Masking and Employment Changes During the 2000s: Housing Booms and Manufacturing Decline*

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I. INTRODUCTION

Employment among adults aged 21-55 (henceforth, “prime-aged”), has fallen substantially since 2000, with virtually all of the decline coming from those without a Bachelor’s degree (henceforth, “non-college”). Data from the March Current Population Survey (CPS) indicate that the employment rate for prime-aged, less-educated men hovered around 85 percent from 1980 to 2000, then started to fall in the early 2000s.\(^1\) This decline accelerated sharply around the middle of the 2000s, and by 2011 the employment rates for these men had fallen below 75 percent. In 2015 it was only 78 percent, fully 7 percentage points below the 2000 level. At 63 percent in 2015, the employment rates for prime-aged, less-educated women was also about 7 percentage points below the 2000 level. Strikingly, these large and seemingly persistent reductions in employment propensity among the less-educated over the course of the 2000s were much larger than those observed for both prime-aged men and women with Bachelor’s degrees, whose employment rates fell only by 2 percentage points between 2000 and 2015. Figure 1 plots these changes in employment across these groups.

Besides its concentration among the relatively less-educated, another defining feature of the decline in employment since 2000 is that most of it occurred during the Great Recession, with rates falling from 83 percent to 75 percent, and from 68 to 63 percent between 2007 and 2010 for prime-aged non-college men and women, respectively. The overwhelming majority of the active literature attempting to explain the recent decline in employment has studied alternative “cyclical” explanations for the sharp decline in employment during the recession. One strand of this work studies the role of the negative shocks to household balance sheets and bank balance sheets that arose from the recession.\(^2\) 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 non-tradable sectors during the 2007-2009 period. Chodorow-Reich (2014) links the decline in

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\(^1\) The sharp and persistent decline in the employment rate during the 2000 has been documented by several different authors. Moffit (2012) documents that the employment to population ratio was falling before the start of the 2007 recession. Davis and Haltiwanger (2014) show that labor market fluidity in the U.S. declined substantially beginning in the early 2000s. Hall (2014) discusses how the persistent decline in the employment to population ratio is the defining feature of the labor market since 2000.

\(^2\) Also broadly related to this area of research is Giroud and Mueller (2015), which reports evidence that high firm leverage before the start of the Great Recession also contributed to large employment losses during the recession.
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.\(^3\) Mondragon (2015) estimates the effect of local credit supply shocks on employment and finds a large effect.\(^4\)

Other papers in this literature assess the potential explanatory roles of other cyclical factors that 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 (2013) show that measures of aggregate uncertainty were high during the Great Recession relative to historical levels, and argue that this increased uncertainty explains the slowdown in employment. Similar explanations are found in Fernandez-Villaverde et al. (2013). 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. 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 increased expansion of unemployment benefits during the Great Recession has come to mixed conclusions. Rothstein (2013) and Farber and Valletta (2013) find that the unemployment benefit extension during the Great Recession did not have much effect on the employment rate, although it may have propped up the unemployment rate by delaying exits out of the labor force. However, both Johnston and Mas (2015) and Hagerdorn et al. (2015) find larger effects of unemployment benefit extensions on employment rates, suggesting that these policy changes may indeed have had a big effect on employment and unemployment.\(^5\)

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3 There is a large theoretical literature examining the role of tightening borrowing constraints on households and firms and how that translates into declining aggregate employment. See, for example, Eggerson and Krugman (2012) and Guerrieri and Lorenzoni (2015).

4 Greenstone et al. (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 very little effect on local employment rates.

5 Additionally, Mulligan (2012) discusses how broader policy changes that occurred – like the expansion of the SNAP program - during the recession could have discouraged individual labor supply.
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 argument cannot easily explain the persistence of reduced employment among prime-age lower-skilled individuals – 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.6

Alongside the literature studying cyclical factors, a separate literature has emerged studying the role of “structural” factors in explaining recent changes in employment. One strand of this work has emphasized declining demand for routine tasks (Autor et al. 2003) and job polarization (Autor and Dorn 2013) in explaining declining employment rates for lower-skilled workers during the 2000s. Autor, Dorn and Hanson (2013), Charles, Hurst, and Notowidigdo (2013), and Acemoglu, Autor, Dorn, Hanson, and Price (2014) all discuss how the decline in manufacturing during the 2000s depressed employment for less-educated workers. A reason to question whether structural factors explain the full pattern of employment changes since 2000 is that it is not clear how slow-moving structural shifts could explain the sharp, 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 were relatively flat.

