Trade Shocks and Youth Jobs

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Abstract

This paper examines the impacts of trade on youth employment in the US. The overarching goal is to link lessons from the decline of manufacturing jobs in the past decades to future prospects for the US economy. We find that exposure to import competition hurt jobs for youth in the US at much higher rates than for older workers. Our analysis uses buyer-supplier relationships between sectors of the US economy to show that the direct effects of trade on importing sectors under-represent the impact of trade on jobs.

1 Background

The US Midwest has been losing jobs for decades. The housing bubble of the early 2000s may have masked the decline, before the catastrophe of the Financial Crisis and the layoffs of the Great Recession of 2008-09 laid the issue bare again. The decline of US manufacturing employment had a disproportionate effect on the Midwest region. An estimated 6.6 million US manufacturing jobs were lost between 1977 and 2012, and more than 2 million of those were in the Midwest [Fort et al., 2018]. The resulting economic transformation explains the phenomenon of shrinking cities and other social challenges of the Rust Belt. Different age groups felt the changing jobs environment differently. The total number of US jobs grew slowly from 137 million in Q2 2000 to 140 million in Q2 2010. Over the same decade, jobs held by young people in the 16-25 age range fell from 20.5 million to 17.2 million, a 16% drop that has not been fully reversed to date [Bureau of Labor Statistics, 2018]. The focus on youth in this policy brief is motivated by this employment downturn, and the dynamic implications of having fewer younger workers in the workforce.

Youth employment numbers fell every year between 2002 and 2010 in the US Midwest, reflecting the pre-Recession decline in manufacturing jobs. Furthermore, the 10% downturn in 2009 for youth employment in the Midwest was twice the 5% decline in the rest of the country. Figure 1 highlights the challenges faced by the region, and other information sources show it can be linked to the prevalence of manufacturing jobs in the Midwest. The US lost more than 5 million manufacturing jobs between 2000 and 2010, and the Midwest, with just 20% of the population, represented more than 30% of the manufacturing job losses for that decade.

The linked circles in Figure 1 represent the year-on-year growth rates for jobs held by persons below the age of 25 in the US Midwest. (The Midwest in this brief stands for the

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1 The broad pattern of decline in manufacturing is well documented in the literature [Acemoglu et al., 2016; David et al., 2013; Fort et al., 2018].
The graph plots year-on-year employment growth for persons aged 14-24 in the Midwest as linked circles on the vertical axis, (and for the US as squares). Data from the U.S. Census Quarterly Workforce Indicators Database (QWI).

11 states in the North Central divisions of the US Census regions). The light-colored square markers represent the growth rates of all jobs in the region, by contrast. The graph shows a pattern of correlation between age groups in employment growth, but what is more notable is that job losses have been more severe for the youngest age-group, especially before the recovery that followed the Great Recession of 2008-09.

Imports contributed to the job losses captured in Figure 1. The decline of US manufacturing jobs remains the subject of debates, but nonetheless, the impacts of rising import competition and the decline of US firms that were unable to compete with low-cost imports is well-documented [Acemoglu et al., 2016, David et al., 2013, Fort et al., 2018]. Several papers focus on imports from China specifically, given its dramatic export expansion of the last decades. The product innovation and productivity gains that enabled the expansion of Chinese exports are also well known [Amiti and Freund, 2008, Olabisi, 2017, Schott, 2008].

This policy brief will emphasize the impacts of trade on youth employment. The overarching goal is to link lessons from the decline of the past decades to future prospects for the regional and US economy. The main finding from the analysis in Section 3 is that exposure to import competition hurt jobs for youth in the US at much higher rates than for older
workers. For each job lost to import competition by 35-44 year-olds, about 1.8 jobs are lost by workers below the age of 25.

