Weathering the Great Recession: Variation in Employment Responses by Establishments and Countries

Abstract

This paper finds that US employment changed differently relative to output in the Great Recession and recovery than in most other advanced countries or in the US in earlier recessions. Instead of hoarding labor, US firms reduced employment proportionately more than output in the Great Recession, with establishments that survived the downturn contracting jobs massively. Diverging from the aggregate pattern, US manufacturers reduced employment less than output while the elasticity of employment to gross output varied widely among establishments. In the recovery, growth of employment was dominated by job creation in new establishments. The variegated responses of employment to output challenges extant models of how enterprises adjust employment over the business cycle.

Erling Barth, Institute for Social Research, Oslo, ESOP, University of Oslo and NBER
James Davis, U.S. Census Bureau
Richard B. Freeman, Harvard University and NBER
Sari Pekkala Kerr, Wellesley College

June 2016

Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the U.S. Census Bureau. All results have been reviewed to ensure that no confidential information is disclosed. This work has received support from the Russel Sage Foundation and the Norwegian Research Council (#227072).

How did the US labor market, widely viewed as the most market-driven and flexible among advanced countries, weather the Great Recession and ensuing recovery? The preceding decades' ballyhoo about the great American jobs machine notwithstanding, employment fell sharply in the Great Recession and increased slowly in the recovery so that in 2015, six years into the recovery, the employment-population rate was 3.6 points lower than in 2007.[1]

This paper combines establishment data sets from Census Research Data Centers – the Longitudinal Business Database (LBD)[2], Annual Survey of Manufacturers (ASM) and the Census of Manufacturers (CoM) -- with decennial Census long form data on the characteristics of employees in establishments[3], and National Science Foundation data on the research spending of firms to analyze the establishment level underpinnings of employment changes in the Great Recession and recovery.

The paper finds that: 1) In the Great Recession US firms reduced labor usage proportionately more than GDP, producing counter-cyclic changes in productivity, in contrast to labor hoarding in past US recessions and labor hoarding in other advanced countries in the Great Recession; 2) Recession job loss was driven by contraction of jobs in establishments that survived the downturn whereas recovery job gains came largely through entering establishments adding more employees; 3) US manufacturing diverged from the bulk of the economy by hoarding labor in the Great Recession; 4) Manufacturing establishments with observably similar characteristics had widely varying responses of employment to output[4] in the downturn and recovery. The findings show a substantial gap between models of employment in a flexible labor market and actual employment determination.

1. Employment changes differed this time

Figure 1 compares GDP and employment in the Great Recession/recovery and in the three preceding cycles relative to their pre-recession values.

Panel A displays the ratio of GDP to pre-recession peak GDP by the number of quarters in each of the recessions. The decline in GDP relative to pre-recession GDP shows that the Great Recession was deeper and longer than the previous three recessions. Befitting its name, the Great Recession's loss of output was the largest since the Great Depression.

Panel B displays the ratio of the number of jobs before the recession to the number afterward by number of quarters in each recession, where we calculated the quarterly averages from monthly payroll employment data. Given the big decline in output in the Great Recession, it is no surprise that quarterly employment fell more than in the earlier recessions: a near 6.0 percent loss of jobs from pre-recession quarterly employment to the quarter when employment bottomed out compared to an average loss of below 3 percent in the other recessions depicted in the figure. The finer grained monthly data shows a drop in employment of 5.3% from December 2007, when NBER dated the beginning of the recession to June 2009, when it dated the end of the recession. But employment fell for the first eight months of the recovery, bottoming out in February 2010 at 6.3% below its pre-recession peak. The number of months in which employment was below its previous peak exceeded that in the other recessions.

---

1 Based on seasonally adjusted May data from BLE Series Id: LNS12300000 Employment-Population Ratio.

[2] We use the LBD to clarify entry and exit in the ASM and CoM. These data are also used by Census to construct the Business Dynamics Statistics used in Tables 2 and 3.

[3] We added data on education matching the public use U.S. 2000 Census long form data (IPUMS) at the 6-digit industry and county level to each establishment by industry, at the most detailed naics code as available in the IPUMS, and county level, with PUMA areas mapped to counties. This procedure parallels that of Moretti (2004).

[4] Output as measured by gross revenues, which is sales.

Comparing the two panels, the link between changes in employment and changes in output as employment weakened, indicating that employment had moved from being a coincident indicator of the cycle to a laggard indicator. In the 1981 recession, employment recovery tracked GDP recovery closely. In the 2001 recession, the GDP decline was short but employment kept shrinking after GDP recovered. In the Great Recession, employment fell proportionately more than output and did not begin to recover until three quarters after output increased. The 4.2% drop in real GDP from peak to trough and the 5.3% fall in employment over the same period produces an implicit employment to GDP elasticity of 1.26 (= 5.3/4.2). In the recovery, by contrast, GDP's 7.8% increase through Q1 of 2015 exceeded employment's 4.8% increase, with an implicit employment to GDP elasticity of 0.62 (= 4.8/7.8). The rapid drop in labor usage and the slow recovery produced counter-cyclic labor productivity, contrary to the pro-cyclic labor productivity in earlier recessions (Okun, 1970; Solow, 1964, Biddle, 2014)[5] that led economists to develop labor hoarding models of firm employment decisions.

Labor Productivity and Hoarding

Studies of employment adjustments in the business cycle began with the prior that productivity should vary counter-cyclically (Biddle (2014)). The reason is clear. Recession reductions in employment should raise labor productivity due to the increase in the marginal productivity of variable labor relative to fixed capital. In a recession workers who remain employed have more capital with which to work and thus should have higher productivity. Recovery increases in employment, by contrast, ought to reduce labor productivity as additional employees lower the capital/employee ratio. In addition, selectivity in hiring or firing (which macro models generally ignore) also suggests a counter-cyclical movement of labor productivity as firms lay off the least productive workers in a recession and hire them back in recovery. To explain the surprising pro-cyclic movement of labor productivity in the business cycles in the 1960s-1990s, analysts developed “labor hoarding” models in which the costs of adjusting employment made workers a quasi-fixed rather than variable factor of production.[6]

In the Great Recession, however, US productivity did not to show the drop predicted by labor hoarding. This contrasted with almost all other advanced countries, where productivity fell in the recession. Table 1 documents the Great Recession pattern of changes in GDP per hour with data on GDP per hour worked for major countries from the Conference Board's International Labor Comparisons (ILC) program. Columns 1 to 3 give the estimated GDP per hour worked in 2007, 2009, and 2012. Column 4 records the annualized rate of change of productivity in the recession (2007-2009) while column 5 gives the annualized rate in the recovery (2009-2012). The last column records the difference between annualized productivity growth in the recovery and recession. Positive differences imply pro-cyclic productivity. Negative differences imply the opposite.

All of the countries save the US and Japan, which was mired in its lost decade of economic stagnation, had positive recovery–recession differences, implying pro-cyclic movements of productivity. The decline in productivity in most countries came, however, not only from the “normal” costs of adjustments at the heart of hoarding models but also from explicit collective bargaining or government policies to save jobs in the Great Recession. In Sweden unions and employers negotiated agreements that maintained many jobs during the recession. In Germany the government introduced a short-term work program and work

5 For the impact of pro-cyclic labor productivity in Solow's thinking, see Assous, 2013 and Biddle 2014.

6 Biddle (2014) stresses the important contributions of Holt, Modigliani, Muth, and Simon (1960).

allowance that subsidized part of labor cost in firms whose receipts decreased by 10 percent. The Netherlands paid 70 percent of the wages for the non–work hours of employees that firms kept "on the job." And so on (Freeman 2013). Absent agreements and policies, European firms would likely have terminated more workers in the recession and hired more in the recovery, attenuating if not reversing the pro-cyclic movement of labor productivity.

