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The Masking of the Decline in Manufacturing Employment by the Housing Bubble

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The employment-to-population ratio among prime-aged adults aged 25–54 has fallen substantially since 2000. Many authors have commented on this decline (including Hall 2011; Moffitt 2012; Davis and Haltiwanger 2014). Hall (2014) describes it as the defining feature of the labor market since 2000. Similarly, Acemoglu et al. (2016) call the employment decline of the 2000s the "Great US Employment Sag."

The magnitude of the fall in employment and its distribution across the population can be seen in Figure 1. This figure shows the employment rate from 1980 to 2015, separately by gender and education level, using annual data from the March Current Population Survey (CPS). Most of the reduction in the employment rate since about 2000 has come from those without a four-year college degree, who we refer to as "noncollege" throughout this paper. The employment rate for prime-aged, noncollege men hovered around 85 percent from 1980 to 2000, but in 2014 was only 79 percent, fully 6 percentage points below the 2000 level. The employment rates for prime-aged, noncollege women fell from roughly 70 percent in the late 1990s to 64 percent in 2015, also a decline of about 6 percentage points relative

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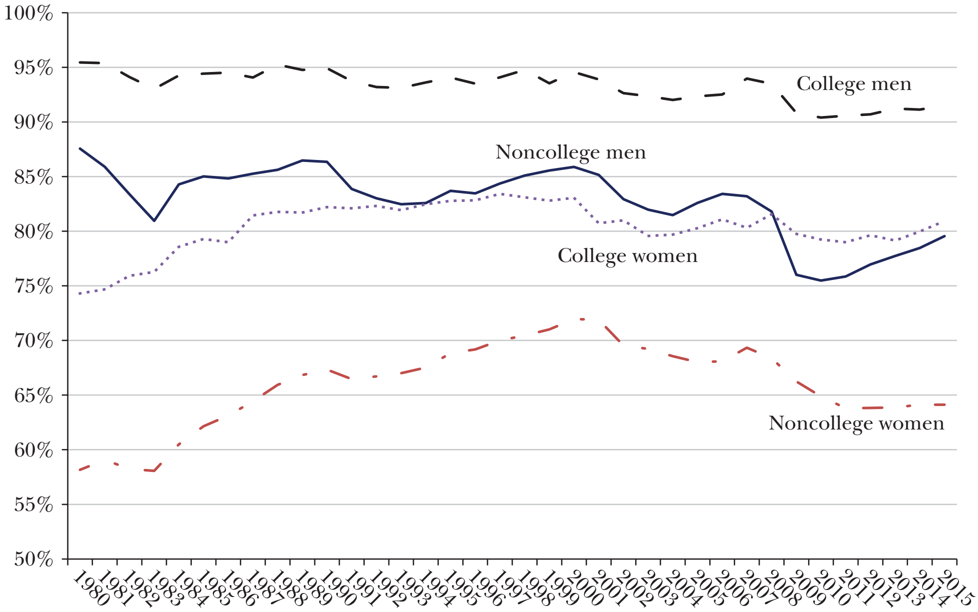
Figure 1
Employment Rate, Prime-Age Individuals, 1980–2015 Current Population Survey



Source: This figure uses data from 1980–2015 March Current Population Survey.
Note: : The "College" men and women are all prime-age adults (aged 25–54) who have at least a four-year college degree. Adults with lower levels of education are "Noncollege." The figures calculate employment rates as share of total population of each group using individual-level survey weights.

to the 2000 level. These large and seemingly persistent reductions in employment among the less-educated over the course of the 2000s were much larger than those for both prime-aged men and women with four-year college degrees, whose employment rates fell by only about 2 percentage points between 2000 and 2014.

The explanations proposed for the decline in the employment-to-population ratio have been of two broad types. Focusing on the fact that the employment rate decline was especially sharp from 2007 to 2010—that is, during and immediately after the Great Recession—one set of explanations emphasizes cyclical factors associated with the recession, including temporary declines in labor demand, economic and policy uncertainty, "mismatch" between unemployed workers and jobs, and the availability of unemployment insurance for extended periods. The second set of explanations focuses on the role of longer-run structural factors, the potential importance of which is suggested by the reduction in the employment rate even before the start of the Great Recession began, and the persistently low employment-to-population rates for low-skilled workers years after the official end of the recession. Structural explanations focus on long-term secular trends, such as the falling demand for routine tasks performed by workers in many manufacturing jobs. However, if structural factors indeed explain much of the decline in employment since 2000, it is not immediately clear why the effect of these long-term factors should have been so modest from 2000 to 2007, only to appear with sudden and pronounced effect during the Great Recession.

In this paper, we argue that while the decline in manufacturing and the consequent reduction in demand for less-educated workers put downward pressure on their employment rates in the pre-recession 2000–2006 period, the increased demand for less-educated workers because of the housing boom was simultaneously pushing their employment rates upwards (Charles, Hurst, and Notowidigdo 2016, 2015). For a few years, the housing boom served to "mask" the labor market effects of manufacturing decline for less-educated workers. When the housing market collapsed in 2007, there was a large, immediate decline in employment among these workers, who faced not only the sudden disappearance of jobs related to the housing boom, but also the fact that manufacturing's steady decline during the early 2000s left them with many fewer opportunities in that sector than had existed at the start of the decade.

We begin with a short overview of various cyclical and structural arguments about the decline in the employment-to-population ratio. We then present several different pieces of evidence which support our hypothesis that the masking and unmasking of manufacturing decline by the housing boom and bust play an important role in changes in the employment rate since 2000. The evidence we present in support of this argument includes aggregate time-series results; local labor markets evidence that exploits the large variation in the size of manufacturing decline and in the size of the housing boom and bust across different metropolitan areas in the United States; and individual-level evidence using data about the re-employment rates of displaced manufacturing workers in the Displaced Workers Survey. Our focus throughout is on prime-aged, noncollege men. However, in the conclusion we briefly discuss employment masking for prime-aged, noncollege women, as well. Our conclusion also discusses why the presence of masking and the distinction between cyclical and structural forces is important for policymaking.

Reviewing Cyclical and Structural Explanations of Employment Rate Changes Since 2000

Most of the decline in the employment-to-population ratio for lower-skilled workers since 2000 occurred during the Great Recession, as shown in Figure 1. Perhaps because of this pattern, several recent papers seeking to understand employment changes have focused on "cyclical" explanations.