This paper proposes an explanation that reconciles the key facts about the full pattern of changes in employment since 2000 for prime-aged non-college adults, including the sudden large decline in 2008 after a period of relatively little change, and the persistently low levels of

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6 There is a separate literature using more structural macro models to explain the declining employment rate. These papers also suggest that cyclical forces are important for explaining the decline in employment during the 2000s. These papers also struggle to explain the persistent employment decline with cyclical shocks. See, for example, Hall (2011), Beraja et al. (2015), and Christiano et al (2015). Another related literature emphasizes the role of demographics in decline in labor force participation (see, e.g., Aaronson et al. 2015). This literature tends to find evidence of a meaningful role for demographics in understanding the decline in employment and labor force participation.
employment several years after the end of the recession. We argue that employment losses arising from the structural decline in manufacturing were “masked” by positive employment effects associated with the national housing boom during the 2000-2006 period, and then “unmasked” when the housing market suddenly reverted to be closer to its normal state after 2007.

As discussed in detail in Charles Hurst, and Notowidigdo (2015), the housing boom raised employment among less-educated workers by increasing demand for their labor in construction and housing-related services, as well as in the local non-tradable service jobs that households demanded more of as the boom increased their wealth and relaxed their liquidity constraints. As a result, 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 2000-2007 period, the increased demand for less-skilled workers because of the housing boom was simultaneously pushing their employment rates upwards. Aggregate 2000-2007 employment changes – to a large extent the sum of these two offsetting forces – changed little. Had there been no housing boom masking the effect of structural manufacturing decline, aggregate employment for less-educated workers would have likely declined during this period. When the housing market abruptly collapsed in 2007, there was a large, immediate decline in employment among less-skilled 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.

Below we present several different pieces of evidence which support our hypothesis that the masking and unmasking of manufacturing decline by the housing boom and bust explains the key features of employment changes since 2000. This includes aggregate time series evidence; local labor market evidence which 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 U.S; and person-level evidence using data about the re-employment rates of displaced manufacturing workers in the Displaced Workers Survey. Our focus will be on prime-aged, non-college men throughout, but we briefly discuss masking for prime-aged, non-college women in the discussion section.
II. MASKING: EVIDENCE FROM AGGREGATE TIME SERIES DATA

Using monthly data from the Bureau of Labor Statistics (BLS), Figure 2 plots the number of workers in the U.S. employed in the manufacturing sector. In January 1980, U.S workers held over 19 million jobs in manufacturing. Roughly 2 million of those jobs had disappeared by 1999, and an additional 4 million were lost between 1999 and 2007.\(^7\) Manufacturing’s sharp decline continued through the 2008 Great Recession, during which 2 million more of these jobs disappeared. By 2010, manufacturing losses had stabilized, and the economy even added about 500,000 manufacturing jobs between 2010 and 2015. Despite this recent stabilization and modest improvement, over the fifteen year period between 2000 and 2015, the U.S. economy lost 6 million manufacturing jobs, roughly one third of the 2000 total.

These patterns show that, to a substantial degree, the low levels of manufacturing employment today compared to 2000 are the result of longer-term, structural considerations, whose influence was evident in the massive loss of manufacturing jobs long before the start of the recession. Recent work suggests that a key structural factor in manufacturing’s during the 2000-2007 period, and perhaps beyond, was the rising import completion caused by the loosening of trade restrictions with China (Pierce and Schott 2015), which decreased U.S. manufacturing jobs because of reduction in manufacturing activity (Autor, Dorn and Hanson 2014) and the adoption of more labor saving technologies by manufacturing firms (Baker, Bloom and Davis 2013).