Employment adjustments relative to output in US manufacturing, however, looked more like adjustments in non-US OECD countries than those in the aggregate US. Bureau of Labor Statistics data show manufacturing employment declining proportionately less than output in the downturn – a sign of labor hoarding absent substantial bargaining or government policies pressuring or rewarding firms to maintain employment. As a result from Q1 2008 to Q4 2009 *real value added* per hour in manufacturing fell by 24% while in the recovery real value added per hour increased by 27% through Q4 2012.[7] However, Conference Board data tells a different story for *real gross output* per hour worked, where gross output includes intermediate goods/materials as well as value added. The gross output per hour data show increased manufacturing productivity in the Great Recession.[8] The difference between the ILC and BLS measures reflects a divergent movement of the price deflator for real gross output and the price deflator for real value added[9] whose resolution lies beyond this study.

To better identify the role of the Great Recession and recovery on changes in employment from the long term effects of technological change and capital-labor substitution on employment requires a micro level analysis of employment, to which we turn next.

2. Changes in continuing, exiting and entering establishments

To probe the micro-underpinnings of the US's Great Recession employment experience, we decomposed changes in employment into the changes that occur in continuing establishments – those that operated before the downturn and kept operating through the recession – and changes that result from the exit and entry of establishments. Let E(t) be employment in year t; Ec(t) be employment in t in establishments operating in t and t-1; Eb(t) be employment in establishments that entered the market in year t (operated in t but not in t-1); and Ed(t-1) be employment in establishments that exited the market in year t (operated in t-1 but not in t). Then the change in employment from t-1 to t is:

(1) $E(t) - E(t\text{-}1) = [Ec(t) - Ec(t\text{-}1)] + [Eb(t) - Ed(t\text{-}1)]$,

where $[Ec(t) - Ec(t\text{-}1)]$ is the change among continuers and $[Eb(t) - Ed(t\text{-}1)]$ is the change due to job creation in entering establishments minus job destruction in exiting establishments.

Dividing both sides of the equation by $E(t) - E(t\text{-}1)$ gives the relative contribution of changes in continuers and of exit-and-entry to each part to the total change from (t -1 to t).

---

7 Federal Reserve of St Louis, FRED data base, Manufacturing Sector, Real output per hour for all persons, Series ID OPHMFG. Also Bureau of Labor Statistics',Major Sector Productivity and Costs Original Data Value Series Id: PRS30006032 Sector: Manufacturing.

8 The Conference Board, International Labor Comparisons, International Comparisons of Manufacturing Productivity & Unit Labor Costs Trends, 2014, time series tables downloadable from https://www.conference-board.org/ilcprogram/index.cfm?id=30136.

9 Bureau of Economic Analysis, Commerce Department, GDP by Industry spreadsheet GDP by Ind_VA_NAICS_1997-2014 shows that manufacturing gross output fell by 17% from 2007 to 2009 and increased by12% for a 29 point swing while manufacturing value added fell by 10% and then increased by 6% for a 16 point swing. The price index for Gross Output increased by 1% from 2007 to 2009 and by 16% while the price index for Value Added increased by 4% in the recession and 8% in the recovery. Baily and Bosworth (2014, table 2) show different growth of gross output and value added in the computer and electronic products industry manufacturing due in part to differences in value added and gross output price deflators. Houseman, et al (2011) analyze the problems that price indexes create in measuring economic activity in manufacturing.

Table 2 presents this decomposition for one digit sector private sector industries and the entire private sector in the recession and ensuing recovery.[10] Taking the NBER dating of the end of the recession as occurring in June 2009, we treat 2009 as the year when the recession ended and the recovery began in the BDS annual data. The recession period "All" line shows a net loss of jobs of 5.007 million and a larger loss of 5.748 million among establishments that continued operating. The 0.741 million jobs difference implies that in the Great Recession, *entering establishments hired more employees than exiting establishments terminated*. The one digit industry data locate one third of the recession job loss in manufacturing and almost 1/4th in construction for 58% of all job losses. In two other sectors with large declines in employment, retail trade and services, the decline occurred despite large net employment gains from exit and entry as continuing establishments contracted jobs massively.

The recovery "All" line shows a different pattern. Changes in employment are dominated by exit and entry rather than by continuing establishments. Of the 2.187 million net gain of jobs, 1.385 million (63%) was due new entrants creating more jobs than exiting establishments destroyed. Manufacturing and construction shed jobs through the recovery, with exit and entry accounting for 36% of the recovery job loss in manufacturing and 59% of the recovery job loss in construction. The importance of exit-entry in the recovery does not contravene the finding that the continuing establishments who make up the majority of establishments dominate changes in employment at all phases of the cycle. Appendix A shows that changes among continuers are the major component of job creation and destruction in the recovery and recession in the LBD data. What is distinct about our exit-and-entry analysis is that it organizes data around *net changes in jobs*, which depend on *differences* in job gain and loss among continuers relative to *differences* in job creation in entering establishments and job destruction in exiting establishments rather than on the contributions of changes among these types of establishments to total job creation or destruction.

To illuminate further the dominance of continuers in recession job changes compared to exit and entry in recovery job changes, we decomposed employment changes into the changed number of establishments in the continuers, entrants, and exiting groups, and the average number of jobs gained/lost per establishment for each group. The "All" figures for the *recession* in Table 3 show that continuing establishments dominated recession job loss because continuing establishments made up about 80% of all establishments.[11] In the recession more establishments exited than entered but entering establishments created 1.2 more jobs than exiting establishments eliminated so that exit and entry produced a modest *net*

---

10 Aggregate data on employment, job creation and job destruction are from the Census Bureau's Business Dynamics Statistics (BDS) website. We use the "Economy Wide" table for total counts and the Sector-table for counts by 1-digit SIC sectors. The BDS reports yearly employment based on March data, along with the total number of jobs created and destroyed each year based on the last 12-months. Job destruction/creation are jobs lost via establishment deaths/gained via establishment births. The "Establishment Age by Sector" table splits the data by establishment age. The BDS does not define birth in a unique way: an establishment is born when it begins with age 0, but if employment goes to zero and later back to a positive number the establishment is "born again" even if its age is greater than zero. BDS suppresses job counts in cells that fall under a certain firm count.

11 Using the 2007 to 2009 recession data, continuers made up 79% of establishments in 2007 (= 5.121 million continuers / (5.121 + 1.398 establishments in 2007 but gone by 2009)) and 80% of establishments in 2009 (= 5.121 / (5.121 + 1.291 establishments in 2009 but not in 2007)). Using the 2009 to 2012 recovery data continuers made up 73% of establishments in 2009 (= 5.149 / (5.149 + 1.916)) and 73% in 2012 (= 5.149 / (5.149 + 1.922)).

gain in employment. In manufacturing, by contrast, nearly 40% more establishments exited than entered the market with little difference in the average size of entering and exiting establishments, so that exit and entry contributed to the job loss. Still continuers dominated job loss in manufacturing because of their large 6.4 decline in average employment.

