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Rhode Island in the Great Recession: Factors Contributing to its Sharp Downturn and Slow Recovery

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Abstract:
This paper seeks to discover why Rhode Island experienced a more severe recession than any other New England state and why the state continues to lag the region in some measures of labor market health. We find that two key factors can explain the state's last-place rank in the region for employment growth between 2008 and 2009, a time when the bulk of job losses occurred both nationally and regionally: (1) the industrial composition of the state's manufacturing sector prior to the recession, which left it vulnerable to particularly steep labor demand shocks and (2) the severity of the state's prior-year house price declines. We also find that Providence as a metropolitan area or NECTA had the most severe recession among a 10-NECTA comparison group, lending robustness to the state-level comparisons. Concerning the economic recovery, we observe that employment remains farther below its pre-recession peak in Rhode Island than in any other New England state because it fell farther during the recession, not because it grew more slowly than in the region's other states during the recovery.

JEL Classification: R11, R23

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1. Introduction

Within New England and the nation at large, Rhode Island was among the states hit hardest during the Great Recession, and based on some measures its economy has continued to lag the economies of all or most other states during the long recovery period. For example, the state held the dubious distinction of having the nation's highest unemployment rate between October 2013 and June 2014, and has had by far the region's highest unemployment rate both during the recession and since. Among states in the region, Rhode Island experienced the largest peak-to-trough losses in total nonfarm payroll employment, at -8 percent, and its current (August 2014) payroll employment level is the farthest below peak, at -3.6 percent. In this paper, we compare the experience of Rhode Island's labor market in the Great Recession and during the recovery period with the labor market experience of the other New England states and the nation as a whole, based on aggregate employment measures and on sector-level, industry-level, and sector-by-skill-level data. The goal is to identify factors, such as the pre-recession industrial composition and other local conditions, that contributed to Rhode Island's sharper downturn than in the region's other states and that may be hindering its recovery. We also compare the recession-and-recovery labor market experience of the Providence NECTA (New England City and Town Area) with those of nine other NECTAs that are similar to Providence in terms of population or location.[1] The NECTA-level analysis helps to address the problem that Rhode Island as a state that is contained largely within a single NECTA[2] may not be comparable to other states in the region, most of which consist of multiple, diverse NECTAs.[3] Key findings include the following:

- Within our 10-NECTA comparison group, the Providence NECTA experienced the sharpest peak-to-trough employment losses during the recession. This NECTA-level analysis shows that the weak performance of Rhode Island does not merely reflect the fact that the state coincides roughly with a single metropolitan area.

[1] The Providence NECTA consists of the cities of Providence and Warwick in Rhode Island, as well as Fall River in Massachusetts, and numerous surrounding small towns. We refer to this NECTA informally as "Providence."

[2] Rhode Island is mostly contained within the Providence NECTA but also includes some towns in the Norwich-New London-Westerly NECTA, which lies mostly in Connecticut.

- Considering peak-to-trough employment losses in the recession, the state's industrial composition prior to the recession at the supersector level does not do much to explain why Rhode Island experienced larger percentage job losses than any other New England state. Rather, it is at the sector-specific level that the problem becomes evident: throughout the recession, Rhode Island experienced the largest sector-specific job loss percentages in New England in four of nine economic sectors for which data are available for all the region's states, and in three other sectors Rhode Island had the second-largest job loss rates in the region.
- In most of the New England states (including Rhode Island), weak performance in the manufacturing, construction, and trade, transportation, and utilities (TTU) sectors drove the bulk of employment losses in the recession. The three sectors that contributed most to Rhode Island's poor relative performance in the region were finance, government, and manufacturing, in that order. Had Rhode Island performed only as poorly in each of these latter three sectors as Connecticut, the second-worst-performing state in the region, virtually all of the difference between these two states in terms of peak-to-trough percentage job losses would have been erased. The difference between Rhode Island and Connecticut in the finance sector alone explains 0.40 of the 1.08 percentage point wedge between these two states.
- Rhode Island saw steeper house price declines during the recession than any other New England state. This difference may help to explain why Rhode Island's economy had larger job losses across its economy than the other New England states, and it may have contributed to the larger shock to its financial sector in particular. Unfortunately, data on real estate employment (which falls within the financial activities sector) are not available for Rhode Island.
- Our analysis suggests that excess manufacturing job losses in Rhode Island contributed to greater overall job losses in the state via multiplier effects than in the other New England states, even after controlling for the influence of house price changes. The state's steep manufacturing losses most likely contained a large structural component that was already in force prior to the recession. Recent papers by Autor, Dorn, and Hanson (2013a, 2013b) find

that, between 1990 and 2007, Providence's manufacturing industries faced above-average increases in competition from Chinese imports, compared with the industry mix in other New England cities and the nation as a whole, contributing to excess manufacturing job losses in the area even before the recession.

- As of August 2014, Rhode Island's employment level remained lowest among New England states in relation to its pre-recession peak level. However, this shortfall obscures the fact that, since October 2009, Rhode Island's employment growth rate has, with minor exceptions, *not* been slowest in the region. In fact, Rhode Island's employment level (relative to its pre-recession peak) gained significant ground on relative employment levels in Connecticut, Vermont, Maine, and New Hampshire between October 2009 and August 2014.
- Weak recoveries in the manufacturing and construction sectors, in absolute terms and when compared with other states in the region, go a long way toward explaining why Rhode Island's employment level remains farthest below its pre-recession peak. Comparatively weak growth in the education and health services sector since the recession trough has also exerted a drag on Rhode Island's (and Providence's) employment growth during the recovery. Both Worcester and New Bedford have had weaker performance in manufacturing employment than Providence during the recovery, but their overall recoveries have been stronger, as a result of strong growth in the education and health services sector.

2. Just how badly did Rhode Island do in the recession?

First, we describe in detail the extent to which Rhode Island's labor market downturn was, in fact, more severe than the national downturn and those in other states in the region. Exhibit 1 shows the rates of decline by location between a given location's pre-recession, seasonally adjusted, total nonfarm payroll employment peak and its recessionary trough.[4] Comparing states in the region (rows 2–7 of the table), Rhode Island experienced the steepest peak-to-trough decline in total nonfarm payroll employment. The only New England state with losses

[4]We select peak dates from the period January 2006 to December 2008, and we select trough dates from the period January 2009 to December 2013. In most cases, these restrictions are not binding.

that approached those of Rhode Island is Connecticut. The remaining states all saw comparatively moderate losses, both in relation to Rhode Island and in relation to the nation as a whole.

As is well known, Rhode Island experienced significantly higher unemployment than the other New England states during the recession and afterwards (see Exhibit 2A). Since December 2007, Rhode Island's unemployment rate has been at least a full percentage point higher than Connecticut's, and for significant periods it has been two percentage points higher or more.

Exhibit 2B shows labor force participation (LFP) rates for each New England state between August 2004 and August 2014. An increase in unemployment that is accompanied by an increase in labor force participation may actually indicate a strengthening labor market, and therefore unemployment rate movements in Rhode Island (in comparison with other New England states) must be examined in the context of LFP trends. Exhibit 2B shows that Rhode Island's LFP rate first fell and then rebounded between August 2008 and August 2010, while its unemployment rate climbed steadily the entire time, indicating that movements in LFP were not solely or primarily responsible for movements in the unemployment rate. Moreover, the negative trend of the state's LFP rate between June 2010 and the present appears roughly equal to (as in Connecticut and Vermont) or steeper than (as in Massachusetts, Maine, and New Hampshire) the negative LFP trends in the other New England states. Therefore, movements in LFP rates in Rhode Island in comparison with those of other New England states do not appear to explain why Rhode Island experienced a steeper initial increase in unemployment during the recession, nor why its unemployment rate has remained higher than in those of the other New England states during the recovery.

3. The Providence NECTA's recession experience compared with those of other NECTAs

It is fair to ask whether Rhode Island is comparable to the other New England states as an economic entity. In terms of population, it is second-smallest in the region, after Vermont. Unlike Vermont, however, Rhode Island has much smaller land area and, as noted above, it is

contained largely within a single NECTA. Vermont also includes only a single metropolitan NECTA—encompassing the Burlington area—yet it also includes a number of smaller, micropolitan NECTAs.[5] Therefore, Rhode Island's economy may be less diversified than the economies of states with a larger number of distinct NECTAs. To address this possibility, we compare the economic performance of the Providence-Warwick-Fall River NECTA with the performance of nine other NECTAs during the recession and recovery period. This 10-NECTA group consists of the top nine NECTAs in terms of population plus the New Bedford NECTA (in Massachusetts). Providence ranks second among this group in terms of population. Although New Bedford ranks only 14th in population among NECTAs, its geographic proximity to Providence and its similarly large manufacturing base make it a natural choice for comparison, as opposed to Barnstable Town, which ranks 10th in population after Norwich-New London-Westerly, but is less urban than the New Bedford NECTA. Exhibit 3 lists the populations of these 10 NECTAs as of the 2010 Census.

As shown in Exhibit 1, the Providence-Warwick-Fall River NECTA (labelled "Providence") experienced the steepest peak-to-trough losses in total nonfarm payroll employment in the recession among our 10-NECTA comparison group.[6] The Norwich-New London-Westerly NECTA, which contains portions of Rhode Island, experienced the next-largest decline, followed closely by Bridgeport (CT). The estimates in the table indicate that, at least in terms of payroll employment growth, the performance of a given NECTA lines up fairly well with the performance of the state within which it mostly resides, suggesting that there were not large variations in employment growth rates across NECTAs within a state. (However, this analysis excludes micropolitan NECTAs.) Rhode Island's weak performance in the recession therefore appears robust to comparisons at the NECTA level. Unemployment rates are not readily available at the NECTA level, so a comparison along that dimension is not undertaken.

[5]As defined by the Office of Management and Budget, a micropolitan statistical area is an area based around an urban cluster, with a population of 10,000 to 49,999.

[6]At the NECTA level, total payroll employment figures are seasonally adjusted, but sector-specific employment data (discussed below) are not seasonally adjusted. We define peak and trough dates based on seasonally adjusted total employment data; this leaves sector-specific losses somewhat sensitive to choice of peak and trough.

4. Why did Rhode Island (and Providence) see greater total employment losses than the other New England states and NECTAs?

a. Role of prior industrial composition

Bartik (1991) argues that employment growth (or decline) experienced at the national level in a sector produces an exogenous labor demand shock of the same proportional magnitude for the same sector within a given local labor market. Based on this notion, one can construct an instrument for the total labor demand shock in a given area over a given period by taking a weighted average of the industry-specific employment growth rates for the United States over the period. The set of weights consists of the prior employment shares of the industries within the local area. More precisely, the "Bartik shock" to local labor demand is the inner product of two vectors, the vector of industry-specific employment growth rates at the national level over a given period and the vector of local employment shares in each industry at the beginning of (or as of a date prior to) the period.[7]

One very simple way to use this idea is to predict the state-level and NECTA-level changes in total employment over various periods using state-specific or NECTA-specific Bartik shocks for our locations of interest. The prediction for a given state or NECTA represents the change in employment that would have occurred at that location solely on the basis of these exogenous labor demand shocks—that is, the changes that would have occurred if each industry in a given state had experienced the same employment growth rate over the period as the same industry in the United States on average.[8] Differences between the predictions for any two states or NECTAs will therefore be driven solely by differences in their prior industrial composition. To the extent that the Bartik shocks explain actual variation in employment growth rates across locations, we can say that local industrial composition explains the variation. We follow the

[7]This instrument overcomes the endogeneity of actual local employment changes in local wage growth, and can therefore be used to predict a number of different labor-market outcomes for the locality, such as wage growth, as in Bartik (1991), and local migration rates, as in Saks and Wozniak (2011).

[8]To obtain a purer calculation, one could remove a state's contribution to the U.S.-average employment growth rates; however, every New England state is small enough as a share of total U.S. employment that industry-specific growth rates do not change significantly when any single New England state is removed, so we do not omit individual states from these calculations.

methodology of Saks and Wozniak (2011) in calculating the sector shares based on the 5-year chained average employment share for a given sector between 2002 and 2006.

Exhibit 4 shows the predicted changes in total employment by state over various periods, as given by the Bartik shocks. For a period, such as 2007–2008, employment changes refer to the difference between the state's employment level in 2008 and its employment level in 2007, averaged across 12 months within each year. The exhibit also shows the actual employment growth rate in each state for each period and the ratio of the predicted growth rate to the actual growth rate. This latter ratio, if positive, is a measure of the accuracy of the prediction: the closer the value is to one, the more accurate. Positive values of less than one indicate either that a positive predicted growth rate fell short of the actual positive growth rate or that a negative predicted growth rate was smaller in absolute value than the actual negative growth rate. Vice versa, positive values that are greater than one indicate that the predicted growth rate exceeded the actual growth rate in absolute value, where both values have the same sign.[9]

While the Bartik shocks underestimate actual employment losses in Rhode Island in both 2007–2008 and 2008–2009, for the same periods the Bartik shocks for the remaining New England states predict worse employment performance than actually occurred, in nearly all cases. The only exception for these two periods is in 2008–2009 for Connecticut, where the Bartik shock comes very close to predicting actual job losses. This means that, between 2007 and 2009, Rhode Island fared worse than expected on the basis of national labor demand shocks in relation to its industrial composition, while other states fared either as expected or better than expected. In contrast, however, for 2009–2010, the Bartik shocks predicted slower employment growth than actually occurred in all states except Connecticut.

One striking feature of Exhibit 4A is that the predicted employment growth rates in a given period do not vary much across the New England states, suggesting that differences in

[9]Negative values for the ratio indicate that predicted growth rates and actual growth rates have opposite signs. Absolute values greater than one indicate that the predicted change had a larger absolute value than the actual change and was opposite in sign; absolute values less than one indicate that the predicted value was lower in absolute value than the actual value and opposite in sign. Accuracy does not increase as the absolute value of the ratio approaches one.

industrial composition at the supersector level across states cannot account for a significant portion of the variation in employment growth rates among these states during the recession. A precise way to show how much of the variation in state employment growth rates is driven by prior industrial composition is to take the ratio of the variance of the Bartik shock predictions to the variance of actual employment growth rates for a given period. These values (expressed as fractions) are given in the far right-hand column of Exhibit 4A (labelled "Variance"), in every third row.

These low variance ratios—the highest value is only 0.083, for 2008–2009—indicate that differences among New England states in industrial composition at this coarse level of detail, when applied to common, sector-specific labor demand shocks, do not go very far in explaining the differences in employment performance among the states during the recession. As shown in Exhibit 4B, employment shares by sector do vary—if not wildly—across states, most notably within the professional and business services sector, the financial sector, and the trade, transportation (TTU), and utilities sector. These differences are not large enough to predict large differences in total employment growth based on the Bartik shocks, in part because each state had a significant concentration in at least one of the sectors (such as manufacturing and TTU) that had large negative employment shocks at the national level in a given year.

Exhibit 5A shows an analogous Bartik shock analysis at the NECTA level. The Bartik shock predictions capture a larger portion of the actual variance in employment growth across NECTAs than they did across states within each of the three one-year periods we examine. This finding agrees with the fact that employment shares by sector exhibit greater variance across NECTAs than they do across states, as shown in Exhibit 5B. Still, at their best (2008–2009), Bartik shocks explain only 22 percent of the actual variance in employment growth across NECTAs. As in the case of states, we infer that differences across NECTAs in prior industrial composition at this level of detail do not explain the bulk of the variation in employment growth experienced in the recession.

We saw in Exhibit 4A that Rhode Island was unique in the region in terms of experiencing job losses across 2007–2008 and 2008–2009 that were consistently significantly greater than those

predicted by its Bartik shocks for those years. As Exhibit 5 shows, however, during these same two periods, Providence was not the only NECTA in the region to experience job losses that were greater than expected on the basis of Bartik shock predictions. Other NECTAs that fit this description include, in 2007–2008, New Haven, Worcester, and New Bedford, and, in 2008–2009, Norwich, New Haven, and Bridgeport.

b. *Which sectors contributed most in absolute and relative terms to Rhode Island's total job losses?*

The data in Exhibits 4A and 5A imply that there were significant differences across the New England states (or across NECTAs) in their sector-specific employment growth rates during the recession. To describe such differences, a number of comparisons can be made. Exhibits 6A and 6B show actual employment growth rates peak-to-trough by sector and state and by sector and NECTA.[10] (Peaks and troughs are defined on the basis of total nonfarm employment in a location, not by employment in the specific sector under consideration.) Exhibit 6A shows that Rhode Island had the largest percentage job loss rates among the states in the region in each of the manufacturing, trade, transportation, and utilities, financial activities, and government sectors; the state had the second-steepest percentage loss in the construction sector, and (as seen in Exhibit 6B) the second-worst performance in the professional and business services sector, the other services sector, and the education and health services sector.