The national housing boom is widely agreed to have begun in the late 1990s. After about eight years of massive increases in housing prices, transactions and building and renovation, the housing market then completely collapsed over a very short time beginning in 2007.\(^8\) The boom changed employment opportunities in many sectors, but we focus in this section 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 second series in Figure 2, which is the total amount of monthly construction jobs in the U.S between 1980 and 2015 as estimated with data from the Bureau of Labor Statistics (BLS). From 1980 to the mid-1990s, construction employment

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\(^7\) See Bound and Holzer (2000) and Berman, Bound and Griliches (1994) for analyses of the decline in U.S. manufacturing during the 1980s and 1990s.

\(^8\) See Charles, Hurst and Notowidigdo (2015) for description of these patterns.
fluctuated between 4 and 5 million jobs. However, between the mid-1990s and the mid-2000s the number of construction jobs surged by 3, peaking at nearly 8 million jobs in 2006. When the boom ended in 2007, total construction employment collapsed with it. By 2010, construction employment had returned to their 1996 levels and have remained close to those levels ever since.

The third series in Figure 2 is total combined number of jobs in manufacturing and construction from 1980 to 2015. The figure shows that between 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 boom and as the number of manufacturing jobs continued to decline. The job gains from the housing boom meant that decline in the number of jobs because of long-term, sectoral decline that would have been apparent in aggregate data on the total number of jobs was not until 2008, although the decline started years earlier.

Figure 3, which uses individual level data from the Current Population Survey (CPS), shows the large role that employment in manufacturing and construction represents in the overall activity prime-aged non-college men – the group experiencing particularly pronounced changes in employment in the last twenty years. The figure shows that, among all non-college prime-aged men, including those not working at all, roughly thirty percent worked in either manufacturing or construction at any time between 1980 and 2007.9 Employment in manufacturing as a share of the overall activity of declined from about 23 percent to 20 percent in the eighteen years between 1982 and 1999, then fell by 5 percentage points in the short 2000-2006 interval.10 The decline in manufacturing employment continued through 2014, by which time working in manufacturing represented only 12 percent of the possible employment outcomes of prime-aged non-college men.

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9 For the results in Figures 3 and 4, we use data from the March CPS, which are downloaded from the IPUMS website. See Ruggles et al. (2015).

10 See Charles, Hurst and Notowidigdo (2013) for discussion that although some of decline in manufacturing employment share from 1982 to 1999 was result of increase in size of prime-aged non-college 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 the work by Jaimovich and Siu (2015).
Figure 3 is strongly suggestive that employment effects from housing masked manufacturing decline for prime-aged, non-college men. During the 2000-2006 period, as the share of all prime-aged, non-college men working in manufacturing fell substantially, the proportion of these men employment in construction increased by an approximately offsetting amount. The top line in Figure 3 shows that those employed in manufacturing or construction, as a proportion of the all non-college prime-aged men, was essentially constant from 2000-2006, hovering around 30 percent. After 2007, with the bust in construction and continued decline in manufacturing, the share of all prime-aged non-college men employed in construction has fallen sharply, going from roughly 30 percent in 2008 to 23 percent in 2014.

Figure 4 presents some strongly suggestive evidence that many of the men not working in these two sectors since 2007 have ceased being employed altogether. Using data from the Current Population Survey (CPS), Figure 4 plots the share of all prime-aged, non-college men engaged in one of the following two activities: not working at all, or working in either construction or manufacturing. The strongly negative association between the series is striking. Historically, when the manufacturing plus construction employment share for prime-aged, non-college men has gone up, the incidence of non-employment among such men has gone down; when the manufacturing/construction share has been flat, as from the mid-1990s to mid-2000s, non-employment has been flat; and when the manufacturing plus construction share has gone done, as it did sharply after 2007, non-employment 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, non-college men engaged in these three activities has been over time.

The patterns in Figures 2-4 are strongly consistent with masking and its effect on aggregate employment. The patterns suggest that the structural decline in manufacturing is having lasting effects on the employment propensities of lower-skilled workers. These adverse employment effects from manufacturing showed up in aggregate statistics only at the start of the recession because the housing boom had masked these problems during the early 2000s in aggregate data.
III. MASKING: LOCAL LABOR MARKET EVIDENCE

The obvious concern with the time-series evidence shown above is that the temporal association between the different series need not capture any causal relationship. In particular, it could be that other unmeasured, national shocks account for the upward pattern in non-employment after 2007 and for its sustained low level in 2015.