The "All" changes in the *recovery* section of Table 3 tell a different story. The dominance of entry-exit in the recovery is due primarily to the difference between the average gain in employment in entering establishments and the average loss in employment among exiting establishments.[12] Again, however, manufacturing is different. Even in the recovery more establishments exited than entered in manufacturing (and construction) while the average employment in exiting establishments exceeded the average employment of entrants.

To the extent that establishments that enter the market better fit existing economic conditions than establishments that exit, differences in their characteristics provide insight into the selectivity of technological and market forces. Figure 2 displays the mean 2007 physical and human capital characteristics of manufacturing establishments that entered or exited in the recession or recovery.[13] A characteristic more (less) frequent among entering than exiting establishments suggests that the characteristic's economic value has increased (decreased) over time. The figure shows that entering establishments had larger capital-to-employee ratios, college shares of the work force, and made greater investment in computer per employee than exiting establishments but had similar ratios of non-production employees. These differences are consistent with technological upgrading and capital-human capital complementarity in the technology that affects employment.

3. Heterogeneity in Responses to Output Shocks

Behind average changes in employment lie distributions in which some establishments change employment more and others less than the average either because the market conditions they face differ from the average and/or their technologies differ, or because they respond differently than other establishments to the same conditions. Regardless of the cause, heterogeneity of responses among establishments is potentially important in the micro-underpinning of aggregate employment changes in the business cycle.

We examine next changes in employment relative to output among continuing establishments in manufacturing[14]. We limit our analysis to manufacturing because the yearly production data in the Census Bureau's Annual Survey of Manufacturers allows us to differentiate recession from recovery, whereas production data in the quinquennial Censuses of Production for other sectors lacks the time detail to distinguish the two parts of the cycle.

---

12 Let Ne = number of entering establishments, Ae = average employment in those establishments; Nd = number of exiting establishments and Ad = average employment in those establishments. Then job change from exit and entry is NeAe -Nd Ad, which decomposes algebraically into (Ne-Nd) Ad + (Ae-Ad) Nd + (Ne-Nd) (Ae-Ad), where the first term is the different number of entering and exiting establishments, weighted by average employment in exiting establishments; the second term is the difference in average employment in entering and exiting establishments, weighted by the number of exiting establishments and the last term is the interaction of the two differences. The difference in average sizes times the exiting number of firms accounts for 97% of the contribution of exit and entry to growth of jobs.

13 The characteristics are for 2007 for exiters to avoid reverse causality from the recession/recovery on the characteristics.

14 Establishments are included in the calculations if they exist in the beginning and end of each period. This calculation is possible with the ASM because the ASM 5-year panels can be linked to prior and subsequent Census of Manufacturers to retain all ASM plants (i.e. not limited to the large plant certainty sample). For example the 2009 ASM panel is linked to the 2007 CoM. Focusing on continuing establishments sidesteps the discontinuity in changes related to exit and entry and potential differences between exit and entry decisions and expansion/contraction decisions.

We follow Davis, Haltiwanger and Schuh (1996) and measure changes in employment relative to average establishment employment in the starting and ending period, in order to reduce the risk that large relative changes in employment for small establishments unduly affects the estimates.[15]

Table 4 shows the average annual changes in employment and output for all establishments and those in the 0-20th, 40-60th, and the 80-100th quintile of changes ranked by rate of increase from lowest to highest. The natural measure of variation in these statistics is the inter-quintile range, defined as the difference between the top quintile's mean change in employment and the bottom quintile's mean change in employment. In the Great Recession, manufacturing employment declined on average by 13% while output declined by 18.6%, for an implicit employment to output elasticity of 0.70, per labor hoarding behavior. The quintile changes reveal large increases in employment and output at the upper end of the distributions and large decreases at the lower end: a top quintile employment increase of 42.1% compared to a bottom quintile decrease of 90%, giving an inter-quintile range of 132 points; a top quintile average increase in output of 33.8% and a bottom quintile average decrease in output by 93%, giving an inter-quintile range of 127 points.

In the recovery, manufacturing employment fell by 3.8 % while output increased by 13.1%, producing a 16.9% increase in productivity. But, as in the recession, the averages masque huge variation: a 78% employment drop in the bottom quintile compared to a 57.7% increase in the top quintile; a 63.2% output drop in the lowest quintile compared to a 72.1% increase in the top quintile. The large recession gain in employment and output in the highest quintile of establishments compared to the large recovery loss of employment and output for the lowest quintile highlights the heterogeneous experience of establishments. Some establishments expand even in a huge recession and some contract even in a recovery.

To see whether the heterogeneity was exceptional to the Great Recession or normal for recent recessions, we computed inter-quintile ranges of change in employment and output in the 2000-2002, 1989-91, and the 1979-81 recessions. The bottom panel of Table 4 shows smaller inter-quintile ranges of changes in those recessions than in the Great Recession and smaller inter-quintile ranges in changes in the recovery phases than in the recovery from the Great Recession. But, the ranges still evince huge heterogeneity.[16]

Technological change and capital-labor substitution

Changes in employment or output associated with the characteristics of continuing establishments offer insight into the direction of economic and technological forces, just as do comparisons of the characteristics of entering and exiting establishments. A characteristic that raises growth of output or employment in a regression indicates that market forces favor that characteristic. To see how the attributes of establishments affect employment and output, we regressed changes in employment and output in the Great Recession and in the recovery separately on: the share of college graduates; capital per employee[17]; computer investment per employee; and whether the firm that owns the establishment did R&D, among other factors.[18]

---

15 This problem can also be addressed by weighting observations by the number of employees.

16 Davis, Haltiwanger and Schuh (1996) and Haltiwanger (2012), among others, also note the heterogeneity in changes in employment among enterprises.

17 Capital stocks were created by Foster, Grim and Haltiwanger (2016) using perpetual inventory methods.

18 The R&D status for the firm that owned an establishment is from the NSF Survey of Industrial R&D (SIRD) and Business R&D and Innovation Survey (BRDIS). We find R&D spending to be persistent, where we pool R&D years to determine if a firm ever performs R&D, in which case they are indicated as an R&D firm. This procedure helps overcome coverage issues, given the R&D data are surveys, and thus captures R&D

The regressions include a vector of 3 digit NAICS level industry dummies interacted with the state location of the establishment, so the estimates come from variation within industry-state cells. To ease interpretation of the regressions, we normalized the variables to their average 2007 value so that the constants measure change for an establishment with average characteristics.

Column 1 of table 5 records the estimated coefficients from OLS regressions of changes in output in the Great Recession on the characteristics. The estimated constant shows that revenue in the average establishment declined 19.2 % from 2007 to 2009. Column 2 records the estimated coefficients for regressions of changes in employment in the recession on the characteristics. The estimated constant shows that employment declined by 14.7%. The smaller change of employment than of output to the recession reflects "labor hoarding" for establishments with similar characteristics. The characteristics that differentiated entering from exiting establishments in figure 2 affect output and employment in table 5 in a similar manner: establishments with relatively more college graduates, capital per employee, and computer investment per employee had higher growth than other establishments in the same industry and state during the recession. By contrast, establishments in firms that do R&D averaged a 3.9 point greater increase in output than establishments in non-R&D firms but had a 0.8 point smaller change in employment. This likely reflects the fact that R&D-based technology creates process as well as product innovation. New/improved products add to output and employment while new production processes are often labor saving and can reduce employment.