One strand of this work studies the role of the negative shocks to household and bank balance sheets that arose from the recession. Using cross-region data, Mian and Sufi (2014) find that local areas that experienced larger declines in household net worth had larger reductions in employment in nontradable sectors during the 2007–2009 period. Chodorow-Reich (2014) links the decline in employment to disruptions in the banking sector, by showing that firms that had pre-recession relationships with distressed banks were much less likely to secure credit during the recession, and were much more likely to shed employment during 2007–2009.[1] Mondragon (2015) estimates the effect of local credit supply shocks on employment and finds a large effect.[2] Also broadly related to this area of research is the work of Giroud and Mueller (2015), who find that high firm leverage before the start of the Great Recession also contributed to large employment losses during the recession.

Several other papers in this literature assess other cyclical factors that were likely changed because of the recession, including increased economic and policy uncertainty, increases in sectoral and spatial mismatch, and changes in the duration and generosity of unemployment benefits and other transfer programs. Baker, Bloom, and Davis (2015) show that measures of aggregate uncertainty were high during the Great Recession relative to historical levels, and argue that this increased uncertainty can account for some of the decline in the employment rate. Similar explanations are also found in Fernández-Villaverde et al. (2015). Sahin, Song, Topa, and Violante (2014) examine the extent to which search frictions that affect the ease with which workers can move between occupations and locations may have increased the unemployment rate and reduced the employment rate. Their results suggest that these mismatch forces may explain as much as one-third of the rise in the unemployment rate between 2007 and 2010, with the effect diminishing by 2012.

The growing literature relating the decline in aggregate employment to the expansion of unemployment benefits during the Great Recession has come to mixed conclusions. Rothstein (2011) and Farber and Valletta (2013) find that although unemployment benefit extension may have propped up the unemployment rate by delaying exits from the labor force, benefit extension did not have much of an effect on the employment rate. However, Johnston and Mas (2015) and Hagedorn, Karahan, Manovski, and Mitman (2013) find larger effects of unemployment benefit extensions. Additionally, Mulligan (2012) discusses how broader policy changes that occurred during the recession—such as the expansion of the Supplemental Nutritional Assistance Program (often known as Food Stamps)—could have discouraged individual labor supply and thus reduced the employment rate.

Finally, another program that could have had an important effect on aggregate employment during the recession and thereafter is Social Security Disability Insurance (SSDI). Even before the Great Recession, there were staggering increases in enrollment, due both to reduced screening stringency and higher demand for the partial wage insurance provided by the program (Autor and Duggan 2006). Although there were no significant changes to the program during the Great Recession, research has documented a strong link between labor market conditions and SSDI application rates (Autor and Duggan 2003; Sloane 2015), and strong effects of SSDI on

[1] A large theoretical literature examines the role of tightening borrowing constraints on households and firms and how that translates into declining aggregate employment: for example, see Eggertsson and Krugman (2012) and Guerrieri and Lorenzoni (2011).

[2] Greenstone, Mas, and Nguyen (2015) also examine the relationship between local credit supply shocks to local banks and local employment outcomes. They show that while credit supply shocks do reduce credit to small firms, the employment losses of small firms have little effect on local employment rates.

both employment and earnings (Maestas, Mullen, and Strand 2013). Sloane (2015) documents large increases in disability rates between 2007 and 2011 in local markets with large increases in unemployment rates during the Great Recession. Given that disability tends to be persistent, this could explain some of the low employment rates after the recession. Her estimates, however, suggest such effects are modest. Additionally, unlike unemployment insurance and many other social insurance programs, there are often large waiting times to get onto SSDI, which means that denied SSDI applicants typically search for work after long periods of detachment from the labor market. The delay in processing applications appears to generate duration dependence in nonemployment (it is more difficult to become employed the longer one has already not been employed). So it is harder for rejected applicants to return to the labor market (Autor, Maestas, Mullen, and Strand 2015).[3] As a result, the large number of rejected SSDI applicants during the Great Recession may experience lower employment rates in the longer-run (Maestas, Mullen, and Strand 2015).

While the preceding papers seem to explain a meaningful share of the employment changes observed over the course of the Great Recession, a problem for the notion that cyclical factors are the main explanation for the full pattern of observed employment changes since 2000 is that cyclical factors cannot readily explain the *persistence* of reduced employment among prime-age lower-skilled individuals: that is, the fact that rates have remained low long after the impact of cyclical factors from the recession should have ended. Despite growing evidence of market normalization in the years since the end of the Great Recession—stabilization of housing prices, favorable lending conditions, declines in aggregate uncertainty, return of labor market mismatch to pre-recessionary levels, and the cessation of extended unemployment benefits—the employment rate remains significantly below pre-recessionary levels.

Alongside the literature studying cyclical factors, another literature has emerged studying the role of structural factors in explaining recent changes in employment. How long-term changes in underlying demographics, such as the ageing of the population, have contributed to the decline in labor force participation has been the focus of one strand of research (for example, Aaronson, Hu, Seifoddini, and Sullivan 2015). On the whole, results from this work indicate that demographic factors explain a portion of the overall decline in employment and labor force participation. Our work focuses throughout on the population of prime-aged, noncollege men, so the declines we document and attempt to explain cannot be accounted for by changes in demographics and must be due to other factors. The focus on these other factors complements existing work studying demographics.

[3] For simplicity, this section focuses on explanations of changes in employment during the 2000s that can be readily categorized into either cyclical or structural explanations. However, factors such as duration dependence belong to a class of explanations that suggest important interactions between the two. For example, Kroft, Lange, Notowidigdo, and Katz (2016) calibrate a search and matching model to show that the low job finding rate in the aftermath of the Great Recession may partly be due to duration dependence in unemployment. As a result, the sharp decline in vacancies generated an increase in long-term unemployment and—through duration dependence in unemployment—reduced both the overall job-finding rate and aggregate employment.

Another strand of the work studying longer-term structural factors has linked declining demand for routine tasks (Autor, Levy, and Murnane 2003) and job polarization (Autor and Dorn 2013) to declining employment rates for less-educated workers during the 2000s. Autor, Dorn, and Hanson (2013), Charles, Hurst, and Notowidigdo (2016), and Acemoglu et al. (2016) all discuss how the decline in manufacturing during the 2000s depressed employment rates for less-educated workers. International trade appears to account for some of the decline in manufacturing employment. Autor, Dorn, and Hanson (2013) provide local labor markets evidence that increased import competition from increased trade with China reduced manufacturing employment during the 1990s and 2000s. Similarly, Pierce and Schott (forthcoming) provide evidence that the "surprisingly swift" decline of manufacturing during the 2000s is linked to changes in trade policy that eliminated potential tariff increases for Chinese imports. Consistent with their interpretation of the role of changes in trade policy, there is a clear divergence in manufacturing employment trends between the United States and the European Union following this policy change.