To address these concerns, our next set of results exploit variation across metropolitan statistical areas (MSAs), $k$, in the size of manufacturing decline and the size of the local housing boom. We create a panel of 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 Use Microsamples (IPUMS) database (Ruggles et al., 2004). The analysis extends from 2000 (the first year during the boom with reliable information in the Census at the MSA level) to 2012 (the midpoint of 2011-2013 ACS data set). These years span the 2000-2006 housing boom, the 2007-2009 housing bust, and the years since the return of the housing market to normal. We compute employment rates, employment shares in various occupations, and total population in each MSA.$^{11}$ The primary sample consists of non-institutionalized men aged 21-55 without any college education.

Our measure of the decline in manufacturing in an MSA, $\Delta M_k$, is the change in the fraction of total prime-age adult 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 housing supply – i.e., the amount of housing built. Our measure of the housing demand change, $\Delta H_k$, is therefore the (log) change in the average price of houses sold in the 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 get permits data from the Census Building Permits Survey, and match the MSA codes in the permits data to the Census/ACS metro area codes by hand.

$^{11}$ For the 2000 numbers, these means are from the 2000 Census. For the 2006 numbers, we pool the ACS data from 2005 to 2007 to increase the precision of the MSA estimates. Similarly, we pool the 2011-2013 ACS for the 2013 numbers.
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, 2012). 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 these effects.

We investigate the relationship between employment changes in an MSA and manufacturing decline and housing demand shocks by estimating:

$$\Delta E_k = \beta_0 + \beta_1 \Delta M_k + \beta_2 \Delta H_k + X_k + \eta_k,$$  \hspace{1cm} (1)

where $X_k$ is a vector of observable controls and $\eta_k$ is a mean-zero regression error. The parameters $\beta_1$ and $\beta_2$ measure, respectively, the effect of a change in local manufacturing employment and a change in local housing demand. For simplicity, we estimate these two coefficients in a single OLS regression model. The analysis is conducted in first differences and thus accounts for time-invariant differences across MSAs. In most specifications, the $X$ vector follows Charles et al. (2015) and includes controls for the share of employed workers with a college degree, the share of women in the labor force, the MSA population, and the share of the population that is foreign-born. All standard errors are clustered by state and are weighted by the prime-age adult population in 2000.

Table 1 reports summary statistics for our sample of 275 MSAs with non-missing labor market and housing market data. Panel A 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 local manufacturing employment share across MSAs was -1.06. The standard deviation of 1.12 indicates that there was substantial variation across MSAs in this mean decline, and it is this variation that regression (1) exploits. The mean change in the housing demand proxy across MSAs between

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12 As we discuss in Charles et al. (2013), our results are similar in a more complicated two-equation model that allows for both 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. The similarity of our two-stage estimates to the simpler models discussed in this paper are 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.
2000 and 2006 was 0.51 with a standard deviation of 0.49. The sum of housing prices and building permits rose by more than fifty percent across MSAs, on average, with substantial variation in the boom across MSAs.

Panel B of Table 1 presents summary statistics for the change in the employment rate and in the construction employment share for prime-aged non-college men for different periods between 2000 and 2012. These cross-MSA means are consistent with the aggregate patterns shown before. Across MSAs, the employment rate and overall construction share rose during the 2000-2006 boom, then fell sharply after 2007. By 2012 in the average MSA, the share of non-college men working in construction had returned to levels seen in 2000, but their employment rate remained substantially below 2000 levels, long after the end of the housing cycle.