Comparing across NECTAs within sectors (Exhibits 6A and 6B, lower rows), Providence does not stand out as clearly as Rhode Island as the weakest location across multiple sectors. Rather, Providence's relative weakness appears concentrated within the manufacturing sector, and also—but to a much lesser extent—in the finance and TTU sectors. While Providence saw much steeper losses in construction employment than Boston, we cannot safely say how Providence fared in relation to the remaining NECTAs in this sector because construction employment data are available only for the Providence and Boston NECTAs.

[10]Data are available for only nine sectors in Rhode Island, while Vermont has data for 10 sectors, and the remaining New England states have data for 11 sectors. Missing sectors for Rhode Island are mining/logging and information. Vermont's missing sector is information. For the NECTAs, the only seasonally adjusted employment data refer to total nonfarm employment; sector-specific payroll employment data are not seasonally adjusted. Peak and trough dates for NECTAs are determined using seasonally adjusted total employment data.

These percentage losses by sector and location, while suggestive, cannot tell us directly which sectors contributed most to a location's overall job losses peak-to-trough, because a sector that experienced steep losses may have constituted only a small share of employment. To calculate the contribution of a given sector in a given location to that location's overall percentage employment change (peak-to-trough), we take the sector's raw job gains (or losses) across the recession—based on the local peak and trough of total employment—as a percentage of the location's pre-recession peak total employment level. After normalizing each location's pre-recession peak employment level to 100, the percentage point contributions are fully comparable across locations.

As shown in Exhibit 7, the sectors that made the three largest contributions to Rhode Island's recession job losses were manufacturing, TTU, and construction. The three sectors that contributed most to Rhode Island's poor *relative* performance in the region were finance, government, and manufacturing, in that order. Had Rhode Island performed only as poorly in each of these latter three sectors as Connecticut, the second-worst-performing state in the region (in terms of the contributions shown in the table), virtually all of the difference—1.04 of 1.08 percentage points—between Rhode Island and Connecticut in terms of peak-to-trough percentage job losses would have been eliminated. The difference between Rhode Island and Connecticut in the finance sector alone explains 0.40 of the 1.08 percentage point difference between these two states.

c. Role of house price declines

It is conventional wisdom that the housing bust and the attendant financial crisis precipitated the Great Recession. Consistent with this notion, research has identified a strong correlation between the severity of the recession in a state or local area and the severity of the housing bust experienced in that location. According to Mian and Sufi (2010), this correlation can be traced back to increases in household leverage prior to the recession: they find that counties that saw greater increases in household leverage during the housing boom (2002–2006) experienced sharper subsequent declines in house prices and more severe recessions. Briefly, they argue that run-ups in leverage exerted direct, negative effects on household consumption that were

exacerbated by negative shocks to wealth as house prices fell. We examine further the potential influence of household leverage on the severity of the recession in the New England states, below.

More recently, Foote and Willen (forthcoming)[11] argue that the negative effect of the housing bust on economic activity operated primarily through its depressing effect on construction. This alternative mechanism also predicts a more severe recession in locations with steeper house price declines—in this case via sharper contractions in construction activity. Regardless of the underlying mechanism, if we accept that house price declines contributed to negative demand shocks and associated job losses, it is natural to ask whether Rhode Island's recent housing market experience might help to explain why it had a deeper recession than the other New England states. The large contribution of the state's financial sector to its poor relative performance is consistent with this notion, although we cannot observe employment performance within specific industries in this sector, such as real estate brokerage and mortgage finance.

Foote and Willen (forthcoming) demonstrate the importance of house price changes—via their impact on construction activity—in determining the severity of the recession, using a number of different regression specifications. In their simplest model, state employment growth rates for 2008–2009 (calculated as the percentage change in average monthly employment between 2008 and 2009) are regressed against the change in the CoreLogic house price index for the given state over the same period, along with a state-specific Bartik shock to the manufacturing sector for 2008–2009. Similar to the Bartik shocks constructed above for total employment, the manufacturing Bartik shock for a given state in a given year represents the weighted average of U.S. employment growth rates for that year across all 2-digit industries within manufacturing, as weighted by the respective prior employment shares in the state of each 2-digit manufacturing industry.[12] They find that these two factors—house price declines and the

[11]This citation refers to work in progress by Chris Foote and Paul Willen.

[12]To alleviate endogeneity concerns and missing data problems, Foote and Willen create employment shares based on each state's industrial composition within manufacturing as of 1995. Shares refer to the industry's share of total employment in the state. If data are missing for a given industry, those data are simply omitted from the calculation.

exogenous shock to manufacturing employment—can explain roughly 81 percent of the variation among the 50 states in employment growth rates between 2008 and 2009. They go on to argue, using more complicated regression models, that house prices mattered mostly as a result of their impact on construction activity and associated multipliers, rather than via direct effects of household balance sheets on consumption.

We adapt this basic regression framework to investigate the extent to which the model explains variation in employment growth rates among New England states during the recession. To alleviate concerns that there could be a reverse causal link between house price changes and employment growth—that is, job losses might reduce demand for housing and/or cause mortgage defaults, either of which might result in house price declines—we use once-lagged state-level house price changes instead of contemporaneous house price changes. Otherwise, we employ the same dependent and independent variables as in the basic specification described above. In addition to running the regression for 2008–2009 state employment growth rates, we run a separate regression using 2007–2008 state employment growth rates as the dependent variables, and another regression using 2009–2010 state employment growth rates.

Exhibit 8 shows coefficient estimates, standard errors, and other relevant results. The year indicated in a given column refers to the latter year of the period over which employment growth rates are measured. For example, the column heading "2008" indicates that the dependent variable is calculated as the percentage change in a state's (total nonfarm payroll) employment level between the monthly average in 2007 and the monthly average in 2008. The lagged house price change (L. CoreLogic HPI change) in this column refers to the change in the CoreLogic house price index for the state between its average level in 2006 and its average level in 2007. Also in the model estimates displayed in this column, Bartik manufacturing shocks use employment growth rates within 2-digit manufacturing industries for the United States between 2007 and 2008. The sample size within each year is 50 because we have one observation per state per year.

The sum of shares for a given state amounts to the combined share of total employment over the set of industries with non-missing data, which may be less than the share of all manufacturing employment in the state's total employment level.

Because the steepest job losses in the recession generally occurred between 2008 and 2009, we consider first the results of the model estimated over that period, given in the middle column of the table (headed "2009" for 2008–2009 employment growth). The coefficient on the lagged house price change—which is highly statistically significant—implies that a 1 percentage point increase in the year-over-year house price change induces an increase in the employment growth rate of 0.22 percentage points, all else being equal. The coefficient on the Bartik shock to manufacturing is also positive and highly significant, consistent with the significant contribution of the manufacturing sector to overall job losses in the recession. The point estimate in excess of one suggests also that job losses in manufacturing may have had negative spillover or multiplier effects on other sectors of the economy—for example, because laid-off manufacturing workers likely reduced their consumption of a variety of goods and services. Consistent with this result, Acemoglu et al. (2014) find evidence of negative multiplier effects (also called "aggregate demand" effects) on total employment, stemming from job losses in manufacturing over the period 2000-to-2007, although they also infer that job losses from multiplier effects were offset by job gains in nonmanufacturing sectors as a result of labor reallocation.

The model does a good job of capturing variation in employment growth across the 50 states, particularly for the critical 2008–2009 period. Now we consider how well it captures variation among the New England states—including Rhode Island's worst-in-region employment growth.[13] Exhibit 9 gives, for each state in New England and for each period for which we estimate the model, the actual value of the dependent variable ("actual employment growth") and of each of the independent variables ("Bartik manuf. Shock" and "Lagged CoreLogic HPI Change"), along with the fitted value and the residual from the regression.

Examining the fitted values and actual values for 2007–2008 and 2008–2009, we see that the model correctly predicts the last-place rank of Rhode Island within the region for both periods. For 2007–2008, Rhode Island had the lowest value in the region for both the Bartik

[13]The model's weaker results for 2009–2010 may reflect the fact that overall employment in some states (and in the nation) began to recover during this period, while both house prices and manufacturing employment continued to fall in most places.

manufacturing shock and the lagged house price change, thereby ensuring that it would have the region's lowest predicted employment growth rate. In 2008–2009, Rhode Island still had the region's lowest (lagged) house price change, but only the second-lowest value for the Bartik shock, suggesting that weak house price growth was definitive in placing Rhode Island last in the region (in expectation) in this period. In terms of determining Rhode Island's ranking among the fitted values, it can be shown that house price changes were in fact more important (quantitatively) than Bartik manufacturing shocks in both 2007–2008 and 2008–2009. This is shown in Exhibit 10. As indicated in the top panels, which plot predicted employment growth rates in relation to the Bartik manufacturing shocks, the predicted values do not line up closely with the rank of the shocks; in the lower panels, which plot the same predicted growth rates against lagged house price changes, the linear relationship can be seen more clearly.

As stated above, Mian and Sufi (2010) claim that increases in (county-level) household leverage between 2002 and 2006 are strong predictors of the severity of recession between 2007 and 2009 at the county level, as well as predicting the severity of house price declines. Within this framework, it is natural to ask whether Rhode Island's households increased their leverage to a greater extent than households in other New England states in the pre-recession period. We do not have access to the measure of household leverage employed by Mian and Sufi (2010), which consists of county-level household debt-to-income ratios based on Equifax data. Instead, we use Equifax data on mortgage debt per capita, by state.

Exhibit 11 shows cumulative percentage increases in mortgage debt per capita between 2002 and 2006 for the New England states. Rhode Island saw the largest increase in mortgage debt per capita among the New England states over the period, consistent with having had the most severe recession in the region. However, mortgage debt increases in New Hampshire approached those of Rhode Island, yet New Hampshire experienced a significantly less severe recession, and a relatively moderate increase in mortgage debt occurred in Connecticut in tandem with the second-worst recession in New England. Moreover, the increase in mortgage debt in Vermont was significantly less than in New Hampshire, yet the two states had roughly equivalent declines in total employment peak-to-trough (4.7 percent and 4.8 percent,

respectively). Therefore, increases in mortgage debt per capita between 2000 and 2006 do not appear to be strongly predictive of the relative severity of recession among the New England states.

5. Why did Rhode Island and Providence experience excess manufacturing losses?

As shown in Exhibit 12A, Rhode Island was the only New England state where manufacturing employment performed worse than in the nation during the recession. As shown in Exhibit 12B, New Bedford was the only NECTA in our group other than Providence where the percentage losses of manufacturing jobs exceeded the national average. In addition to the large, direct contribution of Rhode Island's manufacturing sector to its total job losses in the recession, the regression analysis above suggests that manufacturing job losses may have contributed to job losses in other sectors of the economy via aggregate demand or multiplier effects. In light of this connection, it is important to understand why Rhode Island experienced steeper losses in its manufacturing sector than any other New England state and steeper manufacturing job losses than the United States as a whole.

a. Prior industrial composition within manufacturing

To investigate this issue further, we consider whether Rhode Island entered the recession with a higher concentration than other states in the region of the types of manufacturing that were subject to particularly steep job losses in the recession at the national level. To answer this question, we again make use of the 2-digit NAICS codes within the manufacturing sector. Similar to the Bartik manufacturing shocks employed in the regression analysis above, we create a related variable that represents the predicted percentage change in manufacturing employment alone for a given state over a given one-year period. Again, we compute an industry-weighted sum of U.S. employment growth rates by 2-digit industry, but in this case a given weight for a given location represents employment in a given 2-digit industry as a share of manufacturing employment in the location, rather than as a share of overall employment. In this case, our weights will sum to 1, whereas previously the weights summed to the share of

manufacturing in total employment for the location. Also, in the previous analysis we used industry weights as of 1995 employment levels, whereas in this case we use industry weights as of 2005 employment levels (due to data availability considerations).[14]

The manufacturing-only Bartik shocks are shown in Exhibit 13 for the states, for each of four one-year periods. (In addition to the periods 2007–2008, 2008–2009, and 2009–2010, which more or less capture the recession in each location, we add 2006–2007 to highlight differences in the timing of manufacturing job losses between Rhode Island and the nation, as discussed below.) Comparing the Bartik manufacturing shocks to actual employment growth rates in manufacturing for Rhode Island, we see that predicted values are too low within each of the four one-year periods considered here, although the predicted value is fairly accurate in 2008–2009 and even more accurate in 2009–2010. More problematic is the fact that predicted manufacturing job losses are never steepest in Rhode Island among New England states, even though the state's actual manufacturing job losses were steepest in the region in all periods under consideration except 2009–2010. (In 2009–2010, however, the Bartik shocks correctly rank Rhode Island in third place in the region in terms of manufacturing job growth.) These findings mean that Rhode Island's industry mix within manufacturing at this level of detail (as of 2005, shortly before the recession) can only partly account for the poor relative performance of the state's manufacturing sector in the recession.

b. Exposure to Import Competition

Within a given 2-digit manufacturing industry, there may be significant variation across locations in the specific goods produced and at the same time relatively little variation within a location, due to local clustering or concentration in specific outputs. This pattern of geographic variation may help to explain Rhode Island's especially weak manufacturing performance in the recession. A pair of recent papers by Autor, Dorn, and Hanson (2013a, 2013b) finds that Rhode Island's economy as of the 1990s and early 2000s was very highly concentrated in the

[14]In cases where data are missing for specific industries in a location, we renormalize by dividing by the sum of non-missing weights. This amounts to an assumption that employment growth in the missing sectors is equal to the weighted average of employment growth across the non-missing sectors.

kinds of labor-intensive manufacturing that proved susceptible to increasing competition from Chinese imports. Their analysis indicates that increases in such competitive pressures explain why the Providence commuting zone (CZ) and other locations that saw large increases in exposure to import competition experienced particularly large manufacturing job losses between 2000 and 2007 and also (albeit less severely) between 1990 and 2000. Greater increases in import exposure were also associated in their data with increases in local unemployment and declines in labor force participation, suggesting that lost manufacturing jobs were not fully offset by hiring in other sectors.

In Autor, Dorn, and Hanson (2013b, p. 3), import exposure for a given CZ is measured in terms of the value of "competing Chinese manufactures that would potentially be produced in [the given CZ] if not imported." To be exact, they measure the change in import exposure in a given location for a given industry (in dollars) using the increase in the real dollar value of imports of the industry's output to the United States from China, multiplied by prior local employment in that industry as a share of U.S. employment in the industry.[15] (Industries are observed at the 6-digit Harmonized System (HS) product level, a level of detail that is finer than our 2-digit NAICS codes.) These industry-specific measures are summed across manufacturing industries within a location, and then divided by (prior) total employment at the location in order to get a per-worker measure of the change in exposure. Among the largest 40 CZs, the Providence CZ had the second-largest increase in exposure to Chinese import competition after San Jose for both the 1990–2000 period and the 2000–2007 period. (See Exhibit 14, taken from Autor, Dorn, and Hanson 2013a.) As shown in the table, the increase in import exposure in the Providence CZ was greater in 2000–2007 than in 1990–2000.