These papers suggest an important role for structural factors in understanding the pattern of employment changes since 2000. However, it is not clear how these relatively slow-moving structural shifts could explain the sudden reduction in employment rates after 2008. Furthermore, since any structural forces affecting employment likely operated steadily throughout the 2000s, one would have expected their influence to reduce employment substantially before the recession. Yet employment rates in the early 2000s declined only modestly.

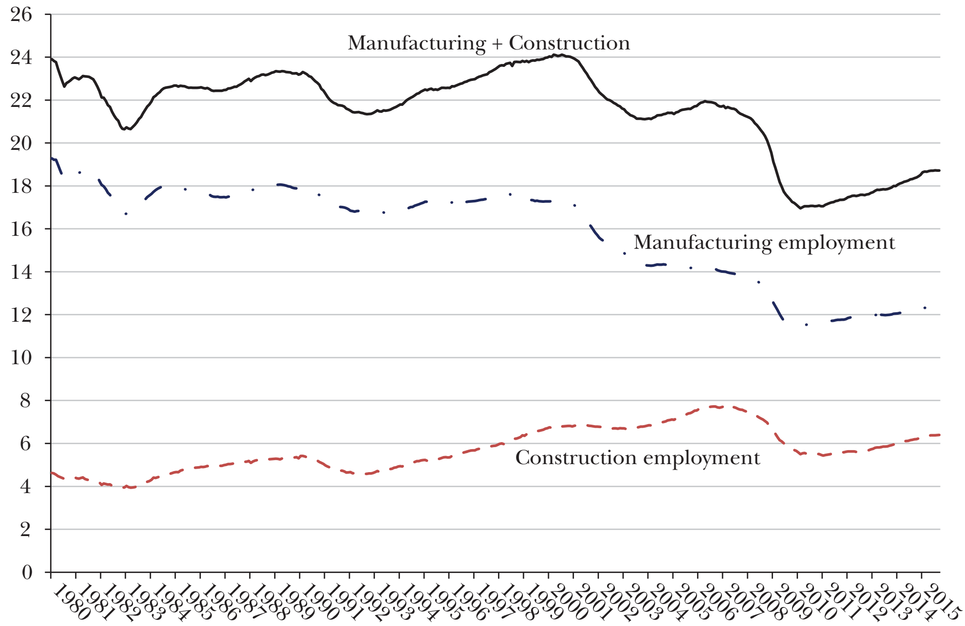
The following sections present an array of evidence that employment losses arising from the structural decline in manufacturing were "masked" by positive employment effects for lower-skilled labor associated with the national housing boom during the 2000–2006 period, and then "unmasked" when the housing market reverted to be closer to its normal state after 2007. This explanation reconciles the key facts about the full pattern of changes in employment since 2000 for prime-aged noncollege adults, including the sudden large decline in 2008 after a period of relatively little change, and the persistently low levels of employment several years after the end of the recession.

Masking: Evidence from Aggregate Time-Series Data

The counterbalancing patterns of long-term job decline in manufacturing and the surge in construction jobs during the housing boom is apparent in time-series data. Figure 2 shows the patterns of total jobs in manufacturing and construction from 1980 to 2015. Manufacturing jobs were in slow decline through the 1980s and 1990s, then entered a period of rapid decline from around 1999 through 2010, and have since leveled out.[4] During the 15-year period between 2000 and 2015,

[4] For analyses of the decline in US manufacturing during the 1980s and 1990s, useful starting points are Bound and Holzer (2000) and Berman, Bound, and Griliches (1994).

Figure 2
Total Monthly US Manufacturing Employment 1980M1–2015M9
(in millions)



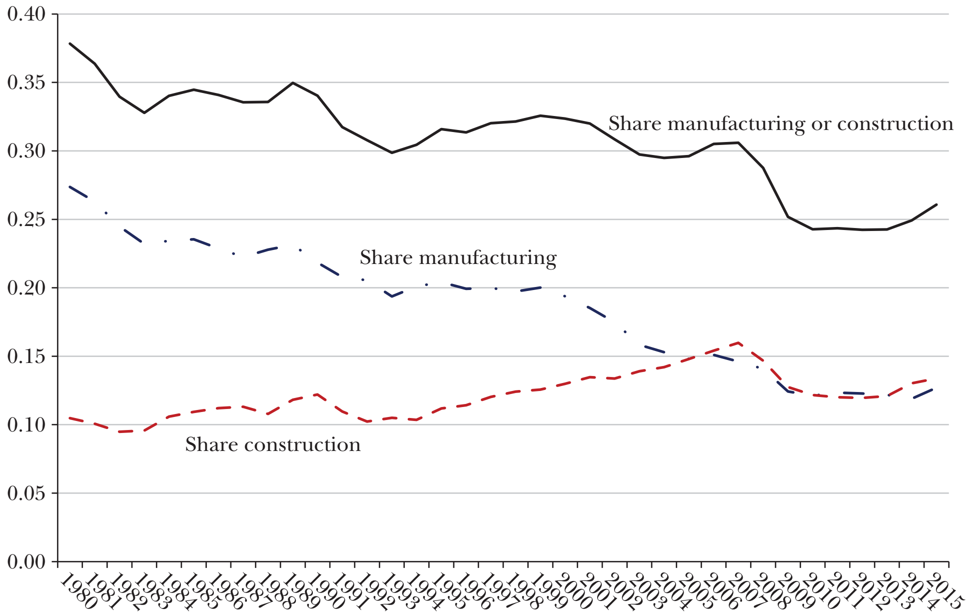
Source: Authors using aggregate data from the Bureau of Labor Statistics on monthly employment in manufacturing and construction sectors.

the US economy lost roughly one-third of the manufacturing jobs that had existed in 2000.