Graphical Results

Before presenting regression results, we offer some graphical evidence of masking using MSA-level data. We define “housing boom MSAs” to be those whose especially large housing booms placed them in the top one-third in the distribution of the housing demand change measure, $\Delta H_k$. We then plot the relationship between the change in manufacturing employment between 2000 and 2006 ($\Delta M_k$) in an MSA and the change in the share of non-college men in employment during the same time period, separately by whether the market was a “housing boom MSA” or not. In the graph, the location of the “housing boom MSA” observations relative to the regression line visually indicates the effect of the housing boom on the employment rates of non-college men. The regression line is formed by regressing the change in the employment rate for prime-age, non-college men in the MSA on the measure of manufacturing decline in the MSA and a “housing boom MSA” indicator variable. We construct fitted values by setting the housing boom indicator to 0.

Figure 5 presents the 2000-2006 plots for the change in employment, with “housing boom MSAs” represented with triangles, and the remaining two-thirds of MSAs with circles. The positive

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13 Intuitively, this measure of “housing boom MSAs” is MSAs that had especially large increases in housing demand. The graphical evidence is fairly similar using other thresholds (e.g., top quartile or top 10%) and also is robust to residualizing housing demand change to manufacturing decline proxy and other controls, so that the housing boom MSA definition 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, Notowidigdo (2013) for more details.
estimated slope (1.49, s.e. 0.32) suggests that local manufacturing decline reduced the employment rate of non-college prime-aged men. Most of the triangles in the figure lie above the regression line, implying that MSAs with especially large housing demand changes had smaller reductions in the employment rates of non-college men than did MSAs experiencing smaller housing booms and similar reductions in manufacturing. Housing boom MSAs had roughly half a percentage point smaller decline in the employment rate for non-college men for any given manufacturing decline than non-housing boom MSAs. This is striking evidence of masking during the boom period.14

Figure 6 is analogous to Figure 5, except that the manufacturing decline and the change in employment for non-college men are defined over the 2000-2012 period. The figure shows that the temporary housing demand shock during 2000-2006 had no lasting effects on employment over the entire 2000-2012 period. This can be seen from the fact that “housing boom” MSAs are distributed evenly around the regression line for the other MSAs. Formally, we estimate no difference in the intercept of the regression line for “housing boom MSAs” and other MSAs. The patterns in Figure 6 suggest that any masking effect of manufacturing decline by the housing boom during the boom years was undone during the bust. Over the entire period from 2000 to 2012, the strong relationship between the local decline in manufacturing the employment rate of non-college men in the MSA was not affected by changes in housing demand in the MSA during the 2000-2006 boom period.

Moving beyond graphical results, Table 2 presents the OLS estimates of equation (1) for the 2000-2006 and 2000-2012 time periods. Each column 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 decreased the employment rate among non-college men by about 1.1 percentage points during 2000-2006. Likewise, over the same period, a one standard deviation increase in housing demand of 0.49 increased the employment rate of non-college men by about 1.3 percentage points.

14 The estimate of difference in employment change between housing boom MSAs and other MSAs comes from estimating an OLS model that includes manufacturing decline proxy and an indicator variable that takes on value of 1 if MSA is a housing boom MSA.
In column 2, we assess how the two local shocks affect the share of non-college men working in construction in the MSA. We find no relationship between the manufacturing shock and construction employment. By contrast, construction employment of non-college men increased the larger the housing demand shock in the MSA. The portion of the employment increases experienced by non-college 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.

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 long-term (2000-2012) change in outcomes for non-college men. The results indicate that the effect of manufacturing decline during the 2000-2006 period on the long-term employment of non-college men was, in fact, quite durable. Indeed, the effects of the manufacturing decline on employment growth between 2000 and 2012 were fairly similar to the effects shown for the 2000-2006 change. The results for the employment effects of housing demand changes, however, differed sharply over 2000-2006 and the longer 2000-2012 period. In particular, we find that changes in estimated housing demand during the housing boom period (2000-2006) had no significant long-term effect on employment of non-college men over the 2000-2012 period, indicating that the negative employment effects of housing bust are similar in magnitude than the positive employment effects of preceding boom. Similarly, the effects of the housing market on construction employment and population growth were short-lived.