The paper has two novel elements. First, it focuses on the age-group differences in the pattern of employment. This dimension has been largely ignored by the China-shock literature. Second, the earlier papers in the literature considered only the direct impacts of trade, or the first-order transmission of those impacts along the manufacturing supply chain [Asquith et al., 2019]. Studying the effects of trade on related industries to the importing sector is a recent and developing area, to which this paper contributes. A note of caution from this study’s findings is that US job woes cannot be attributed entirely to China. Figure 1 shows that the most severe job losses came with the housing-induced recession of 2009. Furthermore, just as imports contributed to manufacturing sector job losses, they contributed to service sector job gains [Feenstra et al., 2019].

The long-term impacts of trade on local economies matter to young workers: In the first place, they may be more vulnerable to positive or negative shocks to jobs in their localities [Dennett et al., 2013, Jaimovich and Siu, 2009]. Young employees being fired first in a downturn may be related to their lack of experience (or social capital). The younger workers that are laid off during local economic downturns may also be less able leverage their social networks in searching for new jobs or returning to their old jobs when the economy bounces back. Second, the long-term effects for youth are greater, as they have more years of earnings ahead of them that could be affected by a pay cut, job loss, raise or promotion. College graduates entering the job market in a recession have been shown to have worse occupational quality matches, and persistent negative wage effects [Altonji et al., 2016, Kahn, 2010, Oreopoulos et al., 2012]. Related papers that motivate this concern includes works that show early unemployment in a career could leave a career ‘scar’ with a nontrivial wage penalty that lasts beyond ten to twenty years [Gregg and Tominey, 2005, Mroz and Savage, 2006].

Increasing exports could lead to more jobs, and the evidence suggests that there has been a historic expansion in US exports over the last two decades [Lincoln and McCallum, 2018]. This may partially explain why, as US manufacturing jobs declined, service and related sectors expanded. Sectors exposed to import competition, like machinery, lost workers; but the food and food service sector generated more jobs, as they used low-cost imported inputs and were less exposed to import competition [Caliendo et al., 2019]. Other related papers show that the decline in US manufacturing jobs have been more than offset by job gains in related sectors [Feenstra et al., 2019].

Studying import competition effects for linked upstream and downstream industries is increasingly necessary, given how employment in the US Midwest is tied to the supply chains
for large firms, (e.g., the automotive supply chain). Therefore, demand from downstream in the supply chain affects how firms choose to invest in capital and to hire or fire employees. (Changes to the supply of inputs from upstream producers may also play a role). In addition, studying buyer-supplier relationships makes it possible to recognize that the direct effects of trade may not fully represent its impact on the US economy. One sector could see job losses because of higher imports of low-cost substitutes, while the sectors using the imported goods as inputs see higher employment because of the lower operating costs that imports provide. The effects of trade on buyers and suppliers can be outside the manufacturing sector which competes directly with imports.

Figure 2 shows the structure of the United States economy, as a network of supplier-buyer relationships between firms across sectors. (The data used for the plot was the BEA 2002 Benchmark Input-Output Table). For example, the graph shows the centrality of wholesale and storage activities to manufacturing firms, just as it shows the strong connections between real estate services and many services sectors, including hospitals. The size of each node represents total output from the sector, and links or edges between nodes represent shipments of a sector’s output to be used as inputs in another sector. For example, the output of the metals sector serves as inputs for the makers of motor parts, which are in turn inputs into motor vehicles. The thickness of each link represents the proportion of inputs for the sector at the end of the link that comes from the industry at the source of the link.

The pattern of linkages show both obvious and interesting patterns: agriculture is upstream of food, as expected, and architectural services are a needed input for the construction sector. In comparison, it may be surprising that the real estate sector is notably upstream for crop farming, for persons unfamiliar with the extent to which land rentals are a large part of farm production. Only linkages that exceed 5% of the flows for a sector are included in the graph, and only the largest sectors are labeled to keep the graph legible. The sectors are grouped into four broad communities, marked by different colors: [1] Services, [2] Mining, Energy and Utilities, [3] Agriculture and Food-related Sectors, and [4] Manufacturing, Construction and Other Industrial Sectors.