Columns 3 and 4 examine the relation between establishment characteristics and changes in output and employment in the recovery. An establishment with average characteristics had output growth of 16.9% but employment growth of just 3.4% that reflects the "jobless recovery". The estimated impacts of establishment characteristics on output and employment in the recovery differ markedly from the columns 1 and 2 estimated impacts of characteristics in the recession. The coefficients for the share of college employees and computer investment per employee change from positive in the recession to negative in the recovery. The estimated coefficients on R&D performing firms shift from positive to negative on output and become more negative on employment. Only the estimated coefficients on capital-labor ratios show similar patterns in both phases of the cycle, with capital-intensive firms expanding more in output and employment.[19]

A plausible explanation for the general pattern of sign reversal is labor hoarding behavior, with establishments that were more negatively impacted by the recession being commensurately less positively impacted by the upturn; and conversely for those less impacted by the recession. Since firms hoard labor in recessions to avoid recruiting labor in recoveries, the hoarding firm will reduce employment less in the recession and increase employment less in the recovery than the firm that does not hoard labor. Technological change and capital-labor substitution aside, a firm that hoarded completely would lay off no one in a recession and would not have to hire anyone in a recovery to bring output to its pre-recession

---

activity of small firms. However, comparing our R&D indicator to patent data as well as to firm count estimates by firm size using the R&D survey weights, some measurement error for the R&D performance of small firms remains. Another factor in the regressions was the export status of the establishment measured in the share of output sold overseas, which we treat as a covariate control.

19 To see if the Great Recession downturn and recovery differed from downturns and recoveries in earlier recessions, we estimated variants of the table 5 equations for the entire 2007-2012 period and for the downturn and recovery in the three previous recessions. We found only modest differences in the relation between the physical and human capital of establishments and the R&D attribute of the owning firm on output and employment.

level. By contrast a firm that treated labor as completely variable would lay off 10% of its work force when output fell by 10% and rehire all those workers when output regained the pre-recession level.

To assess the extent of job hoarding behavior at the establishment level, we estimate equations linking ln changes in establishment employment to ln changes in establishment output in the recession and recovery periods. Hoarding at the establishment level would show up in an estimated coefficient of the change in employment on the change in output below 1.0. Column 1 of Table 6 gives an estimated coefficient on output of 0.389 in the recession period, indicative of considerable hoarding. Column 2 of Table 6 gives an estimated coefficient on output of 0.473 in the recovery period, far below the 1.0 that one would get if labor was a completely variable input.

Taking the analysis a step further, the establishment data allows us to make a direct test of the proposition that labor hoarding in recession reduces growth of employment in the recovery. Using the information on the changes in establishment employment and output in the recession, we estimate a "recession hoarding" variable for each establishment and add that measure to the regression of employment changes on output changes in the recovery. Our recession hoarding measure is the residual from the column 1 estimate of the change in employment on output in the recession. The larger is employment relative to its predicted level from the regression, the larger is the estimated amount of hoarding[20]. Column (3) shows that this measure obtains a large significant negative effect in the regression for the change in employment in the recovery. Hoarding evinces itself in the adjustments of employment throughout the distribution of employment and output changes as well as in the different average changes in employment and output in recession and recovery.

Finally, we examine the hoarding notion by contrasting the actual pattern of changes in employment and output to a well-specified counterfactual that abstracts from the business cycle. Assume that absent the recession output and employment would have changed smoothly from 2007 to 2012. This identifies the impact of the cycle as the difference between the actual changes and the counterfactual smooth change. Columns 1 and 2 in Table 7 give the regression coefficients of the growth of output and employment on the characteristics of establishments in the 2007-2012 smooth growth counterfactual.[21] These regressions show that the college share of the work force had little relation to growth of output or employment over the entire period; that R&D of the firm is associated with increased output but reduced employment; while capital/employee ratios and computer investments per employee are positively associated with output and employment. Column 3 gives the annual change in output/employee associated with each characteristic obtained by dividing the difference between the columns 1 and 2 coefficients by 5 for the 5 years covered.

Columns 4 and 5 record the deviations of productivity measured by output per employee in the recession and in the recovery from the smooth change. For an establishment with average characteristics, productivity increased by 7.1 ln points more in the recession than in the benchmark smooth adjustment. By contrast, the average establishment fell short of the smooth benchmark by 9.5 points in the recovery. Since changes in recession and recovery are

---

20 The residuals measure of hoarding can be improved in various ways, such as comparing changes in employment with changes in materials, which the firm is unlikely to hoard, or differentiating production from non-production workers, or distinguishing establishments with increases in sales in the recession and/or decreases in sales in the recovery, but the table 6 analysis suffices to establish the establishment basis of hoarding.

21 As in other tables, the output and employment dependent variables were scaled with 2007 as 1.00 so the constants give the growth rates for establishments with the average characteristics.

deviations from the smooth growth, the estimated effects for independent variables in recession and recovery necessarily alternate in sign. The biggest differences in the coefficients are for the share of college graduates. Establishments with high college shares stabilized productivity over the cycle more than other establishments.[22]

4. Conclusion

Our analysis of aggregate, sectoral, and establishment level changes in employment and productivity in the Great Recession and recovery document that employment responses differed greatly to changes in output between the US and other advanced countries, between US manufacturing and the bulk of the US private sector, and among US manufacturing establishments. Taking the economy as a whole, US firms reduced employment proportionately more than output in the Great Recession, in contrast to the labor hoarding behavior in most advanced countries and in earlier US recessions. The main pathway for the huge reduction in US employment was massive contractions of employment by existing establishments. The pathway for job growth in the recovery, by contrast, was dominated by the exit-and-entry of establishments, with new entrants to the market adding greatly to employment. Manufacturing establishments, however, behaved differently, hoarding labor in the recession while evincing widely varying elasticity of employment to gross output in recession and in recovery.

These differences in employment responses challenge simple models of how enterprises adjust employment in downturns and recoveries. Given that labor institutions are generally stronger in the EU than in the US, it is natural to attribute US-EU differences in employment responses to the different institutional settings, in particular to greater employment protection legislation and higher density of collective bargaining in the EU than in the US.[23] But, as noted earlier, many EU countries introduced explicit policies to preserve jobs in the Great Recession and unions and employer federations negotiated new collective bargaining agreements, suggesting two different institutional explanations for hoarding behavior in Europe. The first explanation attributes most of the smaller employment response to the "normal costs of adjustment" stressed in hoarding models. The second explanation attributes most of the preservation of jobs to the emergency legislation and agreements. An institutional explanation ought to provide estimates of these two routes of impact. It should also explain the sizable differences in employment responses among countries beyond the US in Table 1 – for instance why productivity fell in the recession in Britain, Germany, and Denmark while increasing in Spain, Ireland, and Austria. Analyses that propose institutional explanations for US-EU differences should be tested on the details of the proposed institutions at country and more micro levels.

The huge layoffs among continuing establishments and higher elasticity of job loss to output in the US in the Great Recession than in previous recessions may also be partly attributable to institutional changes within the country, such as the continued decline in collective bargaining coverage and the shift in the US toward temporary contracts for more

---

22 To check the interrelation between employment adjustments in the recession and recovery, we examined the pattern of change in employment relative to materials as well as to revenues. This compares the two inputs that firms can potentially adjust in the short run to changes in demand for output. Over the entire period the ratio of materials to output increased by 9.3 percent – a change that implies materials augmenting technical change – while the cyclic pattern resembles the table 7 pattern of output/employees with slower growth in the recession and faster growth in the recovery relative to the five year smooth alternative-- the signature of input hoarding.