As shown in the same table, the Boston CZ ranked fourth among the 40 largest CZs in terms of increase in import exposure for 1990–2000, and dropped to ninth place (among the top 40 CZs) in the 2000–2007 period. Considering all 722 CZs (see Panel A of the table), however, Boston ranked between the 75th and 90th percentiles for the 1990–2000 period and fell to a ranking

[15]Increases in U.S. imports from China are instrumented using increases in imports from China by other high-income countries for the same periods and the same goods to isolate the exogenous component of import increases.

between the 50th and 75th percentiles for 2000–2007. Meanwhile, Providence ranked above the 90th percentile in both periods. Also, Autor, Dorn, and Hanson (2013b) give an estimate for New England as a whole, expressed as an average 10-year equivalent change for the combined period 1990–2007, of $2,280 per worker. The comparable figure for the Providence CZ alone based on values in Autor, Dorn, and Hanson 2013a is $3,790 per worker in terms of 2007 dollars, and the figure for Boston is $2,170 per worker, indicating that Providence's increase in import exposure was significantly greater than average within the region, while Boston's was just slightly below average.[16]

The papers by Autor, Dorn, and Hanson examine only the 1990–2000 and 2000–2007 periods. We do not have direct measures of changes in import exposure among key commuting zones in New England over the recessionary period. However, if we assume that Providence has continued to experience above-average increases in import-exposure since 2007, then Providence's and therefore Rhode Island's worst-in-region manufacturing performance across the recession may be at least partly accounted for by its concentration in increasingly import-exposed industries. That is, Providence may have experienced worse performance in manufacturing during the recession for the same reasons that it experienced steeper job losses in manufacturing prior to the recession.

Exhibit 15A shows manufacturing employment between 2000 and 2009 in each of the 10 NECTAs in our comparison group, indexed to 2000 levels, taking the monthly average within each year. The exhibit shows that, between 2000 and 2006, Providence lost a greater share of manufacturing jobs than any other NECTA in our group, although up until 2005, New Bedford had seen the greatest losses. However, Providence's relative performance in manufacturing was even worse during the recession (2007–2009, roughly) than in the pre-recession period: for seven of nine comparison NECTAs, the wedge between manufacturing losses in Providence and manufacturing losses in the other NECTA is greater in 2007–2009 than in 2000–2006.

[16]This figure represents the average of the 1990–2000 change and the 10-year equivalent change for 2000–2007. These two figures are added together and then divided by two to get the result. We perform this same calculation to get the average 10-year equivalent changes for 1990–2007 for Boston and Providence, based on the separate figures shown in Panel B of the excerpted table.

Similar patterns are observed at the state level (Exhibit 15B). Between 2000 and 2006, Rhode Island experienced steeper cumulative job losses in manufacturing than any other state in the region, but just barely in relation to Massachusetts, and by relatively small margins over Maine and New Hampshire. Between 2007 and 2009, however, Rhode Island experienced significantly steeper manufacturing losses than any other New England state. In sum, excess manufacturing losses in the recession, for either Rhode Island or the Providence NECTA, are not readily explained in a quantitative sense on the basis of pre-recession secular trends in relative manufacturing performance within the region.

c. Exposure to computerization and the loss of middle-skill manufacturing jobs

Another structural influence that may have affected manufacturing employment differentially in Rhode Island is the computerization of routine tasks, as suggested by Autor and Dorn (2013). Autor, Dorn, and Hanson (2013b) find that between 1990 and 2007 computerization for the most part induced changes in the composition of employment within manufacturing and other sectors—a loss of so-called "middle-skill" jobs that were replaced by either low-skill or high-skill jobs—rather than changes in the level of employment. Still, it is worth considering whether Rhode Island was highly concentrated in middle-skill manufacturing jobs prior to the recession, and if so, whether this concentration contributed to the state's excess losses of manufacturing jobs in the recession.

To examine this hypothesis, Exhibit 16 shows facts related to middle-skill manufacturing employment in each of the New England states and the nation as a whole. Rhode Island entered the recession with a somewhat higher share of middle-skill jobs than the national average, and a significantly higher share than Massachusetts, Connecticut, and New Hampshire. However, Rhode Island did not see particularly steep job losses in the middle-skills category during the recession compared with the other New England states, and middle-skill jobs made a relatively low contribution to overall manufacturing job losses in Rhode Island compared with the contribution of the loss of middle-skill jobs in the other New England states except for New Hampshire. Therefore, concentration in middle-skill jobs does not help to explain Rhode Island's disproportionate loss of manufacturing jobs relative to other states in the region.

d. Share of high-school dropouts in the manufacturing sector

Decomposing manufacturing employment by education level (Exhibit 16, lower half), we find that Rhode Island had by far the highest pre-recession concentration of high-school dropouts in its manufacturing sector among the New England states. At the national level, high school dropouts in manufacturing were not especially vulnerable to job losses as compared with other manufacturing employees. Therefore, Rhode Island's high concentration of dropouts in manufacturing, all else being equal, would not have predicted an excess of total manufacturing job losses. However, high school dropouts in Rhode Island's manufacturing sector experienced job losses in the recession at a rate close to three times the national rate and contributed a full one-third of Rhode Island's manufacturing job losses, a larger share than in any other New England state.

It remains to be explained why high school dropouts in manufacturing were more likely to lose their jobs in Rhode Island than in the nation as a whole, and more likely than in three of the five other New England states. Nonetheless, having a large share of poorly educated workers among those who were laid off in the manufacturing sector—and in other sectors, based on evidence shown below—may help to explain why Rhode Island experienced a larger peak unemployment rate during the recession than the other New England states. Nationally, high school dropouts had the highest peak unemployment rate in the recession and the highest percentage point increase in unemployment between the pre-recession unemployment trough and the recession unemployment peak, as shown in Exhibit 17A. As of 2006, Rhode Island had, by a significant margin among the New England states, the largest share of high school dropouts in its labor force, as shown in Exhibit 17B. The difference (of roughly 0.039 percentage point) between the share of dropouts in Rhode Island and the share in Connecticut, the state with the second-highest share, predicts that Rhode Island would have had, all else being equal, a higher peak unemployment rate during the recession by roughly 0.6 percentage point.[17] This

[17]This calculation is based on U.S. unemployment rates by education level as of the overall unemployment rate peak, shown in Exhibit 17A.

represents about one quarter of the actual difference between Rhode Island's peak unemployment rate and Connecticut's, which is 2.4 percentage points (Exhibit 2A).

6. Other factors potentially contributing to Rhode Island's more severe recession

a. Interaction between the manufacturing and construction sectors pre- and post-recession

Charles, Hurst, and Notowidigdo (2013) find that during the housing boom, the construction sector absorbed a significant share of the nation's displaced manufacturing workers. In Rhode Island, as Exhibit 18 shows, the unemployment rate rose from 4.2 percent to 5.5 percent between June 2000 and June 2003, while over the same period the state's manufacturing employment fell by 18.3 percent. By early 2005, after significant additional job losses in manufacturing, the state's unemployment rate had fallen back to 5 percent. In February 2007 unemployment in Rhode Island achieved a pre-recession low of 4.8 percent. Between 2000 and 2006, Rhode Island's construction employment increased by roughly 25 percent. As construction employment began to fall between 2006 and 2007, unemployment also edged up and then climbed rapidly between mid-2007 and mid-2008, a period when construction job losses accelerated and manufacturing job losses held roughly steady at the previous year's pace.

The patterns displayed in Exhibit 18 suggest that once construction activity began to plummet in Rhode Island, displaced manufacturing workers had far worse re-employment prospects than during the construction boom. While this same dynamic would have been in play in the other New England states, the housing bust was stronger in Rhode Island than in any other New England state except Connecticut. Among New England states in percentage point terms the contribution of the construction sector to overall employment losses was largest in Rhode Island. In addition, the housing bust left a void in the labor market for displaced manufacturing workers, who were more numerous in Rhode Island than in other states.

b. The trade collapse

As is well known, exports from the United States (and global trade in general) fell precipitously between 2008 and 2009. According to data from the U.S. Census Bureau via the World Institute

for Strategic Economic Research (WISER), the nominal value of exports from the United States fell 28 percent between Q2 2008 and Q1 2009, the respective peak and trough dates for nominal exports during the recession. Among the New England states, Rhode Island had the second-largest decline after Maine in total nominal merchandise exports (Exhibit 19A) between 2008 and 2009, based on the change in average levels between these two years.[18]

It is difficult to pinpoint the effect of a decline in export activity on employment levels, because we do not have state-level data on export-related employment, or the number of jobs associated with the production of a given dollar amount of exports.[19] However, we can make an estimate under certain assumptions. As of 2008, based on nominal values, merchandise exports in Rhode Island represented 30 percent of the state's goods-based gross state product.[20] Assume that, for Rhode Island in 2008, the share of export-related employment in total employment for goods-producing industries was equal to the share of exports in goods-based gross state product—30 percent, as stated just above. Assume also that between 2008 and 2009 in Rhode Island export-related employment fell by the same percentage as nominal exports—24 percent, as stated above. Based on these assumptions, the decline in Rhode Island's exports between 2008 and 2009 would have contributed a 7.2 percent decline—4,939 jobs—in Rhode Island's goods-producing employment over the same period.[21] This number amounts to roughly 23 percent of the 2008–2009 decline in Rhode Island's total payroll employment and roughly 12 percent of the peak-to-trough decline.[22]

[18]Exports of services are not included in this measure.

[19]Distribution of exports might also generate jobs, but here we assume that export-related jobs reside in goods-producing sectors.

[20]Goods-based gross state product is the sum of the contributions to total gross state product across all goods-producing industries in a state. Because our exports measure refers to goods exports only and does not include services exports, the value of export merchandise must reside within the goods-producing portion of gross state product.

[21]The value 7.2 percent is calculated by taking 24 percent of 30 percent, because we assume there was a 24 percent employment decline in a sector that accounted for 30 percent of all goods-producing jobs.

[22]There is considerable uncertainty around these estimates because the assumptions made in calculating them cannot be validated. For example, if job losses in export-producing industries are less than proportional to declines in the value of exports, our estimates will overstate job losses, and vice versa if job losses in export-producing industries are more than proportional to declines in export activity. In addition, we limit export-related job losses to those induced by movements in exports between 2008 and 2009 only.

This estimate represents a non-negligible share of Rhode Island's recession job losses. However, estimating export-related job losses for the remaining New England states in a similar manner, we find that Rhode Island has the second-lowest share in the region of peak-to-trough job losses contributed by the loss of export-related jobs. Vermont has the highest share in the region by this measure, at 37 percent, more than three times the 12 percent figure estimated for Rhode Island. The greater estimated impact of export declines on employment in Vermont reflects in part the fact (shown in Exhibit 19B) that Vermont ranks first in the region in terms of nominal exports as a share of total nominal gross state product, and Rhode Island ranks last.[23]

c. Government spending

Between 2005 and 2011, nominal spending by state and local governments (combined) increased in all years in all New England states (Exhibit 20). Between 2008 and 2009, however, Rhode Island experienced significantly slower growth in government spending than any other state in the region. And, over the entire period, Rhode Island had the second-lowest cumulative growth rate in government spending in the region, beating out Maine by only a very small margin. In line with this weak growth in government spending during the recession and since, the state experienced the region's weakest growth in government employment peak-to-trough. Furthermore, prior to the recession, government spending represented a relatively large share of Rhode Island's gross state product. As of 2005 (Exhibit 21), Rhode Island ranked third in the region on this score, and its share was closer to the shares of the top two states on this measure (Maine and Vermont) than to the three other New England states (Massachusetts, New Hampshire, and Connecticut, in that order). Rhode Island's weak government spending growth during the recession is likely to have been, at least in part, a consequence of the state's weak economy. At the same time, however, weak public spending growth could have had reinforcing negative effects on aggregate demand and/or employment in the state during this period. While it is difficult to quantify the impact of state and local spending on local employment, any restraining effects of weak public spending growth on job growth are likely to have been

[23]Exhibit 19B shows exports as a share of gross state product for 2005 only. Vermont has had the highest share in the region—and Rhode Island the lowest in the region—since at least 1997, before which no data are available on exports at the state level.

stronger in Rhode Island than in most or all other New England states in light of the evidence in Exhibits 20 and 21, especially between 2008 and 2009.

7. Rhode Island's experience during the recovery (July 2009–August 2014)

Rhode Island's economic recovery, which we define as the period since the state hit its total employment trough in July 2009, can be measured in a number of different ways. While the state has consistently been characterized in the press in recent years as having one of the weakest economies in the country, this depiction has been based largely on the state's unemployment rate, which, as discussed above, has consistently ranked among the nation's highest during the recovery. And if we measure the strength of recovery on the basis of the net percentage change in employment between the pre-recession peak and August 2014, Rhode Island again ranks last in the region, at -3.6 percent.

However, according to numerous other measures of labor market strength in the recovery, Rhode Island has not been the region's laggard. The fact that the state's employment remains farthest below its peak reflects in large measure the fact that it fell farther to begin with. In fact, since July 2009, Rhode Island has enjoyed middling employment growth within the region (see Exhibit 22A), and in some recent periods has enjoyed employment growth rates that have rivaled those of Massachusetts (see Exhibit 23). As a result of its faster employment growth in the recovery, Rhode Island has made significant gains on Maine, Connecticut, Vermont, and even New Hampshire in terms of its relative employment level, as shown on inspection of Exhibit 22B.

If we compute the fraction of total employment losses (peak-to-trough) that have since been recovered—by taking the difference between the peak-to-trough percentage change in employment and the peak-to-current percentage change in employment and dividing this difference by the peak-to-trough percentage change—Rhode Island ranks last in the region, with a recovery share of 0.55, behind Connecticut at 0.60, Maine at 0.67, New Hampshire at 0.69, Vermont at 0.80, and Massachusetts at 1.65. However, in terms of jobs recovered since the

trough in terms of raw percentage points in relation to the pre-recession peak employment level in a given state—which is the absolute value of the raw difference described in the preceding sentence—Rhode Island ranks second-best. Another measure that produces the second-best ranking is the percentage change in trough-to-current employment, shown in Exhibit 24. (The exact values corresponding to Exhibit 24 are reported in Appendix Exhibit 2 in the right-hand column within each state, labelled "trough.")

In terms of percentage point contributions to Rhode Island's current employment shortfall from its peak, shown in Appendix Exhibit 2, the three sectors that made the largest negative contributions are manufacturing, construction, and TTU, in that order of importance. In terms of contributions to Rhode Island's poor *relative* peak-to-current employment change, the two most influential sectors are manufacturing and construction. In addition, Rhode Island's education and health services sector was second-last in the region in terms of its positive contribution to total employment growth since the previous peak.

In terms of percentage gains in employment since the trough (also shown in Appendix Exhibit 2), the three sectors making the largest contributions to Rhode Island's absolute gains are professional and business services, hospitality, and education and health services. Comparing Rhode Island's employment growth contributions since the trough by sector with those of the other New England states, the state's financial sector stands out for making the largest percentage point contribution among financial sectors in the region by a significant margin. Rhode Island's hospitality sector also made the highest percentage point contribution among hospitality sectors in the region, and the state's professional and business services sector contributed only marginally less to employment growth over the trough in Rhode Island than this sector in Massachusetts.

Comparing peak-to-current percentage changes in employment across NECTAs, Providence places second-last behind neighboring Norwich, as shown in Exhibit 25. (Exact values corresponding to Exhibit 25 are reported in Appendix Exhibits 3 and 4.) Norwich's weak performance owes much to the dismal performance of its government sector, which made an especially large contribution (-7 percentage points) to the area's percentage change in peak-to-

current employment. Providence also places second-last (again behind Norwich) in terms of trough-to-current employment change, even though Rhode Island placed second-best on this score among New England states.

Since the trough, then, Rhode Island's relatively strong performance belies the relative performance of the Providence NECTA. Still, employment growth in Providence (on a year-over-year basis in each of the five months between April 2014 and August 2014) has exhibited a modest positive trend in recent months (Exhibit 26). Comparing growth rates across NECTAs in the table, Providence ranked either seventh or eighth in the group in the first four periods shown, but most recently (August 2013–August 2014) ranked fourth in the group, ahead of Boston but behind Worcester, Portland, and Springfield.