IV. INDIVIDUAL-LEVEL MASKING: EVIDENCE FROM DISPLACED MANUFACTURING WORKERS

On the whole, the MSA level results strongly support the notion that the housing market masked the long-term decline in manufacturing during the boom years, then revealed, or unmasked, the long-term structural decline in manufacturing when the boom and bust cycle in housing was complete. The evidence above shows that much of this masking occurred \textit{within} MSAs. What is not clear is the extent to which this within-MSA masking 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 CPS Displaced Worker Survey (DWS). This survey is conducted every two years and surveys individuals who have been displaced from a job at some point during the preceding three years. In addition to the standard battery of CPS questions about current employment and demographics, respondents are asked detailed questions about their previous job. We construct a sample consisting of all men aged 21-55 without a college degree in the 1994-2006 waves of the DWS survey who were displaced from jobs in the manufacturing sector. Displacements in this sample occurred between 1991 and 2004.

At 2,513 persons, this sample 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 MSA experienced. We create an indicator variable to denote displacement between 1996 and 2004, which span the years of national housing boom. Persons for whom this indicator was zero were therefore displaced between 1991 and 1995 (in the years before the housing boom). For each displaced worker in our sample, we also know whether they lived in “housing boom MSA” or not, as defined previously for the cross-MSA results shown above.

We estimate a model of the form:

$$y_{ikt} = \beta_1 [\text{HousingBoom MSA}_k] \times 1[\text{Boom Period}] + \alpha_k + \delta_t + X_{ikt} \Gamma + e_{ikt}$$  \hspace{1cm} (2)

where $y$ is either re-employment or re-employment in construction of a displaced worker $i$ in market $k$ at time $t$. The terms $\alpha_k$ and $\delta_t$ are MSA and time period fixed effects, respectively, and the vector $X$ contains individual level controls like years of education, union status in the last job a fifth-order polynomial in age.

The coefficient $\beta_1$ from regression (2) is a difference-in-difference estimate of the effect of being in an MSA 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 MSA fixed effects 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 period were around 9 percentage points less 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. Given these estimates, individuals displaced from manufacturing in a housing boom MSA were roughly 13 percent more likely to be re-employed in the near term after their displacement spell.

The results for construction are equally 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 0.038 suggests displaced manufacturing workers in markets during the years of the housing boom in markets with substantial appreciation were likely to find re-employment in construction at a rate that was roughly 40-50 percent of the overall employment effect. These results suggest that a meaningful share of the employment “masking” for non-college 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 non-employment during this time period.
V. Conclusion

Many researchers have noticed that employment growth was unimpressive in the United States in the 2000s, even before the Great Recession started. For example, Acemoglu et al. (2015) describe the 2000s as the “Great U.S. Employment Sag.” In this paper, we provide several pieces of evidence that suggest that the sharp declines in employment in the U.S. during the Great Recession would have occurred earlier in the absence of the unprecedented boom and bust in housing. Thus, the employment “sag” that began in the 2000s would have been more clearly observed if not for the fact that the housing boom was “masking” the adverse effects of declining manufacturing during this time period. We showed that this aggregate masking occurred overall in the national time series, and both between and within cities. Additionally, we showed that there are specific individuals who lost jobs in manufacturing during the 2000s and who found jobs primarily because they were living in a city experiencing a contemporaneous housing boom. Since the increased employment from housing boom ultimately turned out to be transitory, the Great Recession “unmasked” the adverse effects of manufacturing decline in the years preceding the housing bust.

Our analysis in the paper focuses on non-college men in the U.S. but we believe the mechanism we have highlighted is more broadly applicable. For example, the masking phenomenon applied to non-college women in the U.S as well. Many of these women lost jobs from the decline in manufacturing. Indeed, when we do a cross-MSA analysis similar to that presented for their male counterparts we find that the local decline in manufacturing had an effect on the employment rate of non-college women that that nearly two-thirds the size of non-college men. We also find that housing booms in their local market increased employment, although for women virtually all of the employment effect came in service sand related sectors rather than construction.

Outside the U.S., Hoffman and Lemieux (2014) have emphasized the surprising explanatory power of construction employment in accounting for cross-country patterns in employment growth in the aftermath of the Great Recession. This suggests that housing booms may well have “masked” the adverse effects of manufacturing decline in other countries, as well.

