***	0.0447***
	(0.363)	(1.129)	(0.00618)	(0.0137)
Female	-56.52**	-11.63	-0.332	0.154
	(23.67)	(49.95)	(0.365)	(0.619)
Black	65.85*	145.3*	1.354**	2.214**
	(36.18)	(87.12)	(0.534)	(1.016)
Asian	28.46	107.2	0.504	1.358
	(29.35)	(75.99)	(0.523)	(0.953)
Pacific Islander	-44.25	134.5	-1.196	0.74
	(186.6)	(241.6)	(2.510)	(2.950)
Two+ races	152.6	110	1.344	0.883
	(109.2)	(172.7)	(1.371)	(2.085)
Hispanic	-33.8	76.51	-0.122	1.073
	(25.36)	(102.0)	(0.349)	(1.135)
Some college	81.1***	82.37**	0.237	0.251
	(28.46)	(32.31)	(0.415)	(0.436)
Bachelor's+	144.2***	66.64	0.748**	-0.0916
	(23.42)	(68.48)	(0.301)	(0.812)
Constant	825.5***	695***	16.31***	14.90***
	(191.4)	(245.9)	(3.422)	(4.128)
Observations	2,050,000	2,050,000	2,050,000	2,050,000

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' estimates from the LEHD, LBD, and CBR (1997-2014).

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