Considering employment change since its trough across NECTAs (Exhibit 25 top panel), the variation in the contributions of the education and health services sector are stark, ranging from a low of -0.9 percentage point in Norwich to a high of 3.2 percentage points in Worcester. Providence had the second-smallest contribution from this sector, at roughly zero, and New Bedford had the second largest. In Worcester and New Bedford, employment gains in education and health services (on either a since-peak basis or a since-trough basis) more than erased losses in the manufacturing sector in these same NECTAs for the corresponding periods (since-trough contributions are shown in the lower panel of the table). The manufacturing sector has actually fared worse since the trough in both Worcester and New Bedford than in Providence, yet Worcester and New Bedford have seen stronger recoveries than Providence in total employment. These trends suggest that formerly manufacturing-intensive cities can recover to pre-recession employment levels more successfully by trying to capitalize on favorable national employment trends in nonmanufacturing sectors, most notably education and health services, than by anticipating a return of lost manufacturing jobs as the overall economy improves.

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Exhibit 1: Peak-to-Trough Employment Growth Rates

by State and NECTA

	Total Employment (percent)
U.S.	–6.29
Rhode Island	–8.03
Massachusetts	–4.23
Connecticut	–6.95
Maine	–4.91
New Hampshire	–4.81
Vermont	–4.75
Providence	–8.56
Boston	–4.17
Bridgeport	–7.25
Hartford	–5.98
New Haven	–6.21
Springfield	–5.18
Worcester	–5.02
Norwich	–7.57
Portland	–4.73
New Bedford	–5.14

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.
Notes: Values refer to changes in total nonfarm payroll employment between the local pre-recession peak date and the recession trough date for total employment, as a percentage of peak-date total employment.

Exhibit 2A: Unemployment Rates in New England States

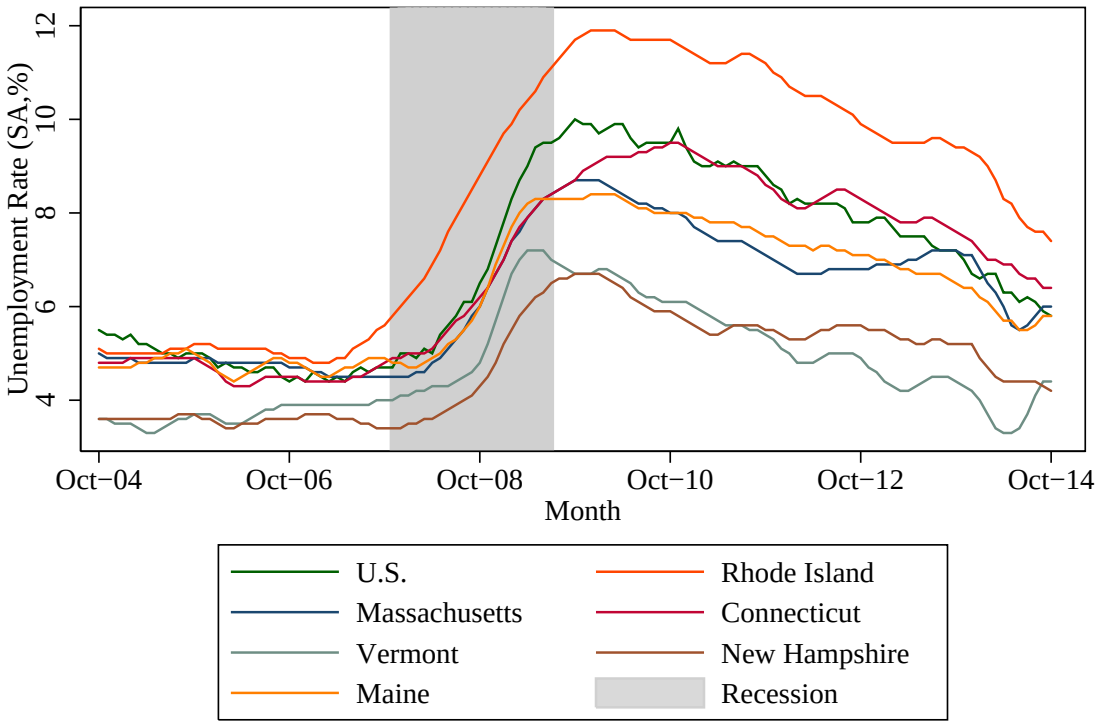
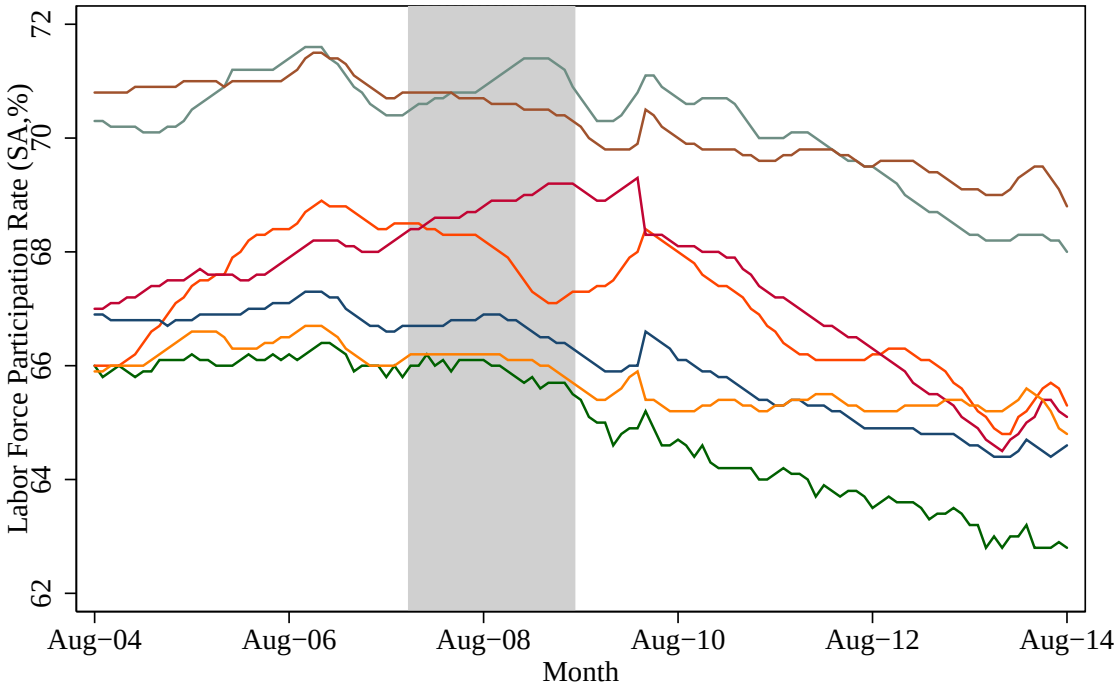


Exhibit 2B: Labor Force Participation in New England States



Sources: U.S. Bureau of Labor Statistics, Haver.

Exhibit 3: NECTA 2010 Census Population Estimates

NECTA	Population
Boston-Cambridge-Quincy, MA-NH	4,703,187
Providence-Fall River-Warwick, RI-MA	1,301,595
Hartford-West Hartford-East Hartford, CT	1,121,463
Bridgeport-Stamford-Norwalk, CT	926,465
Springfield, MA-CT	683,800
New Haven, CT	597,172
Worcester, MA-CT	577,537
Portland-South Portland-Biddeford, ME	357,412
Norwich-New London-Westerly, CT-RI	278,598
New Bedford, MA	175,502

Source: U.S. Census Bureau, 2010 Census.

Exhibit 4A: Actual State Employment Growth (%) and Predicted Growth from Bartik Shocks

	National	Rhode Island	Massachusetts	Connecticut	Maine	New Hampshire	Vermont	Variance
07-08 Bartik Shock	.	–0.367	–0.411	–0.517	–0.345	–0.578	–0.384	0.009
07-08 Actual % Change	–0.555	–2.227	0.357	0.038	–0.086	0.190	–0.357	0.907
07-08 Bartik/Actual	.	0.165	–1.150	–13.496	3.996	–3.037	1.076	0.009
08-09 Bartik Shock	.	–4.028	–4.113	–4.271	–3.979	–4.431	–4.087	0.029
08-09 Actual % Change	–4.337	–4.513	–3.242	–4.285	–3.410	–3.204	–3.266	0.344
08-09 Bartik/Actual	.	0.893	1.269	0.997	1.167	1.383	1.251	0.083
09-10 Bartik Shock	.	–0.655	–0.664	–0.773	–0.773	–0.878	–0.804	0.007
09-10 Actual % Change	–0.723	–0.303	0.410	–1.129	–0.533	–0.578	0.292	0.334
09-10 Bartik/Actual	.	2.161	–1.620	0.685	1.451	1.519	–2.756	0.022

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.

Notes: Bartik shocks are calculated as a weighted average of U.S. employment growth rates by sector for a given period, using prior local employment shares by sector for the weights. The prior local employment share for a given sector is calculated, following Saks and Wozniak (2011), as the 5-year chained average local employment share in the sector between 2002 and 2006. If employment data are missing for some sectors in a location, non-missing shares are normalized to sum to 100 for each location. In the Variance column, every third value is the ratio of the two variances directly above it.

Exhibit 4B: Pre-Recession Employment Shares (%) by State and Sector

	Rhode Island	Massachusetts	Connecticut	Maine	New Hampshire	Vermont
Min	.	0.1	0.0	0.4	0.2	0.3
Const	4.3	4.3	3.9	5.0	4.6	5.4
Manuf	11.7	9.8	12.0	10.4	12.9	12.4
TTU	16.5	17.7	18.6	20.4	22.2	19.5
Info	.	2.8	2.4	1.9	2.0	.
Fin	7.0	6.9	8.6	5.7	6.0	4.4
Prof	10.8	14.1	12.0	8.3	9.1	7.0
EdHlt	19.0	18.4	16.2	18.0	15.2	17.5
Hosp	10.1	9.0	7.7	9.6	10.0	10.9
Serv	4.7	3.6	3.8	3.3	3.4	3.3
Govt	13.5	13.2	14.8	17.1	14.4	17.3

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.
*Notes:*The employment share for a given state and sector is calculated, following Saks and Wozniak (2011), as the 5-year chained average employment share in the state and sector between 2002 and 2006. These shares do not necessarily sum to one for each location due to missing data.

Exhibit 5A: Actual NECTA Employment Growth (%, NSA) and Predicted Growth from Bartik Shocks

	National	Providence	Boston	Bridgeport	Hartford	New Haven	Springfield	Worcester	Norwich	Portland	New Bedford	Variance
07-08 Bartik Shock	.	–0.462	–0.459	–0.423	–0.324	–0.055	–0.147	–0.153	–0.010	–0.180	–0.147	0.028
07-08 Actual % Change	–0.555	–2.272	0.543	–0.594	0.357	–0.213	–0.225	–0.581	0.306	–0.251	–1.258	0.706
07-08 Bartik/Actual	.	0.203	–0.845	0.712	–0.909	0.256	0.655	0.263	–0.033	0.715	0.117	0.040
08-09 Bartik Shock	.	–4.241	–4.210	–4.061	–3.746	–3.434	–3.533	–3.597	–3.179	–3.500	–3.615	0.124
08-09 Actual % Change	–4.337	–4.815	–3.142	–4.454	–3.315	–3.887	–3.498	–3.216	–3.700	–3.246	–2.124	0.557
08-09 Bartik/Actual	.	0.881	1.340	0.912	1.130	0.883	1.010	1.119	0.859	1.078	1.702	0.222
09-10 Bartik Shock	.	–0.768	–0.661	–0.445	–0.542	–0.341	–0.440	–0.352	–0.461	–0.384	–0.472	0.019
09-10 Actual % Change	–0.723	–0.062	0.486	–0.535	–1.237	–0.779	–0.046	0.340	–1.545	–0.049	0.728	0.552
09-10 Bartik/Actual	.	12.479	–1.360	0.831	0.438	0.438	9.515	–1.037	0.299	7.905	–0.649	0.034

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.

Notes: Bartik shocks are calculated as a weighted average of U.S. employment growth rates by sector for a given period, using prior local employment shares by sector for the weights. The prior local employment share for a given sector is calculated, following Saks and Wozniak (2011), as the 5-year chained average local employment share in the sector between 2002 and 2006. If employment data are missing for some sectors in a location, non-missing shares are normalized to sum to 100 for each location. In the Variance column, every third value is the ratio of the two variances directly above it.

Exhibit 5B: Pre-Recession Employment Shares (%, NSA) by NECTA and Sector

	Providence	Boston	Bridgeport	Hartford	New Haven	Springfield	Worcester	Norwich	Portland	New Bedford
Min	0.0	0.0	.	.	.	.	.	.	.	.
Const	4.5	4.2	.	.	.	.	.	.	.	.
Manuf	13.0	9.6	10.2	12.0	12.5	13.2	12.4	13.0	8.1	15.7
TTU	17.7	17.4	18.3	16.4	18.5	20.5	18.5	16.4	21.6	19.6
Info	2.0	3.1	2.9	2.1	3.2	1.6	1.6	1.6	2.5	1.6
Fin	6.4	7.7	10.2	12.6	5.2	5.5	5.8	2.5	8.1	3.1
Prof	10.3	15.7	17.0	10.6	9.7	8.0	11.6	7.4	11.3	6.2
EdHlt	18.5	17.9	14.3	15.5	23.0	18.6	19.1	13.5	17.0	19.0
Hosp	10.1	8.5	7.8	7.0	7.3	8.8	8.6	9.8	10.1	9.7
Serv	4.5	3.6	4.1	3.9	3.9	3.5	3.7	2.8	3.2	3.8
Govt	12.9	12.2	11.4	15.9	12.7	16.6	14.6	29.7	13.0	16.5

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.

Notes: The employment share for a given NECTA and sector is calculated, following Saks and Wozniak (2011), as the 5-year chained average employment share in the NECTA and sector between 2002 and 2006. These shares do not necessarily sum to one for each location due to missing data.

Exhibit 6A: Employment Growth Rates (Peak-to-Trough) by Sector and Location

	Construction	Manufacturing	TTU	Finance	Government
U.S.	–26.32	–16.55	–8.13	–6.67	0.36
Rhode Island	–27.59	–20.46	–8.86	–13.61	–5.08
Massachusetts	–21.02	–12.50	–5.80	–5.44	0.16
Connecticut	–29.17	–12.51	–8.54	–6.57	–2.81
Maine	–20.66	–15.24	–7.50	–3.95	–2.02
New Hampshire	–19.48	–15.63	–6.51	–6.53	0.85
Vermont	–20.47	–15.24	–5.90	–6.82	0.18
Providence	–26.96	–23.77	–10.39	–14.65	–5.39
Boston	–5.97	–9.67	–4.39	–3.34	–8.99
Bridgeport	.	–12.38	–9.66	–8.64	0.65
Hartford	.	–13.73	–8.95	–7.78	1.39
New Haven	.	–15.97	–7.51	–9.02	–2.79
Springfield	.	–13.22	–3.20	–8.57	–2.32
Worcester	.	–13.70	–7.68	–2.92	–1.59
Norwich	.	–8.81	1.30	–3.13	–19.95
Portland	.	–11.64	–4.20	–1.31	–0.40
New Bedford	.	–19.80	–0.74	–13.64	0.86

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.
Notes: Values refer to changes in payroll employment in a given sector between the local pre-recession peak date and the recession trough date for total employment, as a percentage of peak-date employment in the given sector. NECTA employment changes are calculated using NSA data.