23 Cazes,Khatiwada, Malo (2012) Figure 2 shows the difference between US and European countries in collective bargaining and employment protection legislation

and more workers. The growth of the "gig economy" in many non-manufacturing sectors invariably makes labor a more variable input, which could explain part of the higher elasticity of employment to output in the Great Recession. But with labor more variable, the elasticity of employment to output in the recovery should also be high, which it was not. The timing of the shift from permanent to more temporary labor contracts also does not fit well with job shedding in the recession. Katz and Kreuger (2016) date the shift toward temporary, on-call and related jobs as occurring largely from 2005 to 2015[24], the balance of which occurs after the Great Recession. Perhaps the employment-at-will doctrine that dominates US labor contracts[25] gives most firms sufficient flexibility to lay off workers in a crisis without temporary contracts, on-call work, and the like. The Great Recession collapse of construction, where almost all jobs are short term gigs, may also have contributed to the absence of labor hoarding in the broad economy.[26]

Within the US, the finding of continued hoarding behavior in manufacturing poses the question of why manufacturing responded so differently to the Great Recession than most other sectors? One possibility is that globalization allowed US manufacturers to off-shore much of the variable part of production work, so that a larger proportion of remaining workers had skills and knowledge that made adjustment cost of layoffs more expensive than in the past. Testing this proposition requires evidence on the extent to which firms and their suppliers adjusted output and employment overseas in the recession. If US firms vary in their ability to move employment adjustments downstream along their supply chain, globalization may also help explain some of the heterogeneity of employment responses to output among observationally similar establishments. Evidence on establishment level changes in other advanced countries could also help determine the extent to which the manufacturing experience of the US in the Great Recession was driven by the technology and global market in the sector as opposed to institutional differences between the US and other advanced economies.

In sum, the evidence of heterogeneity in responses of employment to output among countries and among observationally comparable manufacturing establishments and the shift in the US from hoarding labor to shedding jobs more rapidly than output declined in the Great Recession shows that we know less about how labor markets operate over the business cycle than we thought. Will the next recession, in which a much larger proportion of the work force will hold irregular jobs produce greater job losses than in 2007-2009? Could greater reliance on labor institutions determining wage and employment outcomes dampen job losses, and, if so, what would those institutions be? To answer these and related questions requires new economic analyses of labor demand that focus on the factors behind the variability of employment responses and that seek ways to influence those responses along the entire distribution of responses so that our economies can adjust better to the next recession in the business cycles that seem endemic to market economies.

---

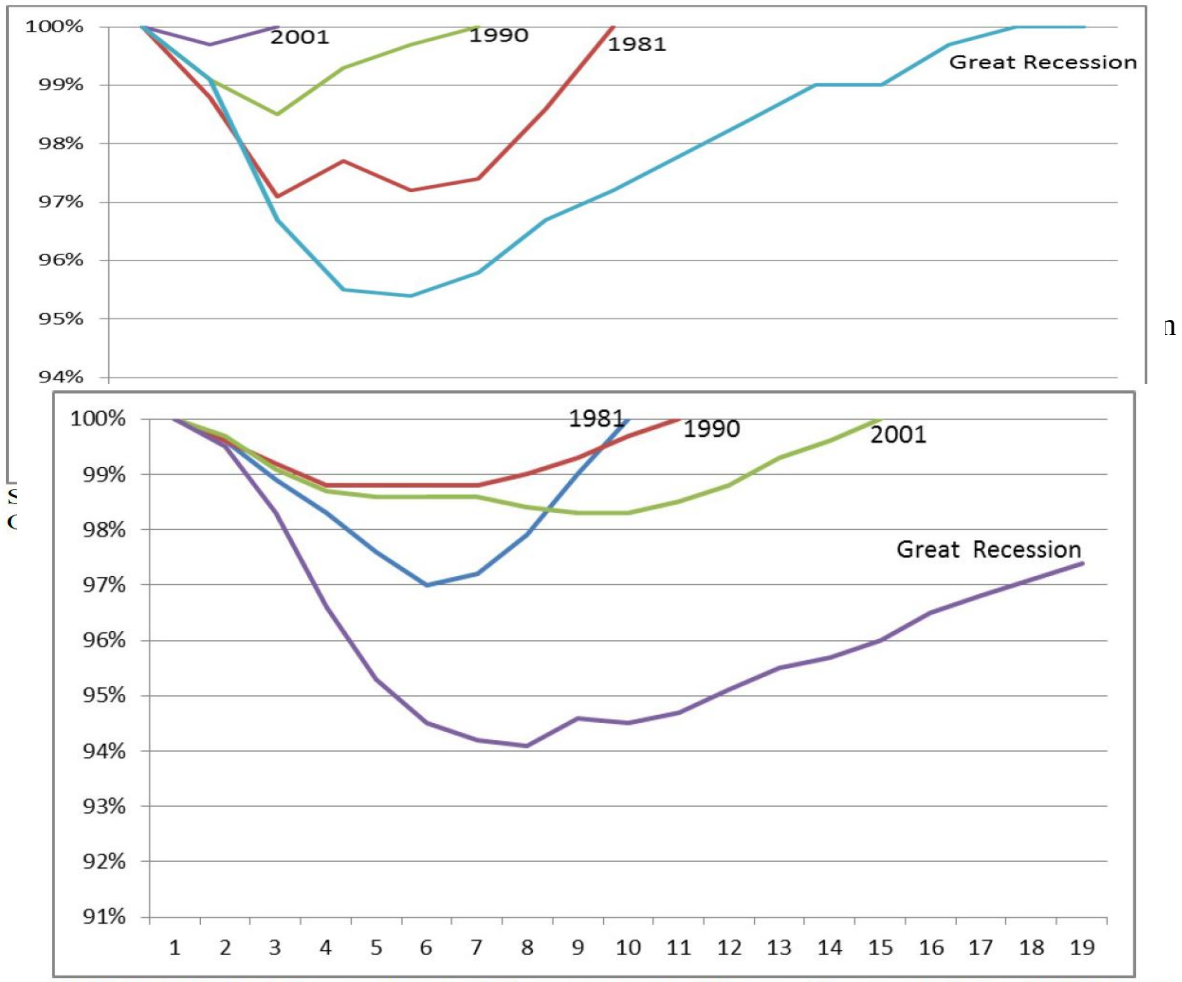
24 Katz and Krueger (2016) show that most of the increase in alternative work arrangements measured by independent contractors, on-call workers, temporary help agency workers, and those provided by contract firms occurred after 2005. See also Abraham, Haltiwanger, Sandusky, and Spletzer, (2015) and Weil (2014).

25 See https://en.wikipedia.org/wiki/At-will_employment

26 Construction employment declined proportionately with construction spending in the recession, based on the data series TTLCONS, for total construction spending, and USCONS, all employees in construction, downloaded from St Louis Fed, FRED data base, https://fred.stlouisfed.org

Figure 1: GDP and Employment Relative to GDP and Employment in Great Recession and Preceding Three Recessions, by quarters since start of each recession

Panel A: Ratio of GDP to GDP Before Recessions, quarterly since recession



SOURCE: Federal Reserve Bank of St. Louis, Federal Reserve Economic Data, FRED Graph Observations; Employment is PAYEMS. Available at: http://research.stlouisfed.org/fred2.

We adjusted the monthly employment data to quarterly basis for comparison with quarterly GDP data.