There is a high degree of employment co-movement between linked sectors in the US economy, even if the underlying shocks to each sector are different. The network structure of buyer-supplier linkages among sectors means that the propagation of idiosyncratic shocks to the “crucial” sectors, such as sectors providing intermediate inputs for most of other sectors, cannot be diversified away and can contribute to aggregate GDP movements. The same could apply to large sectors absorbing the output of many other industries.
The graph shows linkages between US sectors, to illustrate the concept of upstream and downstream sectors. The arrows show the direction of flow for materials, so for example, one can see that Electric Utilities are downstream of the coal- and oil-mining sectors. Similarly the figure illustrates how the food manufacturing sector is upstream of restaurants but downstream of crop- and animal-farming. Data from the BEA 2002 Benchmark Input-Output Tables.

2 Methods and Data

2.1 Methods

We adopt an instrumental variable approach to estimating the effects of trade on US jobs. (We do not estimate regional job losses for this paper because of data limitations - no sources we know provide state-level imports for the years before the Great Recession). Using US-level trade patterns to explain regional job gains and losses could be misleading, because imports are not uniformly distributed throughout the country, and their effects may not be, either. The key variable and primary measure of trade shocks is import exposure – the ratio of changes to imports relative to the baseline domestic production in a US sector. (We use export exposure to measure the positive job effects of US exports). Section 2.2 describes the
variables and how they are constructed from the data.

The instrument we use to address endogeneity for US import exposure in a given sector, is the import exposure for other high-income countries in the same sector, as defined in [Acemoglu et al. 2016]. Using the import exposure of other high-income countries as an instrument helps to avoid the concern that imports surged because of domestic shocks to the US economy, while taking advantage of the fact that other high-income economies are similarly exposed to trade with China, without having perfectly correlated import demand shocks with the US. To recognize changes in the US economy unrelated to trade, the estimation approach includes controls for pre-trend and sector-specific patterns to the changes in US employment.

2.2 Data

We use employment data from the US Census Quarterly Workforce Indicators (QWI) database. The primary advantage of the QWI data is the dis-aggregation of employment into age-groups, and industries. The data organize employment into NAICS 4-digit industries, (which are concorded to match the 369 standard industry classifications for which import exposure is calculated). Employment is reported for age-groups that we collapse to the following 10-year intervals: 14-24, 25-34, 35-44, 45-54, 55-64 and 65+. The reported employment data cover the years 2001 to 2016 for most states.

Three reasons motivate our limiting the periods for analysis: first, as shown in Figure 1, job losses in the US Midwest were lower than the national average before the Great Recession, after which they matched national averages in the recovery that followed. Second, it is important to highlight the effects of trade on the economy before the Great Recession began in 2008 – including the years after that may conflate trade’s effects with outcomes created by the bursting of the housing bubble – the primary trigger for the Great Recession. Third, data limitations prevent any study of the most recent years of trade exposure for US sectors.

Our measure of import exposure captures the change in US imports from China, relative to US sector size for each of the tradable goods sectors. Formally, import exposure for a sector $i$ in the first analysis period, $Exposure_{i}^{imp}$ is defined as:

$$Exposure_{i}^{imp} = (Imports_{i}^{2007} - Imports_{i}^{2000})/(Output_{i}^{2000} + Imports_{i}^{2000} - Exports_{i}^{2000})$$

The definition recognizes import exposure as the change in imports over a time period, relative to the baseline absorption or size of the sector at the beginning of the period. The baseline absorption represents the level of US output and imports less exports of the good. The export exposure is defined as $Exposure_{i}^{exp} = (Exports_{i}^{2007} - Exports_{i}^{2000})/Output_{i}^{2000}$. The
data also include similar trade exposure measures for other high-income countries. The trade exposure measure for other high-income countries will be used as an instrumental variable, as mentioned in Section 2.1. The second period uses the same definition but for the years 2010-2017 (2016, if 2017 data was not available). The measure comes from publicly available replication data [Acemoglu et al., 2016].