The national housing boom—marked by massive increases in housing prices, new construction and renovations, and real estate transactions—began in the late 1990s and completely collapsed over a short time period beginning in 2007. The boom changed employment opportunities in many sectors, but in this section we focus only on the number of jobs in the construction sector, which expanded and contracted significantly over the course of the housing boom and bust. This can be seen in the lower line in Figure 2, which plots total monthly construction jobs between 1980 and 2015, using data from the Bureau of Labor Statistics (BLS). From 1980 to the mid-1990s, the total number of construction jobs fluctuated between four and five million. However, between the mid-1990s and the mid-2000s total construction jobs surged by three million, peaking at nearly eight million jobs in 2006. When the boom ended in 2007, construction employment collapsed with it. By 2010, the number of construction jobs in the economy had returned to their 1996 levels and have remained close to those levels ever since.

The top line in Figure 2 is the total number of jobs in the economy in either manufacturing or construction from 1980 to 2015. The figure shows that between

Figure 3
Construction and Manufacturing Employment Shares, Noncollege Men Aged 25–54; 1980–2015



Source: This figure uses data from 1980–2015 from the March Current Population Survey, restricted to prime-age men with education below a four-year college degree.
Note: The figures calculate employment shares as a share of total population using individual-level survey weights.

2000 and 2006, the surge in the number of construction jobs substantially offset job losses in manufacturing, leaving the total number of jobs accounted for by the two sectors essentially constant during this period. After 2007, the total number of jobs in construction and manufacturing declined sharply, as construction collapsed to long-term historical levels following the housing bust and as the number of manufacturing jobs continued to decline. The job gains from the housing boom meant that the decline in the number of jobs because of long-term, sectoral decline that otherwise would have been apparent in aggregate data on the total number of jobs was not evident until 2008, although the decline started years earlier.

Working in either manufacturing or construction has long been very important in the life experience of prime-aged noncollege men, who we have shown had particularly pronounced changes in employment in the last 20 years. Using individual-level data from the Current Population Survey (CPS), Figure 3 shows that among all noncollege prime-aged men, including those not working at all, roughly 30 percent were working in either manufacturing or construction at any time between 1980 and 2007.[5] In effect, during the 2000–2007 period, as the share of all prime-aged, noncollege men working in manufacturing fell substantially, surging opportunities in construction from the housing boom almost exactly made up for the lost manufacturing employment for these men. Since 2007, with the bust in construction and continued decline in manufacturing, the share of all prime-aged noncollege men employed in construction or manufacturing has fallen sharply, going from roughly 30 percent in 2008 to 23 percent in 2014.[6]

The aggregate evidence suggests that when the housing boom ended, and the construction jobs associated with it disappeared, many prime-aged noncollege men who had been working in construction simply left the labor force. Figure 4 shows the fraction of all prime-aged, noncollege men who are working in construction, working in manufacturing, or are not employed (that is, either unemployed or not in the labor force) has been incredibly stable over time. Historically, when the manufacturing plus construction employment share for prime-aged, noncollege men has gone up, the incidence of nonemployment among such men has gone down; when the manufacturing/construction share has been flat, as it was from the mid-1990s to mid-2000s, nonemployment has been flat; and when the manufacturing plus construction share has gone down, as it did sharply after 2007, nonemployment has surged. The negative association between the two series can be clearly seen in the top line in the figure, which shows how remarkably constant the fraction of all prime-aged, noncollege men engaged in these three activities has been over time. This time-series evidence also suggests that many of the men not working in the construction and manufacturing sectors since 2007 have ceased being employed altogether.

Masking: Local Labor Markets Evidence

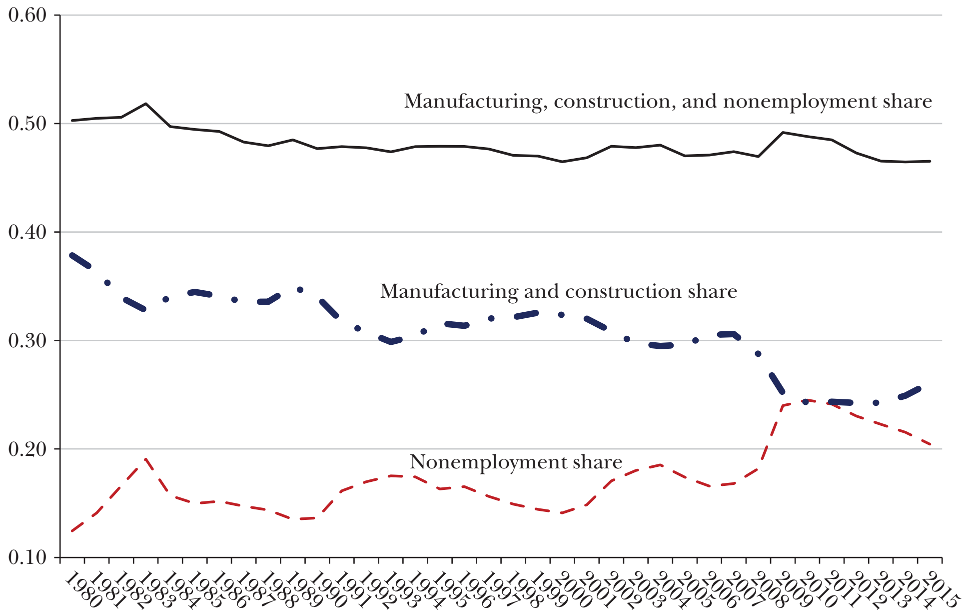
An obvious concern about time-series evidence is that a temporal association between the different series need not reflect a causal relationship. In particular, it could be that other unmeasured, national-level shocks account for both the upward pattern in nonemployment of prime-aged, noncollege males after 2007 and its sustained low level though 2015.

To investigate these concerns, we exploit variation across urban areas in the size of manufacturing decline and the size of the local housing boom they experienced. We create a panel of metropolitan statistical areas (MSAs) using data from the 2000 Census and from various years of the American Community Survey (ACS) individual-level and household-level extracts from the Integrated Public

[5] For the results in Figures 3 and 4, we use data from the March CPS, which are downloaded from the IPUMS-CPS (Ruggles et al. 2015) at https://cps.ipums.org/cps/.

[6] See Charles, Hurst, and Notowidigdo (2016) for discussion that although some of decline in manufacturing employment share from 1982 to 1999 was the result of increase in the size of prime-aged noncollege population, the population was constant in the 2000–2006 interval, so the decline in manufacturing employment share was exclusively the result of sectoral decline. The fact that manufacturing jobs are lost during the 1990 and 2000 recession is highlighted in Jaimovich and Siu (2012).