Table 1: Level and Percentage Changes of Real GDP per Hour Worked in the Great Recession (2007-2009) and Recovery (2009-2012)

	GDP per hour in US $ ppp			Annual Percent change		Recovery-recession
Country	2007	2009	2012	2007-2009	2009-2012	
United States	**59.54**	**61.73**	**64.12**	**1.8**	**1.3**	**-0.5**
Canada	46.52	46.6	47.6	0	0.7	0.7
Australia	48.37	50.1	52.85	1.8	1.8	0
Japan	37.45	37.09	35.73	-0.5	-1.2	-0.7
Korea	23.18	24.34	26.83	2.5	3.4	0.9
Singapore	41.93	37.48	41.17	-5.3	3.3	8.6
Austria	51.84	51.96	53.69	0.1	1.1	0.9
Belgium	63.51	61.79	61.87	-1.4	0	1.4
Czech Republic	30.27	29.82	30.69	-0.7	1	1.7
Denmark	58.96	56.35	59.52	-2.2	1.9	4.1
Finland	50.57	47.37	48.97	-3.1	1.1	4.2
France	58.59	57.95	59.49	-0.5	0.9	1.4
Germany	57.43	55.94	58.26	-1.3	1.4	2.7
Ireland	61.78	62.52	71.31	0.6	4.7	4.1
Italy	45.82	44.46	45.36	-1.5	0.7	2.2
Netherlands	60.94	59.52	60.16	-1.2	0.4	1.6
Norway	88.43	85.78	86.61	-1.5	0.3	1.8
Spain	45.25	46.68	49.99	1.6	2.4	0.8
Sweden	53.73	51.58	54.69	-2	2	4
United Kingdom	50	48.26	48.27	-1.7	0	1.7

Source: Conference Board, International Comparisons of GDP per capita per hour worked, 2012 https://www.conference-board.org/ilcprogram/#Productivity

Table 2: Decomposition of Changes in Employment mong Continuing, Entering and Exiting Establishments in the Great Recession (2007-2009) and Recovery (2009-2102)

	Net Change in Employment	Net job change, Continuers	Continuers % of net change	Total Jobs Change Exits	Entrants	Entrants-Exits
2007 to 2009						
Agriculture	-10 430	-17 741	170 %	-160 293	167 604	7 311
Mining	-64 030	-91 153	142 %	-61 111	88 234	27 123
Construction	-1 205 115	-947 717	79 %	-594 760	337 362	-257 398
Manufacturing	-1 679 584	-1 431 927	85 %	-899 511	651 854	-247 657
Transp, Comm. Util.	-272 942	-322 193	118 %	-541 372	590 623	49 251
Wholesale Trade	-362 068	-302 771	84 %	-595 210	535 913	-59 297
Retail Trade	-618 246	-1 444 660	234 %	-2 166 500	2 992 914	826 414
FIRE	-428 766	-444 030	104 %	-983 565	998 829	15 264
Services	-365 422	-745 614	204 %	-4 077 073	4 457 265	380 192
All	-5 006 603	-5 747 806	115 %	-10 079 395	10 820 598	741 203
2009 to 2012						
Agriculture	21 432	-4 483	-21 %	-207 901	233 816	25 915
Mining	115 599	81 111	70 %	-87 685	122 173	34 488
Construction	-736 530	-432 529	59 %	-734 523	430 522	-304 001
Manufacturing	-537 135	-192 563	36 %	-1 081 277	736 705	-344 572
Transp, Comm. Util.	38 855	-28 010	-72 %	-770 913	837 778	66 865
Wholesale Trade	-129 494	-54 070	42 %	-759 643	684 219	-75 424
Retail Trade	954 567	-203 979	-21 %	-2 865 585	4 024 131	1 158 546
FIRE	-163 323	-204 687	125 %	-1 212 511	1 253 875	41 364
Services	2 623 343	1 841 378	70 %	-5 675 107	6 457 072	781 965
All	2 187 314	802 168	37 %	-13 395 145	14 780 291	1 385 146

Source: US Census Bureau, Business Dynamics Statistics 2012 Release, Sector Table. Note that Total Change in Employment is the difference between job creation and job destruction that in each year reflects the 12-month counts of created and destroyed jobs. This number is different that the change in establishment employment in March of each year.

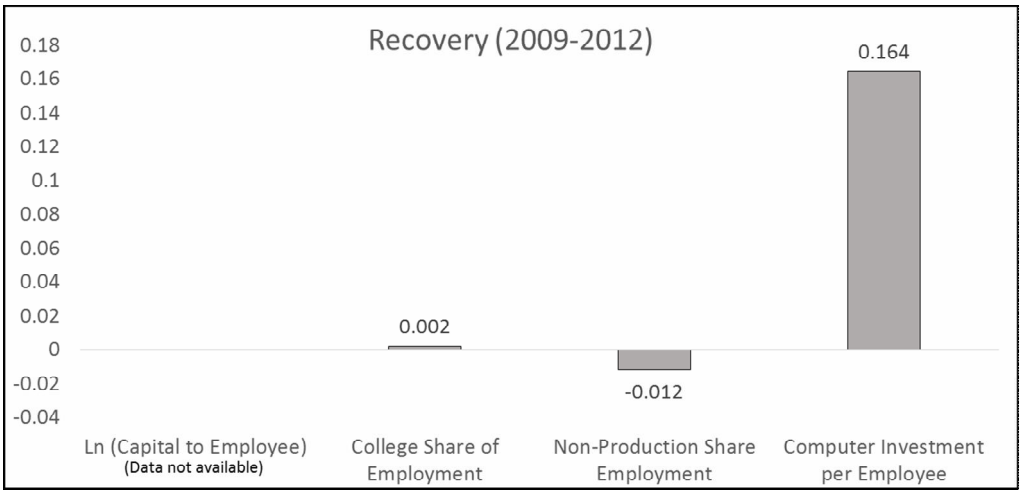
Table 3: Number and Average Employment Size of Exiting and Entering Establishments and Number of Continuing Establishments and Average Change in Employment of Continuers, Great Recession (2007-2009) and Recovery (2009-2012)

	Exits		Entrants		Continuers	
	# of estabs.	Average size at exit	# of estabs.	Average size at entry	# of estabs.	Average Δ in employment
2007 to 2009						
Agriculture	31,448	5.1	31,000	5.4	97,078	-0.2
Mining	4,493	4.8	5,825	15.1	18,747	-4.9
Construction	145,482	4.1	72,722	4.6	370,271	-2.6
Manufacturing	54,477	16.5	39,175	16.6	223,601	-6.4
Transp., Comm. & Util.	71,922	7.5	67,106	8.8	222,527	-1.4
Wholesale Trade	77,751	7.7	68,477	7.8	346,446	-0.9
Retail Trade	284,831	7.6	289,566	10.3	1,164,850	-1.2
FIRE	171,980	5.7	146,390	6.8	550,140	-0.8
Services	555,527	7.3	570,724	7.8	2,127,064	-0.4
All	1,397,911	7.2	1,290,985	8.4	5,120,724	-1.1
2009 to 2012						
Agriculture	43,142	4.8	46,974	5.0	102,952	0.0
Mining	7,179	12.2	8,535	14.3	20,019	4.1
Construction	175,402	4.2	111,927	3.8	320,593	-1.3
Manufacturing	71,615	15.1	54,017	13.6	212,567	-0.9
Transp., Comm. & Util.	94,270	8.2	99,259	8.4	222,337	-0.1
Wholesale Trade	110,191	6.9	100,390	6.8	340,701	-0.2
Retail Trade	396,555	7.2	427,479	9.4	1,185,351	-0.2
FIRE	206,686	5.9	207,231	6.1	552,567	-0.4
Services	811,251	7.0	866,066	7.5	2,191,745	0.4
All	1,916,291	7.0	1,921,878	7.7	5,148,832	0.2

* Source: US Census Bureau, Business Dynamics Statistics 2012 Release, Establishment Age by Sector Table.