3 Analysis

The reduced form of the estimation approach in this paper explains changes in the (age-specific) employment of sector \(i\) with the sector’s import and export exposure, as well as other relevant job drivers for the sector:

\[
\log(\text{EmploymentChange}_{i}^{\text{age}}) = \alpha_0 + \alpha_1 \text{Exposure}_{i}^{\text{imp}} + \alpha_2 \text{Exposure}_{i}^{\text{exp}} + \alpha_3 \mathbf{X}_i + \varepsilon_i \tag{1}
\]

Employment change is the ratio of the number of jobs in each period for a given age-group, and the import and export exposure variables are as defined in Section 2.2. The estimation also includes dummy variables as control for the 10 broad sector groups that make up manufacturing, to recognize that the food manufacturing employment trend, for example, does not exactly match the trend for woodwork and furniture-making. The \(\mathbf{X}\) element represents a vector of controls that include industry-level computer investments, investments in automation or high-tech equipment, and other investments in capital broadly defined. \(\mathbf{X}\) also includes production workers’ share of employment in the sector, as a proxy for its dependence on management or knowledge-workers, the ratio of capital to value-added, as a proxy for capital intensity and average wages in the sector. The set of controls also includes changes in industry wages over the decade from 1990 to 2000 (or the following decade), as well as the change in the sector’s share of total US employment. The latter variables address concerns that the estimation approach conflates import exposure with about long-term growth or decline trends in US sectors.

To address the argument that imports in a sector could affect jobs in upstream or downstream sectors, the main results use an extension of Equation 1 with average import exposure measures for each sector’s upstream and downstream sectors. The instruments for these variables are, as for the main variables, the import exposure of downstream and upstream sectors in other high-income economies, following other papers [Acemoglu et al., 2016, Feenstra et al., 2019]. For all the estimates, the sector employment in the year 2000 is used as regression weights, so that the coefficients are representative for the US economy for main

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2The import exposure data is available online at [https://www.ddorn.net/data.htm](https://www.ddorn.net/data.htm)
analysis period of 2000-2007 period. The period was one of growth (save for a mild downturn in the last quarter of 2001), leading up to the Great Recession that followed the financial crisis in 2008. We include the 2010-2017 period in our analysis to highlight employment changes in the recovery that followed the recession.

The results are estimated separately for the pre-Recession years, and the years following the Great Recession. The job losses in the first period could not have been caused by the bursting of the housing bubble. On the other hand, the large effect of the Financial crisis on investment and hiring, implies that results from the post-Recession years may reflect other changes in the economy not necessarily linked to trade exposure, but to the adjustments that represented the recovery from a large shock to the US economy in 2008-09.

Table 1 explains the main results, showing that increasing imports generally led to lower employment levels in most manufacturing sectors. The instrumental variable regression estimates explain employment change for each US sector with the corresponding change in import and export exposure. (The import and export exposure terms are estimated in the first stage, using the import and export exposure of similar high-income countries. This means that changes to US imports for each sector reflects how other countries became more productive and increased exports to high-income countries in general). The estimates include controls for the pre-trend state of each sector, as well as changes to the sector, e.g., its share of total employment and its average wages.

As expected, the results show that increasing imports lead to job losses and increasing exports lead to job gains. A 1% increase in imports relative to the baseline size of a sector leads to a 0.01% decrease in jobs for the sector. Similarly, a 1% increase in exports relative to baseline sectoral output led to a roughly 0.05% increase in jobs for the average sector before the Recession. (The results for the period after the Recession are more statistically significant, and larger with an estimated 0.1% increase in jobs for a 1% increase in sector exports). OLS estimates yield similar results, not shown to save space, as well as the more robust instrumental variable specifications presented in Table 1.

Columns 2 and 4 highlight the elevated impact of trade on youth. While the results for the first period are similar, the estimated effects of imports is roughly double the average effect in the second period, while the estimated effects of exports are equally larger for our population in the below-25 age group.