Figure 4
Construction, Manufacturing, and Nonemployment Shares, Noncollege Men Aged 25–54; 1980–2015



Source: This figure uses data from 1980–2015 from the March Current Population Survey, restricted to prime-age men with education below a four-year college degree.
Note: The figures calculate nonemployment rates and employment shares as a share of total population using individual-level survey weights.

Use Microsamples database (Ruggles et al. 2015). The analysis extends from 2000 (the first year during the boom with reliable information in the Census at the level of metropolitan statistical areas) to 2012 (the midpoint of 2011–2013 ACS data). These years span the 2000–2006 housing boom, the 2007–2009 housing bust, and several years after the end of the housing bubble and the Great Recession. We compute employment rates and employment shares in various occupations in each metropolitan statistical area.[7] The primary analysis sample consists of noninstitutionalized, prime-aged men aged 25–54 without a four-year college degree.

Our measure of the decline in manufacturing in any given metropolitan statistical area, ΔM_k, is the change in the fraction of the prime-aged, noncollege male

[7] For the 2000 numbers, these means are from the 2000 Census. For the 2006 numbers, we pool the American Community Survey data from 2005 to 2007 to increase the precision of the metropolitan statistical area estimates. Similarly, we pool the 2011–2013 American Community Survey for the 2012 numbers.

population in the Census/ACS employed in manufacturing industries over the relevant time period. In a simple model of housing demand and supply, the effect of a shock that shifts housing demand will be a weighted sum of the change in the price of housing and the change in housing supply, which can be proxied by the amount of housing built. Our measure of the housing demand change, ΔH_k, is therefore the (log) change in the average price of houses sold in the metropolitan statistical area (MSA) plus the (log) change in the number of building permits approved in the MSA. We use house price data from the Federal Housing Finance Agency (FHFA), mapping FHFA metro areas to the Census/ACS metro areas by hand. We use data on housing permits from the Census Building Permits Survey, and match the MSA codes in the permits data to the Census/ACS metro area codes by hand.[8]

Changes in both house prices and in the housing stock can affect employment. House prices affect household wealth or liquidity and thus households' demand for goods and services produced in the local market (Mian and Sufi 2011). Changes in the amount (or quality) of housing necessarily involves construction activity such as demolition, renovation, home improvements, or new construction. Our housing demand measure captures all of these effects.

Table 1 reports summary statistics for our sample of 275 metropolitan statistical areas with nonmissing labor market and housing market data. Our specific approach is to consider the effects of two shocks to local markets during the years from 2000 to 2006: the change in the share of population employed in manufacturing and our proxy for housing demand (based on changes in housing prices and construction permits). We look at the effects of these changes on the employment rate for noncollege, prime-age men and on the share of construction employment for this group in two different time periods: the immediate effect of the shocks from 2000–2006 and the long-run effect from 2000–2012. This set of variables will let us look at masking during the 2000–2006 period, and the extent to which such effects might persist through 2012.

Panel A of Table 1 presents the means and standard deviation of the two local labor market shocks we study. The top row shows that the average decline over the 2000–2006 period in the manufacturing employment share across urban areas was –2.6 percentage points. The standard deviation of 1.9 indicates that there was substantial variation across urban areas in this mean decline; indeed, our analysis exploits this variation. The mean change in the housing demand proxy across urban areas between 2000 and 2006 was 0.66 log points with a standard deviation of 0.58. Because the housing proxy is the sum of the log changes in housing prices and building permits, this can be interpreted as meaning that the sum of housing prices and building permits rose by more than 50 percent across metropolitan statistical areas, on average, with substantial variation across metro areas.

Panel B of Table 1 presents summary statistics for the change in the employment rate and in the construction employment share for prime-aged noncollege

[8] See Charles, Hurst, and Notowidigdo (2015) for more details on the matching of the house price and housing permit data to the Census/ACS data.

Table 1
Descriptive Statistics of Manufacturing Decline and Housing Booms across Cities

	N	*Mean*	*Standard deviation*
Panel A: Manufacturing decline and changes in housing demand (two shocks)			
2000–2006 Change			
In share of population employed in manufacturing, ΔM_k	275	–0.026	0.019
In housing demand, ΔH_k	275	0.657	0.585
Panel B: Changes in total employment and construction employment			
2000–2006 Change			
In employment rate for noncollege men	275	0.019	0.039
In construction employment share for noncollege men	275	0.027	0.019
2000–2012 Change			
In employment rate for noncollege men	275	–0.021	0.048
In construction employment share for noncollege men	275	–0.002	0.022

Notes: This table reports the summary statistics for the baseline sample of 275 metropolitan areas (MSAs) across the time periods studied in the regressions that use the Census/American Community Survey data. The housing demand variable is constructed by adding the change in housing prices (from FHFA house price index) to the change in housing permits (from Census Building Permits Survey). This procedure creates a proxy for the change in housing demand in an MSA between 2000 and 2006; see Charles, Hurst, and Notowidigdo (2015) for more details. All of the reported sample statistics are computed using the 2000 population of prime-aged, noncollege men in the MSA (from Census/ACS) as weights, since these weights are used in all of the regressions.

men for different periods between 2000 and 2012. These means are consistent with the aggregate patterns discussed before. Across metropolitan statistical areas, the employment rate and overall construction share rose during the 2000–2006 boom, then fell sharply after 2007. By 2012, the share of noncollege men working in construction had returned to levels seen in 2000 in the average metro area, but their employment rate remained substantially below 2000 levels, long after the end of the housing cycle.

In Table 2, we will be investigating the relationship between employment changes in a metropolitan statistical area and manufacturing decline and housing demand shocks by estimating:

$$\Delta E_k = \beta_0 + \beta_1 \Delta M_k + \beta_2 \Delta H_k + X_k \Gamma + \eta_k,$$

where ΔE_k is either the change in employment in metropolitan statistical area or the change in the construction share for one of the two time periods 2000–2006 or 2000–2012; the ΔM_k and ΔH_k variables represent the local labor market shocks in manufacturing and housing, which occurred over 2000–2006; X_k is a vector of control variables; and η_k is a mean-zero regression error. The parameters β_1 and β_2 measure, respectively, the effect of a change in local manufacturing employment and a change in local housing demand on the change in employment. For simplicity, the results we present here are estimated with these two coefficients in a single ordinary least squares regression model.[9] The analysis is conducted in first differences and thus accounts for time-invariant differences across metropolitan statistical areas. In each specification, the *X* vector follows our paper Charles, Hurst, and Notowidigdo (2016) and includes controls for the share of employed workers with a college degree, the share of women in the labor force, and the population of the metropolitan statistical area. All standard errors are clustered by state and are weighted by the prime-age, noncollege male population in 2000.