* Notes: Total Change in Employment is calculated as the difference between job creation and job destruction that in each year reflects the 12-month counts of created and destroyed jobs. Continuing establishments for 2007-2009 (2009-2012) are those that are aged at least 2 (3) years old in 2009 (2012).

Figure 2: Ln Differential in characteristic of new entering establishments to exiting establishments in manufacturing in Great Recession and Recovery



Note: Entering establishments are those that first appear in the data set. Exiting establishments are those that disappear from data set. Data on capital to employment not available in recovery as capital data are from Foster, Grim and Haltiwanger (2016), based on calculations that do not extend to 2012. Source: See data description.

Table 4: Changes in the Distribution of Employment and Output of Continuing Manufacturing Establishments in the Great Recession (2007-2009) and Recovery (2009-2012), Compared to Three Earlier Recession-Recoveries

Panel A: Great Recession

	Employment		**Output***	
	Recession	Recovery	Recession	Recovery
	2007-2009	2009-2012	2007-2009	2009-2012
Mean	-0.130	-0.038	-0.186	0.131
Mean of:				
1st quintile	-0.899	-0.780	-0.929	-0.632
3rd quintile	-0.124	-0.004	-0.231	0.146
5th quintile	0.421	0.577	0.338	0.721
Range 5th-1st	1.32	1.37	1.27	1.35

Panel B: Three Previous Recessions

	Employment		**Output***	
	Recession	Recovery	Recession	Recovery
	2000-2002	2002-2004	2000-2002	2002-2004
Mean	-0.083	-0.063	-0.05	0.025
Range 5th-1st Quintile	1.09	1.08	1.21	0.95
	1989-1991	1991-1993	1989-1991	1991-1993
Mean	-0.047	-0.042	-0.024	0.037
Range 5th-1st Quintile	1.06	0.97	1.14	1.04
	1979-1981	1981-1984	1979-1981	1981-1984
Mean	-0.087	-0.011	-0.068	0.096
Range 5th-1st Quintile	1.08	1.08	1.15	1.04

Note: Table shows relative changes: $\Delta Y/Y$ where Y is the average of the first and the last years. Continuing plants only. Authors calculations from the Annual Survey of Manufacturers.
* Output as measured by sales.

Table 5: Regression Coefficients and Std Errors for the Relation of Establishment Characteristics on Change in Output and Change in Employment in the Recession (2007-2009) and Recovery (2009-2012)

	Recession (2007-2009)		Recovery (2009-2012)	
	Output*	Employment	Output*	Employment
Constant (Average pre-recession characteristics)	-0.192*** (0.004)	-0.147*** (0.003)	0.169*** (0.005)	0.034*** (0.004)
College share	0.140*** (0.014)	0.082*** (0.011)	-0.101*** (0.016)	-0.082*** (0.013)
R&D firm	0.039*** (0.005)	-0.008* (0.004)	-0.018** (0.006)	-0.049*** -(0.001)
Computer investment per employee	0.014*** (0.001)	0.005*** (0.001)	-0.007*** (0.001)	-0.001 (0.012)
Ln (Capital/Employee)	0.026*** (0.003)	0.016*** (0.002)	0.036*** (0.003)	0.020*** (0.002)
Industry x state dummies	Y	Y	Y	y
Adjusted R sq	0.182	0.165	0.138	0.143
N	40400	40400	36500	36500

Note: Left hand side variables measured as dY/Y, where Y is defined as the average of the last and the first year. Right hand side variables measured as levels in pre-recession year (2007). All models include ln(Employment/Output) in 2007 as well as industry x state dummies. The unit of observation is establishments. The right hand side variables are normalized as deviations from 2007 level, and the constant term may thus be interpreted as the relative change in output and employment for establishments with average characteristics in 2007. The models also include ln(E/S) and ln ratio of exports to output as well as fixed effects for each industry state cell so statistics are generated by variation among establishments in the same state and industry.
* Output as measured by sales.

Table 6: Regression Coefficients (Std Errors) for Changes in Employment on Changes in Output in Manufacturing Establishments in the Recession (2007-2009) and Recovery (2009-2012)

	(1)	(2)	(3)
Dependent Variable:	ΔE/E 2007-2009	ΔE/E 2009-2012	ΔE/E 2009-2012
ΔS/S 2007-2009	0.389***		
	(0.003)		
ΔS/S 2009-2012		0.473***	0.476***
		(0.003)	(0.003)
Recession Labor Hoarding			-0.267***
			(0.005)
Constant	-0.024***	-0.056***	-0.057***
	(0.001)	(0.002)	(0.002)
r2_a	0.254	0.352	0.392
N	39700	39700	39700

Note: The recession labor hoarding measure is the residual from equation (1).

Table 7: Estimated Regression Coefficients and Std Errors for Relation Between Change in Employment and Output and Establishment Characteristics, 2007 to 2012, Average Annual Changes in Output per Employee and Recession and Recovery Deviations from Average Changes.

	Estimated Coefficients, 2007-2012		Annual change in output/employee due to characteristic	Deviation from average ln output per employee	
	output	Emp	2007-2012	Recession 2007-2009	Recovery 2009-2012
Constant	0.061***	-0.005	0.013	-0.071	0.095
	(0.005)	(0.004)			
Pre-recession characteristics, 2007					
College share	0.012	-0.011	0.005	0.049	-0.033
	(0.017)	(0.014)			
R&D firm	0.017**	-0.072***	0.018	0.011	-0.022
	(0.006)	(0.005)			
Computer Investment per Employee	0.003*	0.006***	-0.001	0.010	-0.004
	(0.001)	(0.001)			
Ln Capital / Employee	0.060***	0.034***	0.005	0.000	0.000
	(0.003)	(0.003)			
Industry x State Dummies	Y	Y			
Adjusted R sq	0.149	0.144	--	--	-
N	36600	36600	--	--	-

Note: Dependent variables : ΔY/ average of the first and the last years.

References

Abraham, Katherine, John C. Haltiwanger, Kristin Sandusky, and James R. Spletzer, "Measuring the 'Gig' Economy," U. of Maryland, October 2015; http://www.sole-jole.org/16375.pdf.

Acemoglu, Daron, David Autor, David Dorn, Gordon H. Hanson, Brendan. 2014. "Price Return of the Solow Paradox? IT, Productivity, and Employment in U.S. Manufacturing," IZA Discussion Paper No. 7906, January 2014

Assous, Michaël. Struggle with Medium-Run Macroeconomics: 1956-1995 CHOPE Working Paper No. 2013-17, September 13, 2013

Bailey Martin & Barry Bosworth, 2014. "US Manufacturing: Understanding Its Past and Its Potential Future" *Journal of Economic Perspectives*, Vol 28(1), Pp 3–26

Basu, Susanto & John Fernald, 2001. "Why Is Productivity Procyclical? Why Do We Care?," NBER Chapters, in: *New Developments in Productivity Analysis*, pages 225-302, National Bureau of Economic Research, Inc.