In other work, we have explored the human capital consequences of the housing boom, which points towards another long-run consequence of the temporary boom and bust in housing.
In particular, our evidence suggests that some individuals delayed investing in human capital by attending college during the boom due to favorable local labor market conditions, but then in the bust many of these individuals did not return, resulting in persistent decline in college attendance for the specific birth year cohorts who were college-going age during the housing boom period.

More broadly, we think that the ongoing manufacturing decline and the boom and bust in housing provide a useful laboratory for studying structural shifts across sectors and occupations. A growing literature suggests that such structural shifts have important macroeconomic effects and may contribute significantly to economic growth. In the U.S. over the past century, there have been several clear structural shifts that have been studied by researchers (e.g., shift from agriculture to manufacturing work, routine jobs to non-routine jobs, etc.). In some cases, these structural shifts proceeded with what appears to have been minimal effects on aggregate employment, while in the case of the recent manufacturing decline, our research and related research by others suggests the possibility of meaningful adverse employment effects in the aggregate. It is not completely clear why some structural shifts have so much larger aggregate employment effects than others. Perhaps the adverse macroeconomic effects depend on the ability of workers to shift between sectors and occupations, either immediately or with some delay after re-training or some other form of human capital accumulation.

Turning to economic policy, our results provide evidence of “structural” factors in understanding sharp decline in employment and labor force participation, ultimately traceable to decline in manufacturing (which existing research suggests is itself due to a combination of technological change and rising trade with China and other developing countries). Our results suggest that the persistent decline in employment of less-skilled men and women in recent years is not likely to be easily addressed by fiscal and monetary policy. This particular structural shift would appear to call for a more creative range of policy tools to boost aggregate employment, such as human capital policies (e.g., job training, education subsidies), or, more boldly, active labor market policies such as wage subsidies or public employment programs.
REFERENCES


Table 1
Descriptive Statistics of Manufacturing Decline and Housing Booms

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: Manufacturing Decline and Changes in Housing Demand</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-2006 Changes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of Population Employed in Manufacturing, $\Delta M_k$</td>
<td>275</td>
<td>-1.057</td>
<td>1.120</td>
</tr>
<tr>
<td>Housing Demand, $\Delta H_k$</td>
<td>275</td>
<td>0.513</td>
<td>0.490</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Panel B: Changes in Total Employment and Construction Employment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-2006 Changes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment Rate for Non-College Men</td>
<td>275</td>
<td>0.021</td>
<td>0.046</td>
</tr>
<tr>
<td>Construction Employment Share for Non-College Men</td>
<td>275</td>
<td>0.029</td>
<td>0.022</td>
</tr>
<tr>
<td>2006-2012 Changes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment Rate for Non-College Men</td>
<td>275</td>
<td>-0.065</td>
<td>0.030</td>
</tr>
<tr>
<td>Construction Employment Share for Non-College Men</td>
<td>275</td>
<td>-0.035</td>
<td>0.027</td>
</tr>
<tr>
<td>2000-2012 Changes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment Rate for Non-College Men</td>
<td>275</td>
<td>-0.044</td>
<td>0.056</td>
</tr>
<tr>
<td>Construction Employment Share for Non-College Men</td>
<td>275</td>
<td>-0.007</td>
<td>0.024</td>
</tr>
</tbody>
</table>

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/ACS data. The Change in Housing Demand is constructed by multiplying the change in housing prices (from FHFA house price index) by the change in housing permits. This procedure creates a proxy for the change in housing demand in an MSA. All of the reported sample statistics are computed using the 2000 population of prime-aged adults in the MSA (from Census/ACS) as weights, since these weights are used in all of the regressions.
### Table 2
Manufacturing Decline, Housing Booms, and Cross-City Masking

<table>
<thead>
<tr>
<th>Sample: Prime-Age, Non-College-Educated Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable:</td>
</tr>
<tr>
<td>Employment Rate</td>
</tr>
<tr>
<td>Construction Employment Share</td>
</tr>
<tr>
<td>Population</td>
</tr>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>(2)</td>
</tr>
<tr>
<td>(2)</td>
</tr>
</tbody>
</table>