Table 2 presents the estimates of regression equations for the 2000–2006 and 2000–2012 time periods. Each column in each panel reports the estimates from a separate equation. The point estimates in the first column of the top panel imply that a one standard deviation decrease in manufacturing employment, given as 0.019 in Table 1, would, multiplied by the coefficient 0.471 from Table 2, decrease the employment rate among non-prime-aged college men by about 0.9 percentage point during 2000–2006. Likewise, over the same period, a one standard deviation increase in housing demand of 0.58 multiplied by the relevant coefficient from Table 2 would increase the employment rate of prime-aged noncollege men by about 1.3 percentage points during the 2000–2006 period.

In column 2, we assess how the two local shocks affect the share of noncollege men working in construction in the metropolitan statistical area. In the top panel, we find no statistically significant relationship between the manufacturing shock and construction employment. By contrast, construction employment of noncollege men increased the larger the housing demand shock in the metro area. The portion of the employment increases experienced by noncollege men as a result of the housing boom that was attributable to the employment in the construction sector is the estimated effect of the housing demand change in column 2 divided by the effect in column 1, or approximately 78 percent (that is, 0.018 divided by 0.023).

The regressions in the bottom panel of Table 2 examine how local manufacturing decline and local housing market changes between 2000 and 2006 affect the longer-term change during the 2000–2012 period in outcomes for noncollege men. The results indicate that the effect of manufacturing decline during the 2000–2006

[9] As we discuss in Charles, Hurst, and Notowidigdo (2016), our results are similar in a more complicated two-equation model that allows for both the direct effect of manufacturing decline on labor market outcomes as well as an indirect effect of manufacturing decline on labor market outcomes coming through the effect of manufacturing on housing demand. In the more complicated two-equation model, we can identify both the direct and indirect effect under the assumption that changes in local housing demand do not affect local manufacturing activity directly, which we show appears to be a reasonable assumption in our setting, since the housing boom has no significant effect on manufacturing employment. We also show that the main results are similar using an instrumental variable for changes in housing demand that is formed by using sharp structural breaks in local housing prices that are interpreted as proxies for speculative activity. This instrument is described in detail in Charles, Hurst, and Notowidigdo (2015). The similarity of the two-stage least squares estimates to the main ordinary least squares estimates reported in this paper is consistent with limited endogeneity bias during the 2000–2006 period, plausibly because this is a time period when a very large share of changes in housing demand is due to speculative activity rather than due to other changes in local labor demand.

Table 2

Manufacturing Decline, Housing Booms, and Cross-City Masking: Regression Results

Sample: Prime-age, noncollege men

	Dependent variable:	
	Employment Rate (1)	*Construction Employment Share* (2)
Panel A: The dependent variable is Change in Employment Rate, or Change in Construction Employment Share, over *2000–2006*		
The independent variables (shocks) are change over 2000–2006:		
In share of population employed in manufacturing, ΔM_K	0.471	0.009
	(0.090)	(0.63)
In housing demand, ΔH_K	0.023	0.018
	(0.006)	(0.004)
R^2	0.76	0.45
N	275	275
Include baseline controls	Yes	Yes
Panel B: The dependent variable is Change in Employment Rate, or Change in Construction Employment Share, over *2000–2012*		
The independent variables (shocks) are change over *2000–2006*:		
In share of population employed in manufacturing, ΔM_K	0.653	–0.057
	(0.156)	(0.089)
In housing demand, ΔH_K	0.004	–0.001
	(0.011)	(0.005)
R^2	0.60	0.29
N	275	275
Include baseline controls	Yes	Yes

Notes: This table reports the coefficients from estimating $\Delta E_k = \beta_0 + \beta_1 \Delta M_k + \beta_2 \Delta H_k + X_k\Gamma + \eta_k$, by ordinary least squares for various samples, where ΔE_k is either the change in employment in metropolitan statistical area or the change in the construction share for one of the two time periods 2000–2006 or 2000–2012; the ΔM_k and ΔH_k variables represent the local labor market shocks in manufacturing and housing, which occurred over 2000–2006; X_k is a vector of control variables; and η_k is a mean-zero regression error. A 0.01 unit decrease in the Share of Population Employed in Manufacturing corresponds to a 1 percentage point decline in share of prime-age (25–54) non-college-educated male population employed in manufacturing. A 1-unit change in housing demand measure corresponds to 1 log point increase in housing demand proxy. The baseline controls include the initial (year 2000) values of the share of employed workers with a college degree, the share of women in the labor force, and the log population in the metropolitan statistical area. Standard errors, adjusted to allow for an arbitrary variance-covariance matrix for each state, are in parentheses.

period on the long-term employment of noncollege men was, in fact, quite durable. Indeed, the effects of the manufacturing decline during 2000–2006 on employment growth between 2000 and 2012 were fairly similar to the effects shown for 2000–2006. The results for the employment effects of housing demand changes during 2000–2006, however, differed sharply over 2000–2006 and the longer 2000–2012 period. In particular, we find that changes in estimated housing demand during the 2000–2006 housing boom period had no significant long-term effect on employment of noncollege men over the 2000–2012 period, either for the overall employment rate or for the share of employment in construction.

This evidence across metro areas suggests that the 2000–2006 housing boom had a masking effect on the loss of manufacturing jobs during those years, but this masking was undone during the housing bust. The negative employment effects of the housing bust were similar in magnitude to the positive employment effects of the preceding housing boom. Over the entire period from 2000 to 2012, the strong relationship between the local decline in manufacturing and the employment rate of noncollege men in a metropolitan statistical area was not affected by changes in housing demand in the metro area during the 2000–2006 boom period.

Individual-Level Masking: Evidence from Displaced Manufacturing Workers

Our local labor markets analysis suggests that masking occurred both within and between metropolitan areas.[10] What is not clear is the extent to which this masking within metro areas was because different types of workers were affected by manufacturing and housing market shocks, and how much, if any, was because some of the specific workers who lost jobs in manufacturing found employment in housing during the boom, only to lose them when housing collapsed.