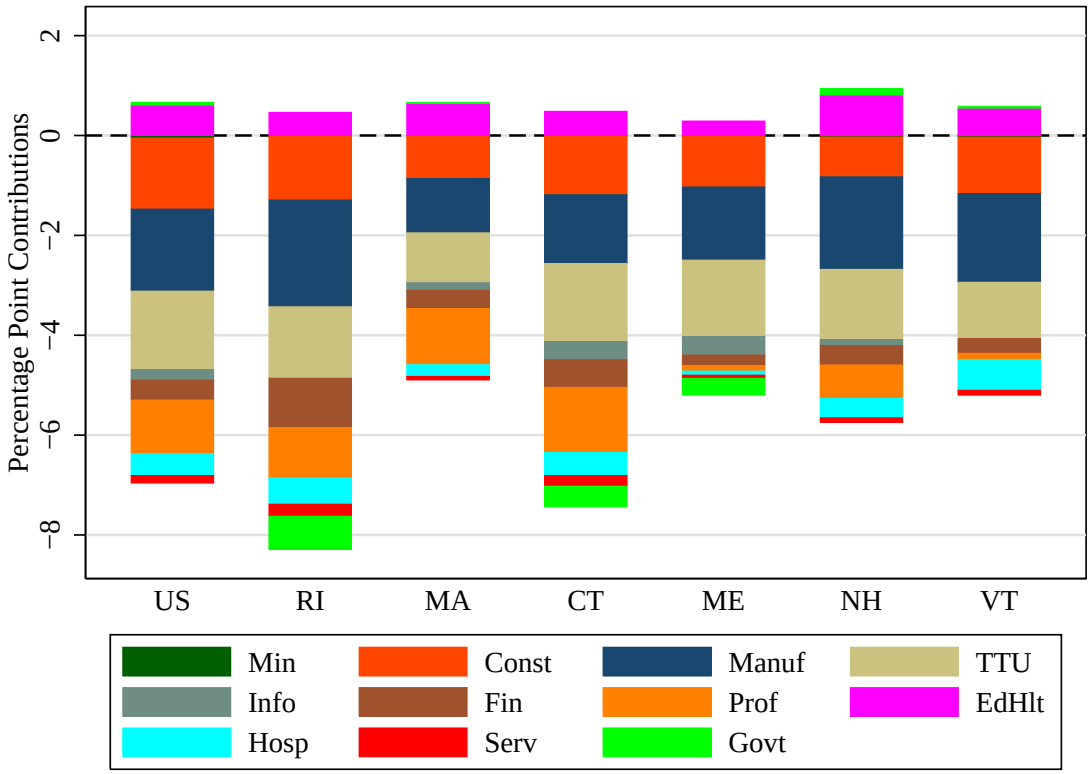
Exhibit 6B: Employment Growth Rates (Peak-to-Trough) by Sector and Location

	Information	Prof. Services	Ed/Health Services	Leisure	Other Services
U.S.	–9.68	–8.24	4.45	–4.50	–3.73
Rhode Island	.	–8.76	2.36	–5.12	–5.17
Massachusetts	–5.59	–7.64	3.23	–2.54	–1.99
Connecticut	–16.32	–10.74	2.81	–5.70	–5.64
Maine	–21.10	–1.24	1.54	–0.83	–2.00
New Hampshire	–6.30	–6.56	5.00	–3.88	–2.61
Vermont	.	–1.78	2.96	–5.76	–3.03
Providence	–6.84	–9.16	2.42	–0.34	–4.14
Boston	–3.58	–4.29	–0.29	8.42	5.22
Bridgeport	–8.47	–14.35	6.04	–19.73	–11.73
Hartford	–12.70	–10.27	3.90	–15.45	–6.60
New Haven	–32.53	–8.58	4.24	–2.00	–5.61
Springfield	–15.56	–9.96	3.25	–6.27	–4.81
Worcester	–15.00	–16.16	10.32	–7.83	–12.77
Norwich	–31.58	–15.69	5.47	–1.96	–5.41
Portland	–22.92	–0.43	3.71	24.39	1.75
New Bedford	–22.22	–2.27	9.02	8.06	0.00

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.
Notes: Values refer to changes in payroll employment in a given sector between the local pre-recession peak date and the recession trough date for total employment, as a percentage of peak-date employment in the given sector. NECTA employment changes are calculated using NSA data.

Exhibit 7: Contributions to Percent Change in Total Employment

Peak-to-Trough



Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.
Notes: The sum of the signed contributions across all sectors adds up to the net peak-to-trough change in total employment for the location. See Appendix Exhibit 1 for exact values.

Exhibit 8: Explaining Variation in State Employment Growth Rates

	2008	2009	2010
Bartik Manuf Shock	1.8186***	1.6662***	1.0190
	(0.6275)	(0.2172)	(0.6986)
L.Core-Logic HPI Change (%)	0.2291***	0.2161***	0.0838***
	(0.0564)	(0.0291)	(0.0187)
Constant	0.6038	–0.8235*	0.4705
	(0.4394)	(0.4203)	(0.4140)
R^2	0.57	0.69	0.37
Population size	50	50	50

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics and CoreLogic.

Notes: * indicates significance at the ten-percent level; ** indicates significance at the five-percent level; *** indicates significance at the one-percent level. Standard errors are in parentheses. These regressions are produced identically to the Foote-Willen methodology.

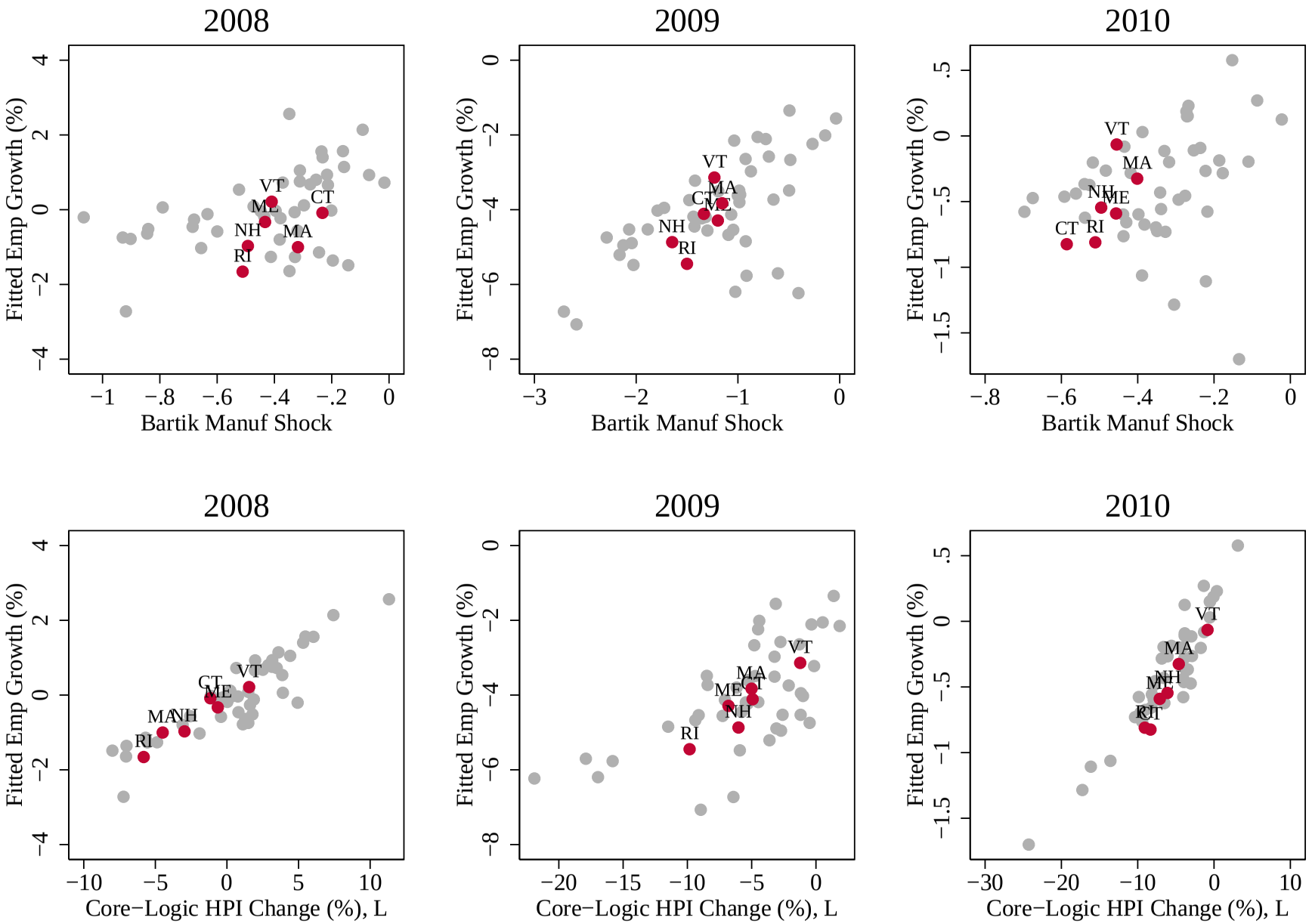
Exhibit 9: All Input and Estimated Values for Bartik Regression

2008	CT	ME	MA	NH	RI	VT
Actual Employment Growth (%)	0.05	–0.08	0.36	0.23	–2.21	–0.37
Bartik Manuf Shock	–0.23	–0.43	–0.32	–0.49	–0.51	–0.41
Lagged Core-Logic HPI Change (%)	–1.16	–0.64	–4.49	–2.96	–5.82	1.55
Fitted Values	–0.08	–0.33	–1.00	–0.97	–1.66	0.21
Residuals	0.13	0.25	1.37	1.20	–0.55	–0.58
2009						
Actual Employment Growth (%)	–4.26	–3.40	–3.21	–3.26	–4.48	–3.25
Bartik Manuf Shock	–1.33	–1.20	–1.15	–1.65	–1.50	–1.23
Lagged Core-Logic HPI Change (%)	–4.93	–6.80	–5.01	–6.03	–9.83	–1.23
Fitted Values	–4.11	–4.29	–3.83	–4.87	–5.45	–3.14
Residuals	–0.15	0.89	0.62	1.61	0.97	–0.11
2010						
Actual Employment Growth (%)	–1.14	–0.56	0.41	–0.58	–0.32	0.23
Bartik Manuf Shock	–0.59	–0.46	–0.40	–0.50	–0.51	–0.46
Lagged Core-Logic HPI Change (%)	–8.33	–7.11	–4.62	–6.10	–9.07	–0.86
Fitted Values	–0.82	–0.59	–0.33	–0.55	–0.81	–0.07
Residuals	–0.32	0.03	0.74	–0.03	0.49	0.30

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.

Notes: This table shows the data and predicted values from the regression table above for the New England States. Actual Employment Growth was the dependent variable.

Exhibit 10: Fitted Employment Growth vs. Bartik Shocks and Lagged House-Price Changes for All 50 States



Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics and CoreLogic.

Exhibit 11: Mortgage Debt Per Capita (%) Change in New England States, 2002–2006

State	% Change
Rhode Island	88.5
Massachusetts	81.7
Connecticut	64.2
Vermont	48.4
New Hampshire	87.8
Maine	77.0

Sources: Federal Reserve Bank of New York Consumer Credit Panel, Equifax.

Exhibit 12A: Manufacturing Employment Changes Across the Recession (SA),

New England States

NATIONAL	Pre-Recession	Change	% Change
Manuf Jobs (NSA)	13,725,000.00	–2,272,000.00	–16.55
Manuf Share(%)	9.92	–1.09	.
Total Jobs (SA)	138,365,000.00	–8,710,000.00	–6.29
RHODE ISLAND			
Manuf Jobs (NSA)	51,800.00	–10,600.00	–20.46
Manuf Share(%)	10.45	–1.41	.
Total Jobs (SA)	495,700.00	–39,800.00	–8.03
MASSACHUSETTS			
Manuf Jobs (NSA)	289,500.00	–36,200.00	–12.50
Manuf Share(%)	8.71	–0.75	.
Total Jobs (SA)	3,325,000.00	–140,800.00	–4.23
CONNECTICUT			
Manuf Jobs (NSA)	188,600.00	–23,600.00	–12.51
Manuf Share(%)	11.01	–0.66	.
Total Jobs (SA)	1,713,000.00	–119,100.00	–6.95
MAINE			
Manuf Jobs (NSA)	59,700.00	–9,100.00	–15.24
Manuf Share(%)	9.61	–1.04	.
Total Jobs (SA)	621,000.00	–30,500.00	–4.91
NEW HAMPSHIRE			
Manuf Jobs (NSA)	77,400.00	–12,100.00	–15.63
Manuf Share(%)	11.86	–1.35	.
Total Jobs (SA)	652,700.00	–31,400.00	–4.81
VERMONT			
Manuf Jobs (NSA)	36,100.00	–5,500.00	–15.24
Manuf Share(%)	11.66	–1.28	.
Total Jobs (SA)	309,600.00	–14,700.00	–4.75

Source: U.S. Bureau of Labor Statistics, collected with Haver.

Exhibit 12B: Manufacturing Employment Changes Across the Recession (NSA), NECTAs

NATIONAL	Pre-Recession	Change	% Change
Manuf Jobs (NSA)	13,619,000.00	–2,279,000.00	–16.73
Manuf Share(%)	10.00	–1.15	.
Total Jobs (SA)	138,365,000.00	–8,710,000.00	–6.29
PROVIDENCE			
Manuf Jobs (NSA)	67,300.00	–16,000.00	–23.77
Manuf Share(%)	11.31	–1.90	.
Total Jobs (SA)	587,500.00	–50,300.00	–8.56
BOSTON			
Manuf Jobs (NSA)	217,200.00	–21,000.00	–9.67
Manuf Share(%)	8.74	–0.59	.
Total Jobs (SA)	2,513,800.00	–104,900.00	–4.17
BRIDGEPORT			
Manuf Jobs (NSA)	40,400.00	–5,000.00	–12.38
Manuf Share(%)	9.53	–0.31	.
Total Jobs (SA)	422,000.00	–30,600.00	–7.25
HARTFORD			
Manuf Jobs (NSA)	64,800.00	–8,900.00	–13.73
Manuf Share(%)	11.47	–0.79	.
Total Jobs (SA)	561,600.00	–33,600.00	–5.98
NEWHAVEN			
Manuf Jobs (NSA)	31,300.00	–5,000.00	–15.97
Manuf Share(%)	11.24	–1.17	.
Total Jobs (SA)	280,000.00	–17,400.00	–6.21
SPRINGFIELD			
Manuf Jobs (NSA)	36,300.00	–4,800.00	–13.22
Manuf Share(%)	11.99	–1.07	.
Total Jobs (SA)	301,400.00	–15,600.00	–5.18
WORCESTER			
Manuf Jobs (NSA)	29,200.00	–4,000.00	–13.70
Manuf Share(%)	11.52	–1.01	.
Total Jobs (SA)	251,100.00	–12,600.00	–5.02
NORWICH			
Manuf Jobs (NSA)	15,900.00	–1,400.00	–8.81
Manuf Share(%)	11.43	–0.01	.
Total Jobs (SA)	137,400.00	–10,400.00	–7.57
PORTLAND			
Manuf Jobs (NSA)	14,600.00	–1,700.00	–11.64
Manuf Share(%)	7.69	–0.90	.
Total Jobs (SA)	196,600.00	–9,300.00	–4.73
NEWBEDFORD			
Manuf Jobs (NSA)	10,100.00	–2,000.00	–19.80
Manuf Share(%)	15.05	–2.74	.
Total Jobs (SA)	68,100.00	–3,500.00	–5.14

Source: U.S. Bureau of Labor Statistics, collected with Haver.

Exhibit 13: Actual Manufacturing Emp. Growth (%) and Predicted Manufacturing Emp. Growth from Bartik Shocks (NSA)

	National	Rhode Island	Massachusetts	Connecticut	Maine	New Hampshire	Vermont	Variance
06-07 Bartik Shock	.	–0.320	–1.345	–0.707	–1.534	–1.505	–1.521	0.267
06-07 Actual % Change	–1.453	–2.969	–0.910	–0.886	0.039	–0.084	0.731	1.639
06-07 Bartik/Actual	.	0.108	1.478	0.798	–39.369	17.947	–2.081	0.163
07-08 Bartik Shock	.	–2.507	–2.715	–2.305	–3.432	–2.998	–3.483	0.235
07-08 Actual % Change	–3.396	–5.787	–3.001	–2.290	–1.441	–2.468	–3.349	2.218
07-08 Bartik/Actual	.	0.433	0.905	1.007	2.382	1.215	1.040	0.106
08-09 Bartik Shock	.	–9.291	–9.598	–10.352	–9.751	–10.923	–10.089	0.342
08-09 Actual % Change	–10.666	–11.966	–8.773	–7.653	–9.217	–9.300	–8.851	2.061
08-09 Bartik/Actual	.	0.776	1.094	1.353	1.058	1.174	1.140	0.166
09-10 Bartik Shock	.	–3.335	–3.318	–3.264	–3.681	–3.351	–3.738	0.042
09-10 Actual % Change	–3.093	–3.606	–2.350	–3.711	–4.041	–3.831	–1.702	0.900
09-10 Bartik/Actual	.	0.925	1.412	0.879	0.911	0.875	2.196	0.281

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.