#### Panel A: Change Between 2000 and 2006

| Change in Share of Population Employed in Manufacturing, $\Delta M_k$ [Manufacturing Decline] | 0.009 | 0.001 | 0.034 |
| Change in Housing Demand, $\Delta H_k$ [Housing Shock] | 0.027 | 0.021 | 0.041 |
| $R^2$ | 0.73 | 0.49 | 0.23 |

#### Panel B: Change Between 2000 and 2012

| Change in Share of Population Employed in Manufacturing, $\Delta M_k$ [Manufacturing Decline] | 0.012 | -0.002 | 0.042 |
| Change in Housing Demand, $\Delta H_k$ [Housing Shock] | 0.008 | 0.001 | 0.045 |
| $R^2$ | 0.61 | 0.35 | 0.35 |

| N | 275 | 275 | 275 |
| Include baseline controls | y | y | y |

**Notes:** This table reports results of estimating equation (3) by OLS for various samples. A 1 unit decrease in the Manufacturing Decline measure corresponds to a 1 percentage point decline in share of prime-age (21-55) non-college-educated adult population employed in manufacturing. A 1 unit change in housing demand measure corresponds to 1 log point change in housing demand proxy described in table 1. 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 MSA. The standardized effects rescale the coefficient by a one standard deviation change using the cross-MSA standard deviation. Standard errors, adjusted to allow for an arbitrary variance-covariance matrix for each state, are in parentheses and p-values are in brackets.
## Table 3
Displaced Manufacturing Workers, Housing Booms, and Individual-Level Masking

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>Employed</th>
<th></th>
<th>Employed in Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Difference-in-difference estimate of effect of housing boom:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Displaced between 1996 and 2005 × Housing Boom MSA</td>
<td>0.088</td>
<td>0.093</td>
<td>0.038</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.040)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>Mean of dependent variable</td>
<td>0.692</td>
<td>0.692</td>
<td>0.056</td>
</tr>
<tr>
<td>N</td>
<td>2513</td>
<td>2513</td>
<td>2513</td>
</tr>
<tr>
<td>R²</td>
<td>0.13</td>
<td>0.13</td>
<td>0.12</td>
</tr>
<tr>
<td>Include MSA fixed effects</td>
<td>y</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>Include Displacement Year fixed effects</td>
<td>y</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>Include Individual-level controls</td>
<td>y</td>
<td>y</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** This table reports OLS estimates of equation (10). The first row reports the Difference-in-Difference estimate of the effect of being displaced during housing boom time period within an MSA that was experiencing a housing boom. An MSA is defined to be a "Housing Boom MSA" if it has value in the top tercile of the distribution of 2000-2006 changes in housing demand as defined in Table 1. If a displaced worker is not in one of these MSAs or is in a non-metro region, then this indicator is set to 0. The controls in columns (3) and (6) 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.
Figure 1

Employment Rate, Prime Age Individuals

Data from U.S. Bureau of Labor Statistics. Employment in 1,000s.
Figure 2

Total Monthly U.S. Manufacturing Employment (in 1,000s):
1980M1-2015M9

Data from U.S. Bureau of Labor Statistics. Employment in 1,000s.
Figure 3
Construction and Manufacturing Share, Non-College Men Aged 21-55, 1980-2014

Data from U.S. Bureau of Labor Statistics. Employment in 1,000s.
Figure 4

Construction, Manufacturing, and Non-Employment Share
Non-College Men Aged 21-55, 1980-2014

Data from U.S. Bureau of Labor Statistics. Employment in 1,000s.
Figure 5
Housing Booms and Manufacturing Decline
Dependent Variable: Change in Employment Rate of Non-College Men, 2000-2006

Note: Sample is Prime-Age (21-55) Men without a Non-College Education. Housing Demand Change is the sum of the change in house prices and housing permits. See text for details.
Figure 6
Housing Booms and Manufacturing Decline
Dependent Variable: Change in Employment Rate of Non-College Men, 2000-2012

Note: Sample is Prime-Age (21-55) Men without a Non-College Education. Housing Demand Change is the sum of the change in house prices and housing permits. See text for details.