To determine the extent to which the specific workers displaced from manufacturing because of the decline in that sector were re-employed in housing-related sectors, we use individual-level data from the Displaced Worker Survey, which is conducted every two years as part of the Current Population Survey.[11] This survey focuses on individuals who have been displaced from a job at some point during the preceding three years. In addition to the standard battery of questions about current employment and demographics, respondents are asked detailed questions

[10] In Charles, Hurst, and Notowidigdo (2016), we present results from more in-depth analysis to assess how much of masking is between-city and how much within-city. We find evidence of both types of masking; many cities experienced either a large housing boom or manufacturing decline between 2000–2006 but not both. Within cities, we find manufacturing affected older adults relatively more than younger adults, while our estimates suggest that the housing boom affected employment rates of older and younger adults similarly.

[11] See Farber (2015) for more information on Displaced Worker Survey data and a detailed investigation of labor market outcomes of workers displaced during the Great Recession (compared to earlier recessions).

about their previous job. We construct a sample consisting of all men aged 25–54 without a college degree in the 1994–2006 waves of the Displaced Worker Survey who were displaced from jobs in the manufacturing sector. Displacements in this sample occurred between 1992 and 2005.

The resulting sample of 2,161 persons is relatively small, but it contains geographic identifiers that allow us to sort displaced workers by the size of the housing boom that their local metropolitan statistical area experienced. We create an indicator variable to denote displacement between 1997 and 2005, which are years in the midst of the national housing boom. Persons for whom this indicator was zero were therefore displaced between 1991 and 1996 (in the years before the housing boom). For each displaced worker in our sample, we also know whether they lived in a "housing boom metropolitan statistical area," which we define to be those areas whose especially large housing booms placed them in the top one-third in the distribution of the housing demand change measure, ΔH_k.[12] And we also create an indicator variable for these areas. Intuitively, this captures the metro areas that had especially large increases in housing demand. We estimate a model of the form:

$$y_{ikt} = \beta_1 1\{Housing\ Boom\ MSA_k\} \times 1\{Boom\ Period\} + \alpha_k + \delta_t + X_{ikt}\Gamma + e_{ikt}$$

where y is either (in different specifications) re-employment or re-employment in construction of a displaced worker i in market k at time t. The terms α_k and δ_t are metropolitan statistical area and time period fixed effects, respectively, and the vector X contains individual-level controls like years of education, union status in the last job, and a fifth-order polynomial in age.

The coefficient β_1 from this regression is a difference-in-difference estimate of the effect of being in a metropolitan statistical area with a large housing boom on the probability of becoming re-employed for a worker displaced from manufacturing during the years of the housing boom. We study two outcomes: whether the person reported employment as of the survey year, and whether the person was employed in construction as of the survey year.

Table 3 presents the estimated effects, with associated standard errors clustered by state. For each outcome in Table 3, we present two difference-in-difference specifications. The first specification (in columns 1 and 3) includes fixed effects for metropolitan statistical areas and adds fixed effects for each year of displacement. The second specification (columns 2 and 4) adds the individual-level controls to the specifications in columns 1 and 3. The results for employment suggest a substantial amount of "individual-level masking." We find that manufacturing workers displaced in markets with especially large housing demand increases during the 2000–2006

[12] The evidence is fairly similar using other thresholds such as the top quartile or top 10 percent. It is also robust to residualizing housing demand change to manufacturing decline proxy and other controls, so the definition of a housing boom metro area is based on change in housing demand that is above and beyond what one would predict from manufacturing decline and other variables. See Charles, Hurst, and Notowidigdo (2016) for more details.

Table 3
Displaced Manufacturing Workers, Housing Booms, and Individual-Level Masking: Regression Results

Sample: Noncollege men, age 25–54, manufacturing workers displaced 1992–2005

	Dependent variable:			
	Employed		*Employed in Construction*	
	(1)	(2)	(3)	(4)
Difference-in-difference estimate of effect of housing boom:				
Independent variable:				
(Displaced between 1997 and 2005) ×	0.094	0.093	0.045	0.045
(Housing Boom MSA)	(0.045)	(0.043)	(0.019)	(0.019)
Mean of dependent variable	0.693	0.693	0.056	0.056
N	2,161	2,161	2,161	2,161
R^2	0.144	0.151	0.119	0.125
Include MSA fixed effects	y	y	y	y
Include displacement year fixed effects	y	y	y	y
Include individual-level controls		y		y

Source: Current Population Survey (CPS) Displaced Worker Surveys, 1994–2006.
Notes: This table reports the coefficients from an ordinary least squares regression of the equation $y_{ikt} = \beta_1 1\{Housing\ Boom\ \ MSA_k\} \times 1\{Boom\ \ Period\} + \alpha_k + \delta_t + X_{ikt}\Gamma + e_{ikt}$. The first row reports the difference-in-difference estimate of the effect of being displaced during housing boom time period within a metropolitan statistical area that was experiencing a housing boom. If a displaced worker is not in one of the MSAs with housing market data or is in a non-metro region, then this indicator is set to 0. The additional individual-level controls in columns (2) and (4) are the following: education, union status in last job, and 5th-degree polynomial in age. Standard errors are clustered by state and are in parentheses.

period were around 9 percentage points more likely to be re-employed. This result holds across various specifications, and is large relative to the mean of the outcome variable of 69 percent. These estimates imply that, compared to displaced workers in other markets, individuals displaced from manufacturing in a metropolitan statistical area with a large housing boom were roughly 13 percent (9/69) more likely to be re-employed relatively quickly after being displaced.

The results for construction re-employment are also striking. In the results in columns 3 and 4, the point estimates suggest that displaced manufacturing workers were much more likely to be employed in construction if they became displaced in markets with big housing demand increases. The point estimate of 0.045 suggests displaced manufacturing workers in markets during the years of the housing boom in markets with big booms were likely to find re-employment in construction at a rate that was roughly 50 percent of the overall employment effect. These results suggest that a meaningful share of the employment "masking" for noncollege men at the individual level came through construction employment.

Collectively, these results provide evidence of individual-level masking. Had there been no temporary housing boom from the late 1990s through the mid-2000s, many workers displaced from manufacturing because of the ongoing decline in that sector would have been significantly more likely to end up in nonemployment during this time period.