Notes: Bartik shocks are calculated as a weighted average of U.S. employment growth rates by 2-digit manufacturing industry, using prior (year 2005) local employment shares by 2-digit manufacturing industry for the weights. If employment data are missing for some industries in a location, non-missing shares are normalized to sum to 100 for each location. In the Variance column, every third value is the ratio of the two variances directly above it.

Exhibit 14: Imports Exposure Taken From Autor, Dorn, and Hanson 2013a

Appendix

A. Tables

Appendix Table 1—Descriptive Statistics for Growth of Imports Exposure per Worker across CZs: Ten-Year Equivalent Changes

	I. 1990–2000		II. 2000–2007	
Panel A. Percentiles				
	90th percentile	2.05	90th percentile	4.30
	75th percentile	1.32	75th percentile	3.11
	50th percentile	0.89	50th percentile	2.11
	25th percentile	0.62	25th percentile	1.60
	10th percentile	0.38	10th percentile	1.03
Rank				
Panel B. Largest and smallest values among the 40 largest CZs				
1	San Jose, CA	3.15	San Jose, CA	7.32
2	Providence, RI	2.59	Providence, RI	4.99
3	Buffalo, NY	2.24	Los Angeles, CA	3.59
4	Boston, MA	1.55	San Diego, CA	3.08
5	Portland, OR	1.53	Portland, OR	2.96
6	San Diego, CA	1.52	Pittsburgh, PA	2.95
7	Newark, NJ	1.32	Chicago, IL	2.93
8	Los Angeles, CA	1.28	Milwaukee, WI	2.93
9	Bridgeport, CT	1.27	Boston, MA	2.79
10	Denver, CO	1.23	Dallas, TX	2.77
20	Forth Worth, TX	0.83	Columbus, OH	1.90
21	Phoenix, AZ	0.83	Phoenix, AZ	1.90
31	Atlanta, GA	0.61	Fresno, CA	1.56
32	Pittsburgh, PA	0.56	St. Louis, MO	1.53
33	Sacramento, CA	0.53	Tampa, FL	1.49
34	Kansas City, MO	0.51	Atlanta, GA	1.31
35	West Palm Beach, FL	0.48	Baltimore, MD	1.25
36	Fresno, CA	0.47	West Palm Beach, FL	1.22
37	Orlando, FL	0.46	Kansas City, MO	1.13
38	Houston, TX	0.45	Washington, DC	0.86
39	Washington, DC	0.21	New Orleans, LA	0.70
40	New Orleans, LA	0.19	Orlando, FL	0.59

Notes: The table reports ten-year equivalent values of (Δ imports from China to US)/worker in *k*US$. The statistics in panel A are based on 722 CZs and weighted by start-of-period population size. The ranking in panel B is based on the 40 CZs with largest population in 1990, and indicates the largest city of each ranked CZ.
Source: Autor, Dorn, and Hanson (2013a).

Exhibit 15A: Manufacturing Employment in NECTAs (NSA), 2000–2009 (Indexed to 2000 Levels)

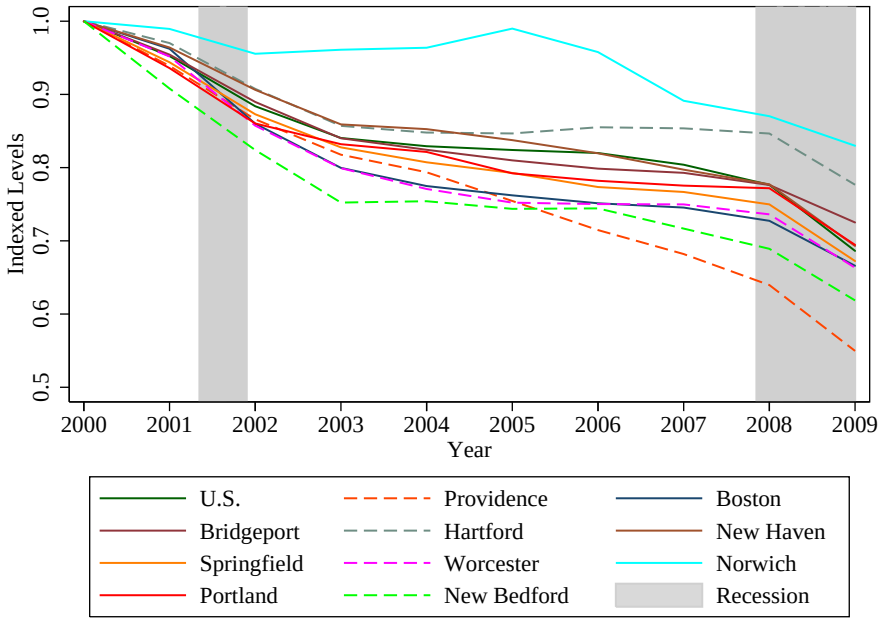
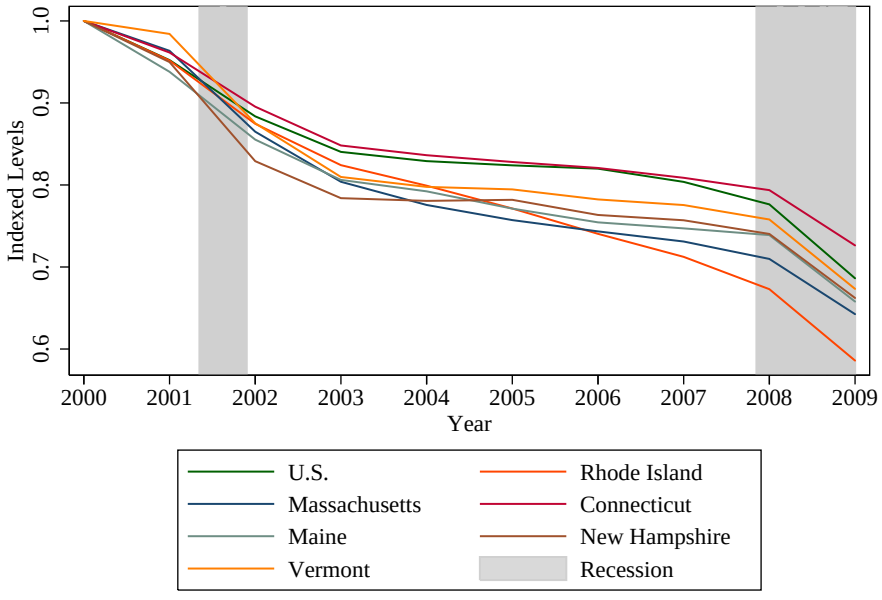


Exhibit 15B: Manufacturing Employment in New England States (SA), 2000–2009 (Indexed to 2000 Levels)



Sources: U.S. Bureau of Labor Statistics, Haver.

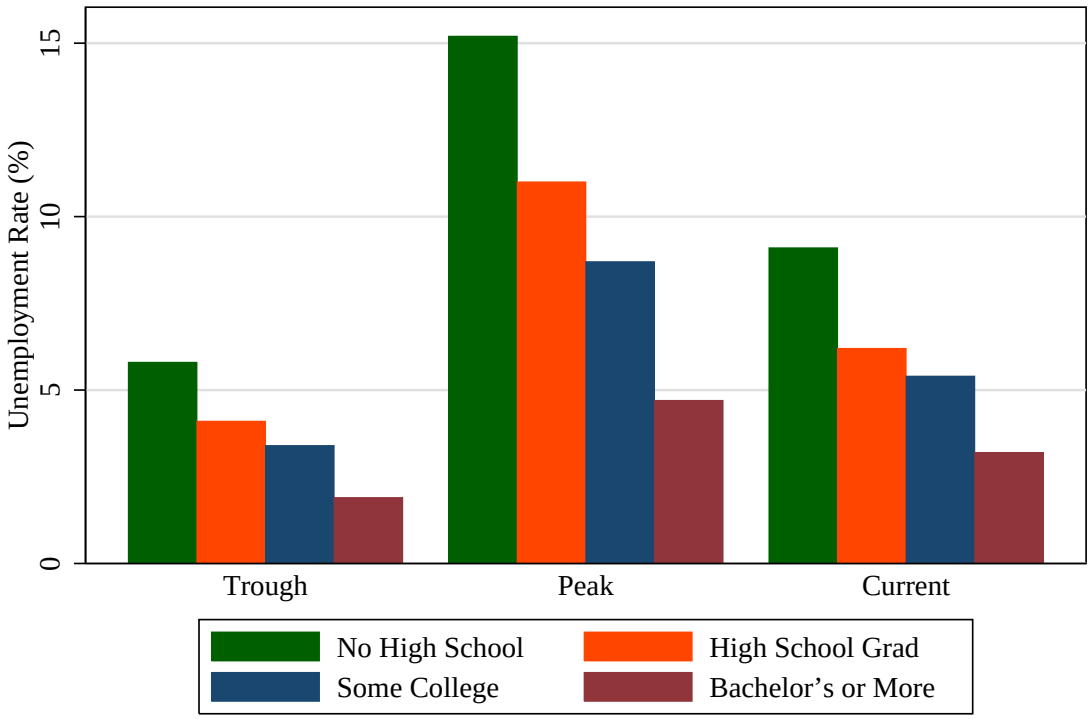
Exhibit 16: Manufacturing Job Losses in New England States

for Middle Skill Workers and HS Dropouts

	US	RI	MA	CT	ME	NH	VT
Middle Skill Workers							
Pre-Rec Middle Share(%)	68	71	59	59	69	54	71
Actual Middle Job Losses	1,882,577	9,248	44,308	22,124	13,272	4,018	6,747
% Change in Middle Emp	–20	–25	–26	–20	–32	–10	–26
Share of Middle in Losses(%)	77	76	117	87	133	33	132
High School Dropouts							
Pre-Rec Dropout Share(%)	12	22	11	7	5	7	2
Actual Dropout Job Losses	195,442	4,009	7,339	4,976	709	2,228	–1,119
% Change in Dropout Emp	–12	–35	–23	–36	–25	–44	149
Share of Dropouts in Losses(%)	8	33	19	20	7	19	–22

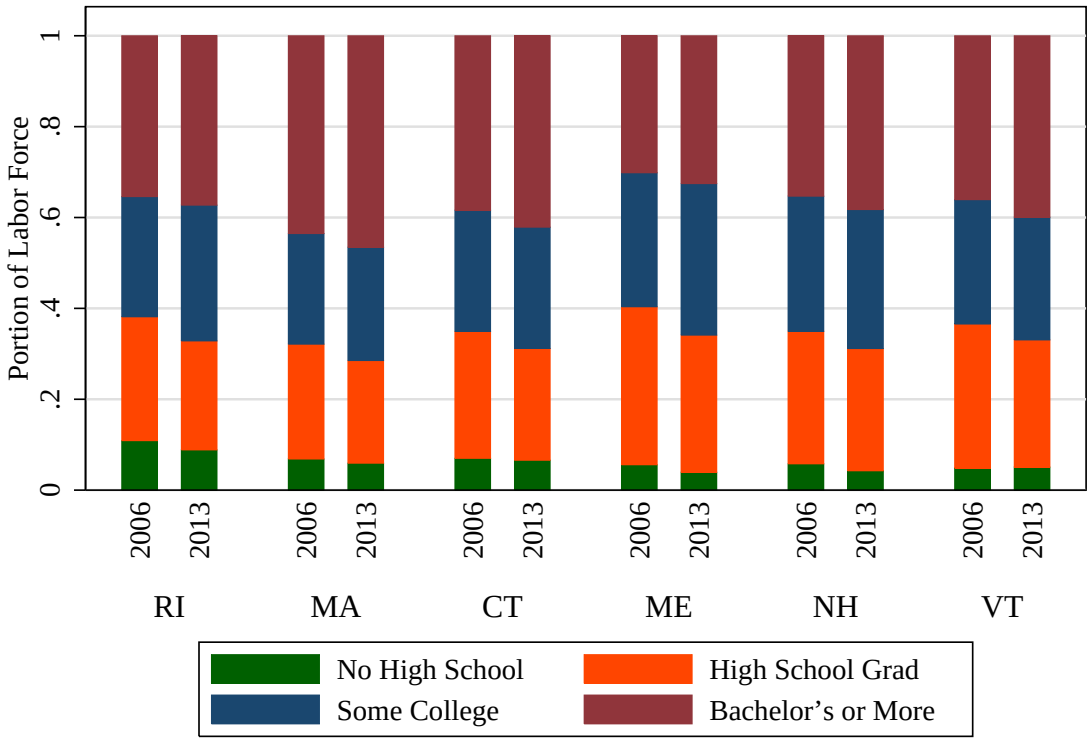
Sources: U.S. Bureau of Labor Statistics, Haver.

Exhibit 17A: U.S. Unemployment Rates by Education, Ages 25+



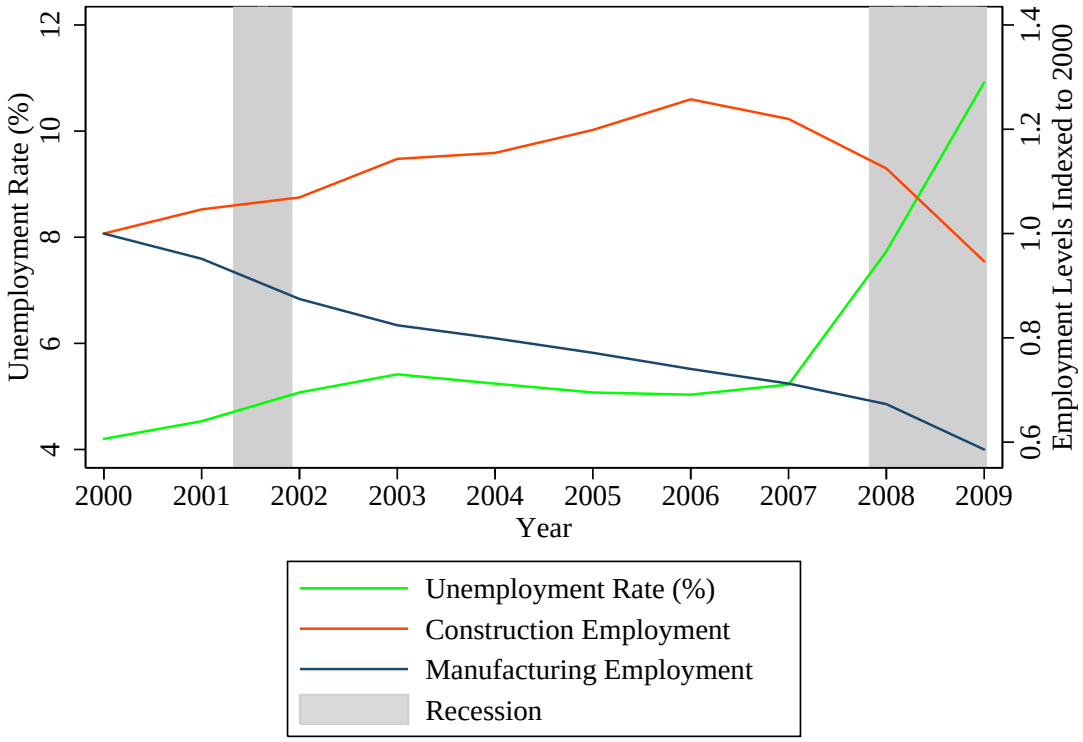
Sources: U.S. Bureau of Labor Statistics, Haver.
Note: Trough date is Oct 2006, Peak is Oct 2009, and Current is Aug 2014.

Exhibit 17B: Educational Breakdown of the Labor Force in New England States, Ages 25-64



Sources: U.S. Bureau of Labor Statistics, Haver.

Exhibit 18: Rhode Island Unemployment Rate (SA) against Indexed Manufacturing and Construction Employment (SA)



Sources: U.S. Bureau of Labor Statistics, Haver.