Biddle, Jeff E. 2014. "Retrospectives: The Cyclical Behavior of Labor Productivity and the Emergence of the Labor Hoarding Concept." *Journal of Economic Perspectives*, 28(2): 197-212.

Carlsson, Mikael, Julián Messinaz, and Oskar Nordström Skans. 2014. "Firm-level shocks and labor adjustments," IFAU WP 2014: 28

Cazes, Sandrine; Khatiwada, Sameer; Malo, Miguel. 2012. "Employment protection and collective bargaining : beyond the deregulation agenda" International Labour Office Geneva : ILO, 2012 Employment working paper, No. 133

Davis, Steve, John Haltiwanger, Scott Schuh Job Creation and Destruction. MIT Press, 1996

Fort, Teresa, John Haltiwanger, Ron Jarmin, and Javier Miranda. 2013. "How Firms Respond to Business Cycles: The Role of the Firm Age and Firm Size." *IMF Economic Review*.

Foster, Lucia, John Haltiwanger, and Chad Syverson, 2013. "The Slow Growth of Young Plants: Learning About Demand" NBER Working Paper No. 17853,

Foster, Lucia, Cheryl Grim and John Haltiwanger (2016). "Reallocation in the Great Recession: Cleansing or Not?" *Journal of Labor Economics*, 34(S1), pp.293-331.

Freeman, Richard B. 2013. Failing the Test? The flexible U.S. Job Market in the Great Recession, *Annals of the American Academy of Political and Social Science*, vol 65 Nov, p 78-97

Giroud Xavier and Holger M. Mueller "Firm Leverage and Unemployment During the Great Recession" NBER Working Paper 21076, http://www.nber.org/papers/w21076

Goos, Marten, Anna Salomons, and Marieke Vandewever, “Job Polarization During the Great Recession and Beyond” KULeuven Forum

Haltiwanger, John 2012 Job Creation and Firm Dynamics in the United States in Josh Lerner and Scott Stern (editors), *Innovation Policy and the Economy*, Volume 12 p. 17 - 38

Haltiwanger, John, Henry Hyatt, Erika McEntarfer. “Cyclical Reallocation of Workers across Employers by firm size and firm wage,” Working Paper 21235 http://www.nber.org/papers/w21235

Holt, Charles C., Franco Modigliani, John F. Muth, and Herbert A. Simon. 1960. Planning Production, Inventories, and Work Force. Englewood Cliffs, N J: Prentice-Hall.

Houseman, Susan, Christopher Kurz, Paul Lengermann, and Benjamin Mandel. 2011. “Off Shoring Bias in U.S. Manufacturing.” *Journal of Economic Perspectives* 25(2): 61– 80.

Hyatt, Henry, and James Spletzer. 2013. “The Recent Decline in Employment Dynamics.”IZA *Journal of Labor Economics* 2(3): 1-21.

Robert Inkaar. 2007. Cyclical Productivity in Europe and the United States: Evaluating the Evidence on Returns to Scale and Input Utilization, *Economica* New Series, Vol. 74, No. 296 (November), pp. 822-841

Jaimovich, Nir and Henry E. Siu. 2012. “The Trend Is the Cycle: Job Polarization and Jobless Recoveries”, NBER Working Paper No. 18334, August 2012.

Jaimovich, Nir and Henry E. Siu, “Jobless Recoveries” Third Way

Jarmin, Ron S., and Javier Miranda, 2003, The Longitudinal Business Database, CES Working Paper 02-17.

Jimenez, Miguel. 2015. *Cyclical Productivity in US Manufacturing*. Routledge

Katz, Larry and Alan Kreuger, “The Rise and Nature of Alternative Work Arrangements in the United States, 1995-2015” March 2016

Mian, Atif, and Amir Sufi, 2014, What Explains the 2007-2009 Drop in Employment? *Econometrica* 82, 2197-2223

Moretti, Enrico, 2004. “Workers' Education, Spillovers and Productivity: Evidence from Plant-Level Production Functions,” *American Economic Review* 92(3): 656-690.

Oi,Walter 1962.“Labor as a Quasi-Fixed Factor.” *Journal of Political Economy* 70(6): 538 – 55.

Pugsley, Benjamin, and Ayşegül Şahin. 2014. Grown-Up Business Cycles, Federal Reserve Bank of New York Staff Reports, no. 707 December 2014

Rothstein, Jesse. 2012. The labor market four years into the crisis: Assessing structural explanations. NBER Working Paper 17966,

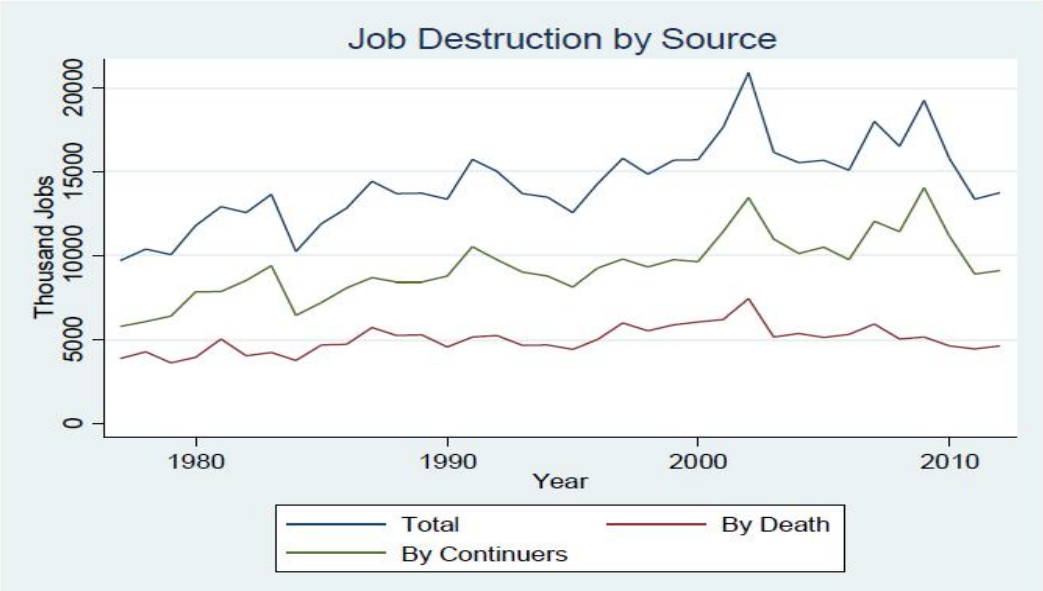
Solow, Robert R. 1964. Draft of Presidential Address on the Short Run relation of Employment and Output. World Congress of the Econometric Society, Vienna, unpublished manuscript.

The Conference Board, International Labor Comparisons. Various years. https://www.conference-board.org/ilcprogram/

Weil, David. 2014. *The Fissured Workplace*, Harvard University Press.

Appendix A: Job Destruction and Creation Dominated by Changes Among Continuers

The job destruction graph records the thousands of jobs that were "destroyed" by plant closing/death of an establishment and by reduction of employment among continuing establishments, and their total. For every year the job destruction by continuers exceeds job destruction by continuing establishments reducing employment.



establishments entering the market (through birth) and by expansion of employment among continuing establishments, and their total. For every year the job creation by continuers exceeds job creation by continuing establishments that expand employment.