The effect of imports on linked sectors is also non-trivial. Increasing import competition in the downstream sectors that absorb an industry’s output led to job losses about four times as large on average for youth in the first period, although the effect switches signs to a large and positive value in the second period. One could speculate that this change is because US firms increase exports to the foreign competitors of their former US customers, or increase
Table 1: Main Results: Employment and Trade Shocks

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<tbody>
<tr>
<td>Import Exposure</td>
<td>-0.01***</td>
<td>(0.001)</td>
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<td>-0.01***</td>
<td>(0.002)</td>
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<td>Export Exposure</td>
<td>0.05*</td>
<td>(0.03)</td>
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<td>0.06**</td>
<td>(0.03)</td>
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<td>Import Exposure (Downstream)</td>
<td>0.02**</td>
<td>(0.01)</td>
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<tr>
<td>Import Exposure (Upstream)</td>
<td>-0.02***</td>
<td>(0.002)</td>
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<tr>
<td>Computer Purchase</td>
<td>-0.01***</td>
<td>(0.002)</td>
<td></td>
<td>-0.004</td>
<td>(0.002)</td>
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<tr>
<td>High-Tech Investment</td>
<td>-0.01*</td>
<td>(0.004)</td>
<td></td>
<td>-0.02***</td>
<td>(0.003)</td>
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<tr>
<td>Production Workers Share</td>
<td>0.18**</td>
<td>(0.09)</td>
<td></td>
<td>-0.09</td>
<td>(0.08)</td>
<td></td>
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<tr>
<td>Log Wages (in year 2000)</td>
<td>-0.09**</td>
<td>(0.04)</td>
<td></td>
<td>-0.02</td>
<td>(0.06)</td>
<td></td>
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<tr>
<td>Capital to Value-Added Ratio</td>
<td>-0.01</td>
<td>(0.01)</td>
<td></td>
<td></td>
<td>(0.01)</td>
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<tr>
<td>Change in Sector Employment Share</td>
<td>0.50**</td>
<td>(0.20)</td>
<td></td>
<td>-0.07</td>
<td>(0.14)</td>
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<tr>
<td>Change in Log Wages</td>
<td>-0.12</td>
<td>(0.09)</td>
<td></td>
<td>0.25***</td>
<td>(0.06)</td>
<td></td>
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<tr>
<td>Constant</td>
<td>1.15***</td>
<td>(0.44)</td>
<td></td>
<td>-0.57</td>
<td>(0.80)</td>
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Observations | 369 | 369 | 363 | 363 |
R^2 | 0.71 | 0.69 | 0.39 | 0.44 |

Employment data from the US Census QWI Database. The instrumental regression estimates in all columns of the table use a dummy for the 10 manufacturing sector divisions, but these are not shown to conserve space. *p<0.1; **p<0.05; ***p<0.01
employment to compete in the downstream space. Import competition in upstream sectors is not as meaningful for predicting employment downturns in the downstream sectors. The finding is not surprising, as most employers of young employees in column 4 appear indifferent to where supplies are obtained, in selecting employment levels.

Other estimated coefficients fit expectations. Sectors with high levels of automation, as measured by high-tech investments, or investments in computers experience job losses. (In the second period, the effect of hi-tech investments disappears in a statistical sense for youth employees, which may suggest that young employees hired to support automated work may be offsetting the ones laid off due to automation). The share of employment in each sector represented by production workers (compared with supervisory and support employees), also does not consistently predict the pattern of jobs losses seen in the data for the pre-Recession period. In one specification, job losses were higher in sectors with higher average wages, but this result is not robust across all the tests in the table, especially for youth employment.

Several control variables do not yield statistically significant estimates. The rate of wage growth over time does not predict the pattern of job losses. Furthermore, sectors’ share of total US employment do not predict the pattern of job losses, except in one specification, which yields estimates suggesting that growing sectors also tend to have job gains, and vice versa. There are statistically significant differences between broad industry groups in terms of job losses. These are captured using a categorical variable for the 10 broad manufacturing sector divisions, but these are not shown to conserve space. The divisions follow the pattern in earlier papers [e.g., Acemoglu et al., 2016].