Exhibit 19A: Percentage Change in Nominal Exports in New England States (2008–2009)

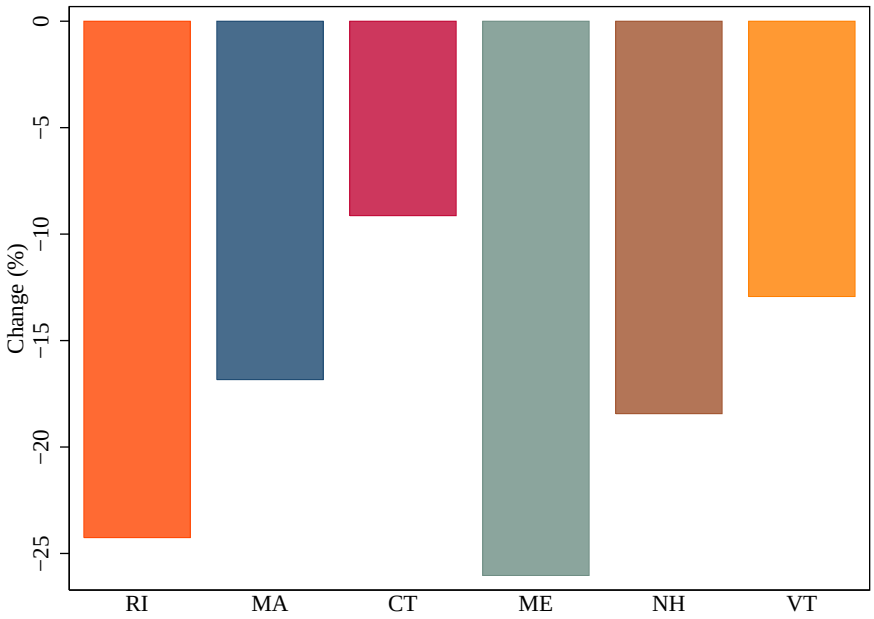
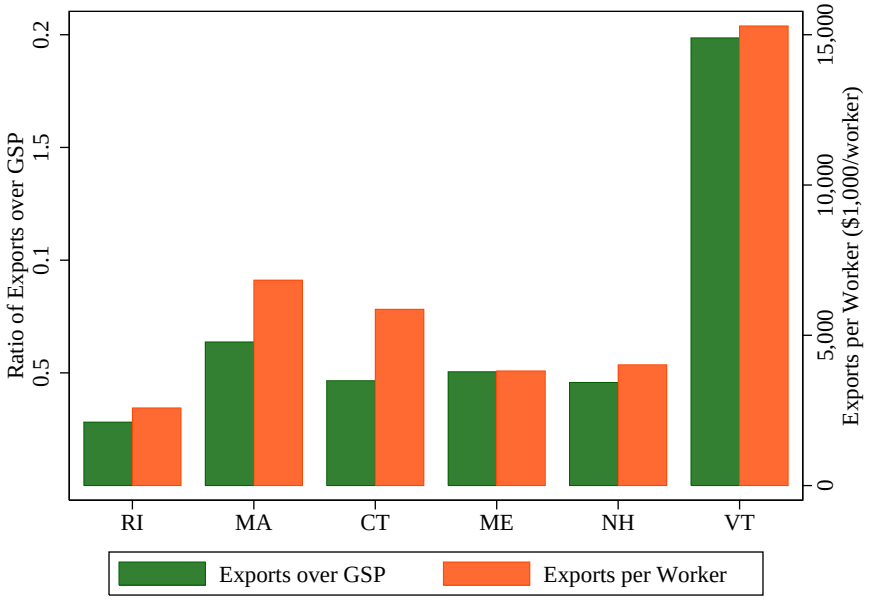
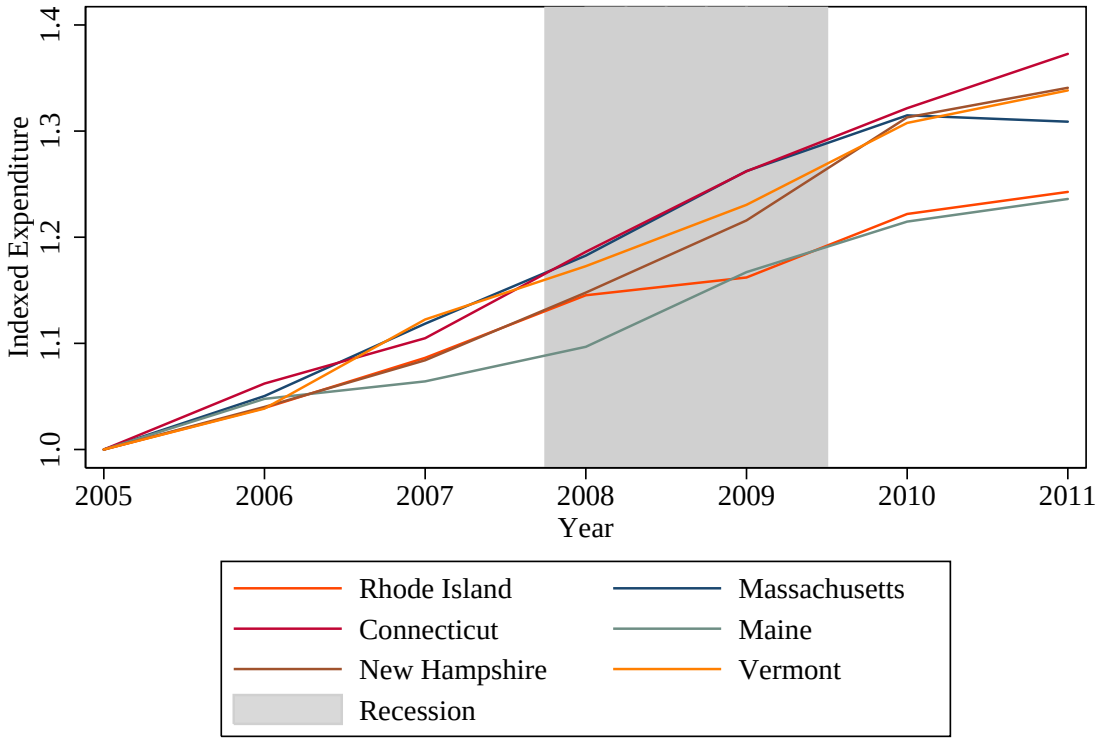


Exhibit 19B: Exports over Gross State Product and per Worker in New England States (2005)



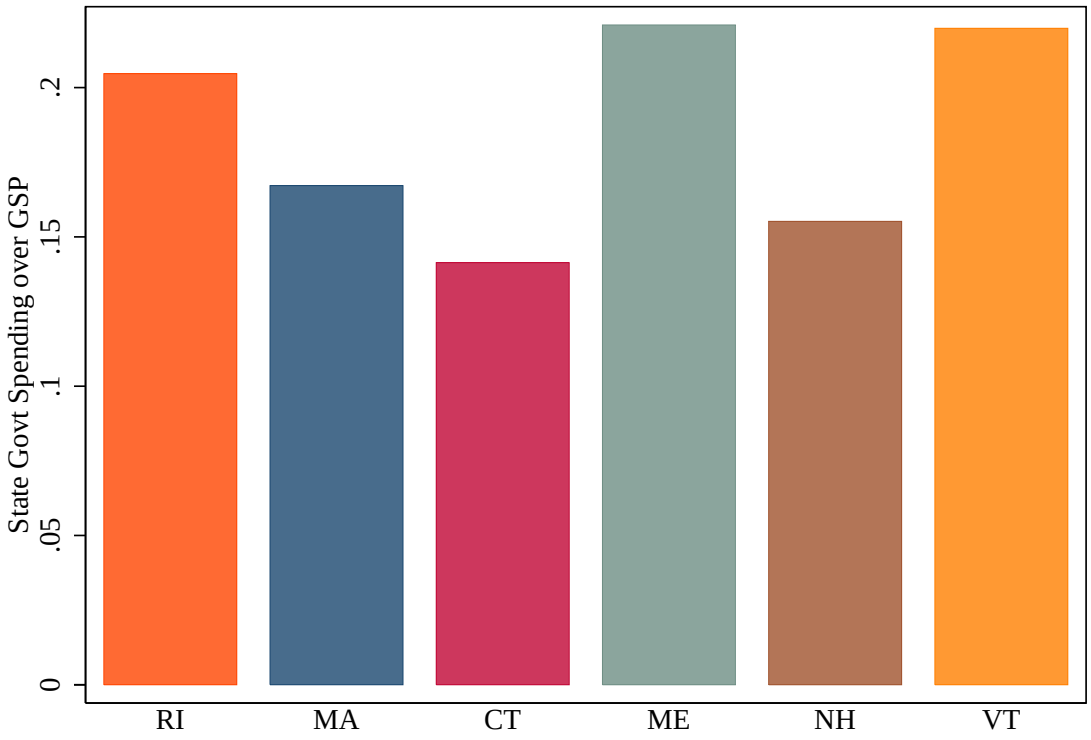
Sources: U.S. Bureau of Economic Analysis, Census via WISER, Haver.

Exhibit 20: Combined State and Local Total Government Expenditure in New England States



Sources: U.S. Census Bureau, Haver.

Exhibit 21: Total Government Spending as a Share of Gross State Product in New England States (2005, Nominal)



Sources: U.S. Census Bureau, U.S. Bureau of Economic Analysis, Haver.

Exhibit 22A: Employment Growth in New England States

since August 2010

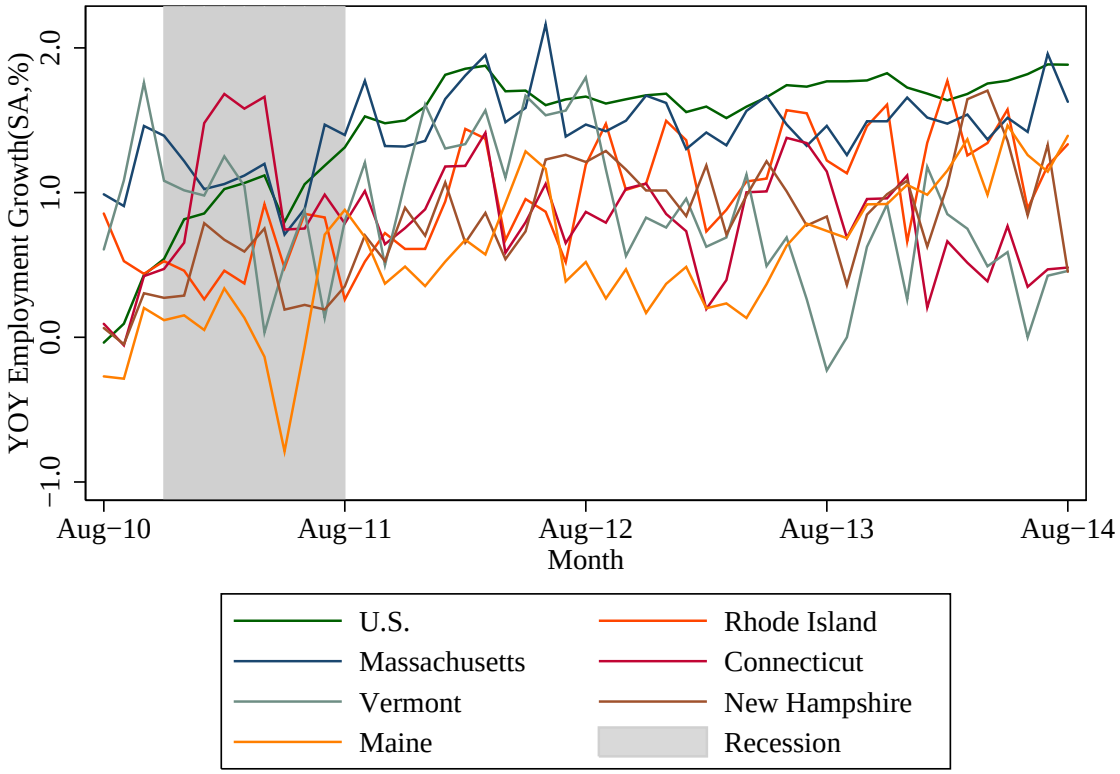
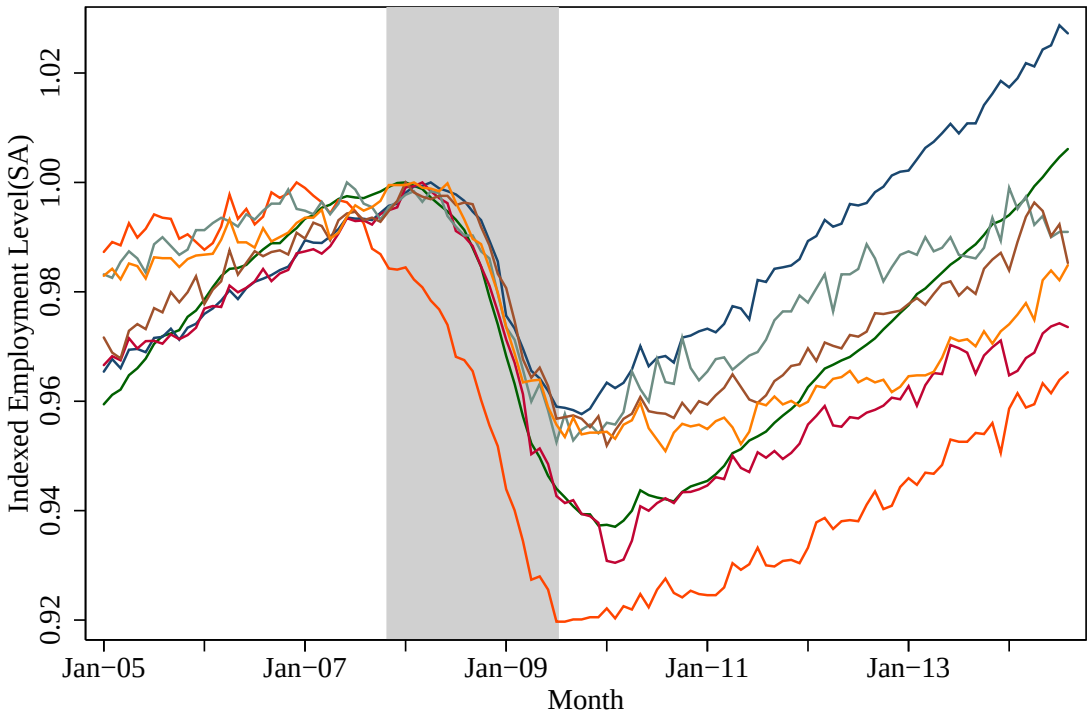


Exhibit 22B: Employment Levels in New England States since 2005

(Indexed to Pre-Recession Peaks)



Sources: U.S. Bureau of Labor Statistics, Haver.
Note: Values refer to total nonfarm payroll employment.