Conclusion

This paper argues that employment gains from the recent national housing boom "masked" the adverse employment effects of declining manufacturing in the years before the Great Recession. What has been called the national "employment sag" that began in 2000 would therefore have been even larger in the absence of this masking in the years before the Great Recession. We show that aggregate masking occurred overall in the national time series, both between and within cities, and at the individual level. The sharp decline in employment that occurred during the Great Recession was due not only to cyclical forces, but also to the fact that the massive housing bust, which coincided with the start of the recession, "unmasked" the adverse employment effects of more than a decade of systematic manufacturing decline. Persistently low employment in the several years after the end of the recession points to the ongoing importance of these structural factors.

Our analysis focuses on noncollege men in the United States, but the mechanism we have highlighted is more broadly relevant. For example, many prime-aged noncollege women also lost jobs from declining manufacturing. When we do an analysis across metropolitan areas similar to that presented for their male counterparts, we find that the local decline in manufacturing had an effect on the employment rate of noncollege women that is roughly two-thirds the size of the effect for noncollege men. While housing booms in local labor markets increased employment for noncollege women, as well, for them virtually all of the increased employment came in services and related sectors (such as finance, insurance, and real estate) rather than in construction. Outside the United States, Hoffman and Lemieux (2016) have emphasized the perhaps surprising explanatory power of construction employment in accounting for cross-country patterns in employment growth in the aftermath of the Great Recession. We therefore speculate that housing booms may have "masked" the adverse effects of manufacturing decline in other countries, as well.

Our results shed light on the question of how much of the recent decline in employment rates are the result of cyclical factors, and how much from structural factors like the long-term decline in manufacturing and associated losses in routine jobs. The answer to this question is crucially important because of its implications for policy response to the falling employment. Traditional monetary and fiscal policy tools, such as temporary interest rate cuts, tax rebates or increases in government spending, are designed to provide a temporary boost to labor demand. These tools can thus offset temporary declines in hiring arising from cyclical factors like short-lived tightening of credit markets or transitory increases in uncertainty, temporarily boosting employment until the economy returns to its normal level. By contrast, there is little reason to suppose that these traditional monetary and fiscal tools can satisfactorily address employment decline arising from structural factors.

What policies might be effective in the future at raising employment rates, particularly among the relatively less-skilled? One set of options might be policies that encourage skill investment among the noncollege educated, thereby directly addressing their skill deficits and hopefully raising their long-term employment prospects. It has historically proved difficult to get people to alter their human capital choice using traditional policies like targeted taxes or educational subsidies. It is therefore likely that in order to encourage workers who have traditionally worked in routine occupations to obtain the skills demanded in the current economic environment, there will have to be experimentation with new policies ideas to spur schooling investment.

Some have suggested that the portion of employment decline attributable to structural factors might be addressed by the undertaking of large-scale, publicly financed infrastructure projects (for example, Summers 2014). A potential benefit of the public undertaking of such projects would be the boost to employment opportunities they would provide for less-educated workers, particularly if the projects raised the overall demand for such workers rather than simply reallocated them from the private to public sectors. Such investments could yield longer-term gains for lower-skilled workers if these investments in infrastructure led to broader productivity gains within the economy.

However, publicly financed infrastructure investments are not without important costs. One set of these are the various efficiency costs associated with raising public funds, even in this period of historically low interest rates. Another potential cost is that the necessarily temporary nature of infrastructure projects might have the unintended effect of adversely affecting skill-upgrading among noncollege persons. Unless infrastructure construction translates into permanent increases in labor demand for lower-skilled workers, the temporary gain in employment such projects would provide would be similar to the gain in employment from the hot housing market in the early 2000s, in the sense that underlying weakness in the labor market would be masked for a time before being revealed when the projects ended.

In other work, we have found evidence suggesting that the abundant but temporary employment opportunities provided by the housing boom during the 2000s caused some young noncollege persons to delay college-going, presumably because they erroneously believed that housing-related job opportunities would exist in the longer-term (Charles, Hurst, and Notowidigdo 2015). Many of these individuals did not return to college when those labor market opportunities vanished during the housing bust, thereby delaying the chance to obtain skills demanded in sectors like high-tech manufacturing and tradeable services. There is thus a persistently lower level of college attendance among the specific birth-year cohorts who were of college-going age during the housing boom period. Employment masking from temporary public construction projects in the future could have a similar effect.

The structural interpretation of the declining employment-to-population ratio highlights another layer to rising inequality in the United States in income and consumption between more- skilled and less-skilled workers during the last three decades. Our work highlights changes in employment inequality between higher- and lower-skilled workers since the early 2000s. While this fact has been highlighted by others (Aguiar and Hurst 2009; Attanasio, Hurst, and Pistaferri 2015), our work shows that the decline in manufacturing employment has contributed to the increased inequality in employment propensities. To the extent that employment propensities translate to earnings, our results account for some portion of the increased earnings inequality between higher- and lower-skilled workers that has occurred since the early 2000s.

Our paper is silent on the welfare implications of the masking phenomenon that we document. As noted above, in companion work, we have documented how the housing boom altered skill acquisition for lower-skilled men and women during the early 2000 boom years. However, there may have been benefits of the masking phenomenon. For example, we show evidence that masking from the housing boom postponed and thereby softened the economic costs of structural transition. The fact that the boom appears to have ameliorated the employment losses that would have otherwise occurred because of manufacturing decline may have given regions time to engage in difficult reallocation of workers across sectors, thereby easing some of the costs of adjustment. One possible benefit of masking may have been added time to develop new tradeable industries better fitted to the changing landscape of import competition. How this benefit compares to the costs of altering human capital decisions has not been studied. In future work, it would be useful to quantify the importance of these different factors.

We close with the observation that the phenomenon of employment masking studied in this paper may be important for understanding the economic consequences of sectoral shifts more broadly. A growing literature finds that large structural shifts such as the shift from agriculture to manufacturing work, and from routine jobs to nonroutine jobs, have important macroeconomic effects and may significantly affect economic growth. In some cases, these structural shifts proceeded with what appears to have been minimal effects on aggregate employment. Results from our work and that of others suggest, by contrast, that the decline of manufacturing may be associated with significant adverse effect on aggregate employment. Whether adverse macroeconomic effects arise from a structural shift may depend on the ability of workers to shift between sectors and occupations, either immediately or perhaps with some modest delay after retraining or some other form of human capital accumulation. Understanding the process of how workers switch sectors in response to large structural shifts is an important area for future research.

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