Figure 3 focuses on the estimated effects of trade exposure on employment for different age groups. Using the QWI data, which reports employment for the sub-25 age group, and for all ten-year age increments through 65, a more detailed picture of the pattern of job losses to trade emerges. First, one should note that the estimated effects of import exposure are negative for all age groups. The effects are also statistically significant; it is the differences between the age groups that is notable.

Figure 3 supports the main findings in Table 1 by reporting age-group specific trade exposure effects for the cleaner estimates of the pre-Recession period. The larger estimated effects for trade on the employment of youth in columns 2 and 4 of the Table are consistent with the pattern of greater job loss severity for youth in Figure 1. (The pattern is obvious for exports, where column 4 of Table 1 shows higher estimated coefficients for the below-25 age group). The negative effects of imports on jobs, appear uniform across all columns of the table, but the detailed coefficients at the greater level of precision in the Figure, illustrate the main finding in this paper more clearly. Not only is the effects of imports on jobs more negative for the under-25 age-group, the confidence interval for this group’s estimates falls
Figure 3: Estimated Coefficients of Import Exposure by Age Group

The graph shows the estimated coefficients and confidence intervals for US import trade exposure, in the simple specification that corresponds to columns 1 and 2 of Table 1. The estimates are constructed separately for each age group.

below the confidence intervals for the estimated negative effect of import exposure on the 35-44 age group, as well as workers older than 55. Trade had the greatest impacts, even in the short term, on the employment of youth.

4 Discussion

We show that the effect of increasing imports on employment is not uniform across age-groups. Young workers are disproportionately affected by import-stimulated job losses, and this calls for concern and further inquiry, given how the unemployment created by those job losses have long-term consequences over a career. For each percentage increase in US import exposure between 2000 and 2007, the estimated percentage change in employment is about

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0.005% for the 35-44 and 45-54 age groups, while it is roughly 0.009% for youths below the age of 25, almost double the effect for the 35-44 age group. (See Figure 3). The estimates also suggest that increasing exports create more job opportunities for youth, relative to the rest of the US population. These findings are consistent with previous papers that suggest greater employment volatility for youth, while calling for further inquiry into how the long-term adverse effects of the ‘scar’ of youth unemployment could be avoided.

The effects of trade on jobs are magnified when considering the networked nature of production, or simply put, the supply chain effects of trade. While a 1% change in import exposure for a sector is expected to yield a 0.01% decrease in employment, based on pre-Recession data, the same change in import exposure for downstream sectors – the industries buying the sectors’ output, is expected to lead to a four-fold relative decline in jobs, at 0.04%. This means that while imports of cars may lead to a loss of car-assembly jobs for example, the impact of car-imports is four times greater on average, for the industries supplying castings, windshields and other components to the auto-assembly sector. These results are expected to change over time, as the structure of US employment changes, but the pattern of larger employment effects on youth is expected to persist.

These findings are particularly relevant to the economy of the US Midwest, which housed a disproportionate share of US manufacturing, and which is still linked through buyer-supplier linkages to some of the largest sectors in the US economy. The region’s agricultural sector is linked to some of the largest food manufacturers, just as its metals and materials production serves many of the largest manufacturing operations in the country. Wholesale trade and other supply chain operations also account for a notable share of the region’s output, which effective links its employment to the jobs and imports of other sectors around the United States.

The findings are particularly relevant to the *trade war* between the US and China. As exports and imports command a greater share of the U.S. economy, there is much to learn about how trade will affect jobs in the coming years. Early indications from the trade war are that tariffs and retaliation from trade partners are costing US jobs [Fajgelbaum et al., 2019] and US consumers [Amiti et al., 2019]. How these tariffs, and the retaliation from the country’s trade partners will affect the US economy in the long run, deserves to be the subject of a future study.

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3This finding resonates with earlier papers that document racial disparities in hiring and firing, in testing the theory that African-Americans are fired first and hired last [Brown, 1997, Couch and Fairlie, 2010, Freeman et al., 1973]. Further research could examine whether the same principle applies to young workers.
References