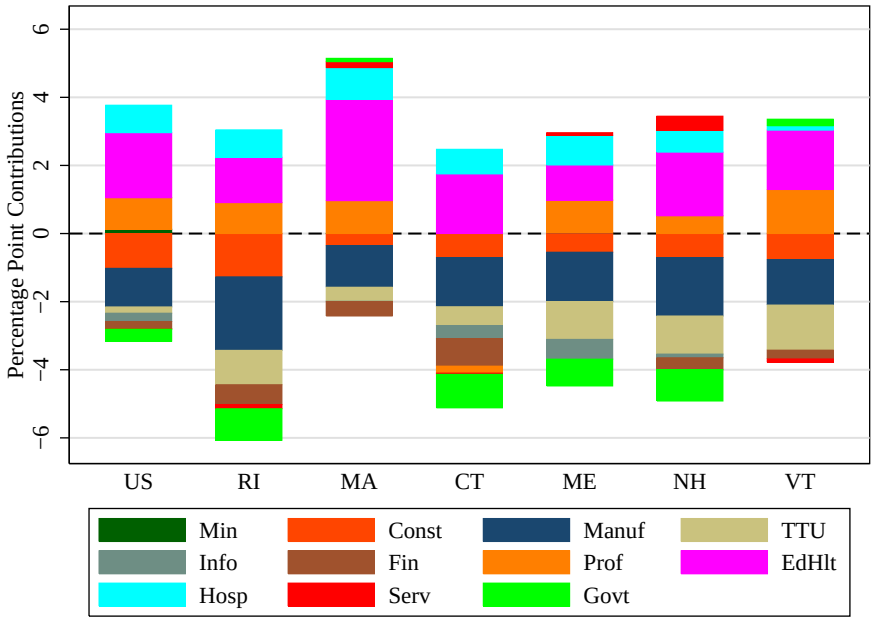
Exhibit 23: State Year Over Year Total Employment Changes (%), 2013–2014

	U.S.	Rhode Island	Massachusetts	Connecticut	Maine	New Hampshire	Vermont
April	1.75	1.34	1.37	0.39	0.98	1.70	0.49
May	1.77	1.57	1.52	0.77	1.46	1.36	0.59
June	1.82	0.89	1.42	0.35	1.26	0.84	0.00
July	1.89	1.19	1.96	0.47	1.14	1.33	0.43
August	1.88	1.33	1.63	0.48	1.39	0.45	0.46
September	1.95	1.29	1.86	1.52	1.56	1.36	0.62
October	1.93	0.76	1.56	1.39	0.96	0.76	0.72

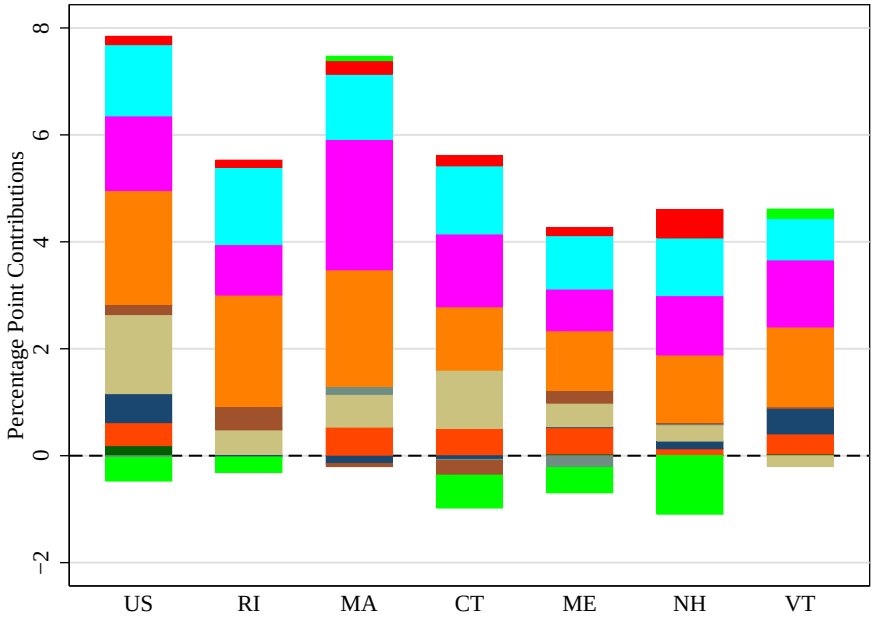
Sources: U.S. Bureau of Labor Statistics, Haver.

Exhibit 24: Contributions to Percentage Change in Total Employment

A: Peak to August 2014



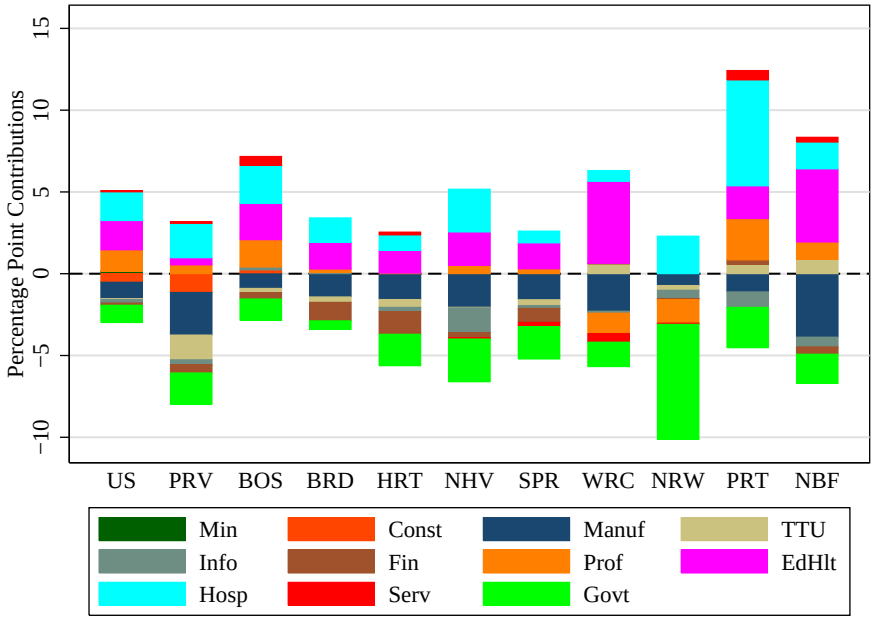
B: Trough to August 2014



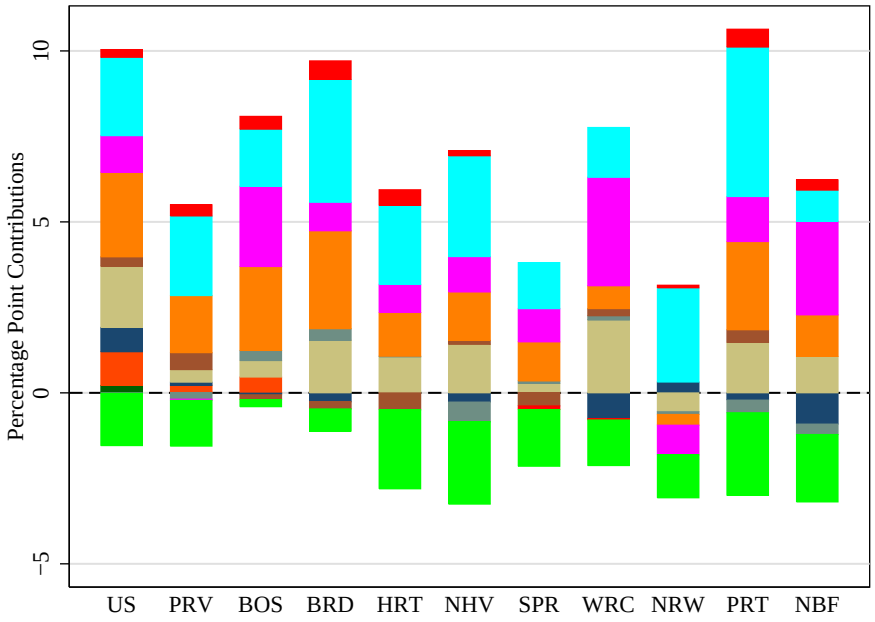
Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.
Notes: The sum of the signed contributions across sectors adds up to the net change in total employment for the location over the given period. See Appendix Exhibit 2 for exact values.

Exhibit 25: Contributions to Percentage Change in Total Employment

A: Peak to August 2014 (NSA)



B: Trough to August 2014 (NSA)



Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.

Notes: The sum of the signed contributions across sectors adds up to the net change in total employment for the location over the given period, except in locations with missing data for some sectors. NECTA abbreviations are Providence (PVD), Boston (BOS), Bridgeport (BRD), Hartford (HRT), New Haven (NHV), Springfield (SPR), Worcester (WRC), Norwich (NRW), Portland (PRT), and New Bedford (NBF). See Appendix Exhibits 3 and 4 for exact values.

Exhibit 26: NECTA Year Over Year Total Employment Changes (%, NSA), 2013–2014

	U.S.	Providence	Boston	Bridgeport	Hartford	New Haven	Springfield	Worcester	Norwich	Portland	New Bedford
April	1.75	0.65	1.23	1.80	0.38	1.09	1.16	0.44	–1.25	0.98	1.74
May	1.77	1.17	1.21	1.66	1.17	1.61	1.54	1.49	–1.25	1.03	2.18
June	1.82	1.15	1.36	1.85	0.36	1.89	1.57	1.85	–1.56	1.43	2.03
July	1.86	1.63	1.73	2.02	0.55	1.64	2.08	3.31	–2.19	2.10	1.02
August	1.82	1.65	1.24	1.60	0.73	1.05	1.87	2.69	–1.96	2.41	1.45

Sources: U.S. Bureau of Labor Statistics, Haver.

Appendix Exhibit 1: Contributions to Percentage Change in Total Employment, Peak-to-Trough

	U.S.	Rhode Island	Massachusetts	Connecticut	Maine	New Hampshire	Vermont
Total Emp	–6.295	–8.029	–4.235	–6.953	–4.911	–4.811	–4.748
Min	–0.052	.	–0.006	–0.012	–0.016	–0.031	–0.032
Const	–1.422	–1.291	–0.854	–1.173	–1.014	–0.797	–1.130
Manuf	–1.642	–2.138	–1.089	–1.378	–1.465	–1.854	–1.776
TTU	–1.570	–1.432	–0.998	–1.565	–1.530	–1.410	–1.130
Info	–0.212	.	–0.153	–0.362	–0.370	–0.123	.
Fin	–0.399	–0.989	–0.364	–0.555	–0.209	–0.383	–0.291
Prof	–1.074	–1.009	–1.125	–1.308	–0.113	–0.674	–0.129
EdHlt	0.608	0.464	0.641	0.485	0.290	0.812	0.549
Hosp	–0.440	–0.525	–0.235	–0.461	–0.081	–0.383	–0.614
Serv	–0.149	–0.242	–0.072	–0.210	–0.064	–0.092	–0.097
Govt	0.058	–0.666	0.021	–0.414	–0.338	0.123	0.032

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.
Notes: Values under "Total Emp" refer to peak-to-trough percent change in total employment; values for a given sector and location refer to the contribution, expressed in percentage points, of the given sector's peak-to-trough employment change to the peak-to-trough change in total employment for the location.

Appendix Exhibit 2: Contributions to Percentage Change in Total Employment to August 2014, Since Peak and Since Trough

	National		Rhode Island		Massachusetts		Connecticut		Maine		New Hampshire		Vermont	
	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough
Total Emp	0.611	7.370	–3.470	4.957	2.725	7.267	–2.644	4.630	–1.514	3.573	–1.471	3.509	–0.904	4.035
Min	0.125	0.189	.	0.000	–0.015	–0.009	–0.012	0.000	0.016	0.034	–0.015	0.016	0.000	0.034
Const	–1.020	0.429	–1.271	0.022	–0.343	0.534	–0.695	0.514	–0.548	0.491	–0.689	0.113	–0.775	0.373
Manuf	–1.133	0.543	–2.159	–0.022	–1.218	–0.135	–1.442	–0.069	–1.449	0.017	–1.716	0.145	–1.324	0.475
TTU	–0.185	1.479	–1.009	0.461	–0.412	0.612	–0.555	1.085	–1.111	0.440	–1.118	0.306	–1.324	–0.203
Info	–0.244	–0.034	.	.	–0.012	0.148	–0.385	–0.025	–0.580	–0.220	–0.107	0.016	.	.
Fin	–0.220	0.191	–0.585	0.439	–0.421	–0.060	–0.806	–0.270	0.016	0.237	–0.352	0.032	–0.258	0.034
Prof	0.926	2.134	0.908	2.084	0.965	2.183	–0.204	1.186	0.950	1.118	0.521	1.255	1.292	1.492
EdHlt	1.911	1.391	1.331	0.943	2.974	2.437	1.751	1.361	1.031	0.779	1.869	1.111	1.744	1.255
Hosp	0.808	1.332	0.807	1.448	0.932	1.219	0.724	1.274	0.870	0.999	0.643	1.078	0.129	0.780
Serv	–0.002	0.157	–0.121	0.132	0.174	0.258	–0.035	0.188	0.081	0.152	0.414	0.531	–0.097	0.000
Govt	–0.355	–0.440	–0.928	–0.285	0.099	0.082	–0.987	–0.615	–0.789	–0.474	–0.919	–1.094	0.194	0.170

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.

Notes: Peak and trough refer to the starting date of each calculation; end date is always August 2014. Values under Total Emp refer to percentage change in total employment for the given period; values for a given sector and location refer to the contribution, expressed in percentage points, of the given sector's employment change to the change in total employment for the location over the given period.

Appendix Exhibit 3: Contributions to Percentage Change in Total Employment to August 2014, Since Peak and Since Trough (NSA)

	National		Providence		Boston		Bridgeport		Hartford		New Haven	
	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough
Total Emp	2.101	8.497	–4.788	3.944	4.314	7.681	–0.896	9.425	–3.291	4.413	–1.652	4.864
Min	0.151	0.216	–0.017	0.000	–0.004	–0.008	.	.	.	.	.	.
Const	–0.515	0.985	–1.126	0.220	0.229	0.461	.	.	.	.	.	.
Manuf	–1.002	0.713	–2.604	0.092	–0.889	–0.046	–1.415	–0.260	–1.575	0.000	–2.047	–0.268
TTU	–0.053	1.787	–1.512	0.367	–0.262	0.482	–0.330	1.536	–0.478	1.051	–0.036	1.417
Info	–0.215	–0.013	–0.302	–0.183	0.177	0.295	0.071	0.338	–0.265	0.019	–1.509	–0.574
Fin	–0.140	0.275	–0.504	0.495	–0.386	–0.141	–1.132	–0.208	–1.380	–0.497	–0.323	0.115
Prof	1.308	2.472	0.538	1.669	1.670	2.455	0.212	2.864	0.035	1.280	0.503	1.417
EdHlt	1.789	1.070	0.437	–0.037	2.217	2.347	1.627	0.833	1.398	0.822	2.047	1.034
Hosp	1.756	2.291	2.100	2.329	2.326	1.670	1.509	3.593	0.938	2.312	2.622	2.949
Serv	0.084	0.230	0.118	0.330	0.555	0.378	0.000	0.547	0.177	0.459	–0.072	0.153
Govt	–1.062	–1.531	–1.915	–1.339	–1.320	–0.212	–0.519	–0.651	–1.929	–2.312	–2.622	–2.413

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.
Notes: Peak and trough refer to the starting date of each calculation; end date is always August 2014. Values under Total Emp refer to percentage change in total employment for the given period; values for a given sector and location refer to the contribution, expressed in percentage points, of the given sector's employment change to the change in total employment for the location over the given period.

Appendix Exhibit 4: Contributions to Percentage Change in Total Employment to August 2014, Since Peak and Since Trough (NSA)

	Springfield		Worcester		Norwich		Portland		New Bedford	
	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough
Total Emp	–2.246	2.564	0.276	6.052	–8.411	0.315	8.162	8.162	2.534	4.559
Min	.	.	.	.	.	.	.	.	.	.
Const	.	.	.	.	.	.	.	.	.	.
Manuf	–1.585	0.000	–2.289	–0.751	–0.719	0.315	–1.106	–0.211	–3.875	–0.912
TTU	–0.363	0.277	0.592	2.129	–0.288	–0.551	0.579	1.474	0.894	1.064
Info	–0.165	0.069	–0.118	0.125	–0.503	–0.079	–0.948	–0.369	–0.596	–0.304
Fin	–0.859	–0.381	0.039	0.209	–0.072	0.000	0.263	0.369	–0.447	0.000
Prof	0.297	1.143	–1.263	0.668	–1.438	–0.315	2.528	2.580	1.043	1.216
EdHlt	1.585	0.970	5.012	3.172	0.000	–0.866	2.001	1.316	4.471	2.736
Hosp	0.727	1.351	0.671	1.461	2.301	2.756	6.477	4.371	1.639	0.912
Serv	–0.264	–0.104	–0.513	–0.042	–0.072	0.079	0.579	0.527	0.298	0.304
Govt	–1.982	–1.663	–1.500	–1.336	–7.045	–1.260	–2.475	–2.422	–1.788	–1.976

Source: Author's calculations, based on data from the U.S. Bureau of Labor Statistics, collected with Haver.
Notes: Peak and trough refer to the starting date of each calculation; end date is always August 2014. Values under Total Emp refer to percentage change in total employment for the given period; values for a given sector and location refer to the contribution, expressed in percentage points, of the given sector's employment change to the change in total employment for the location over the given period.