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Research Brief:
North Carolina's Manufacturing Wage Gap

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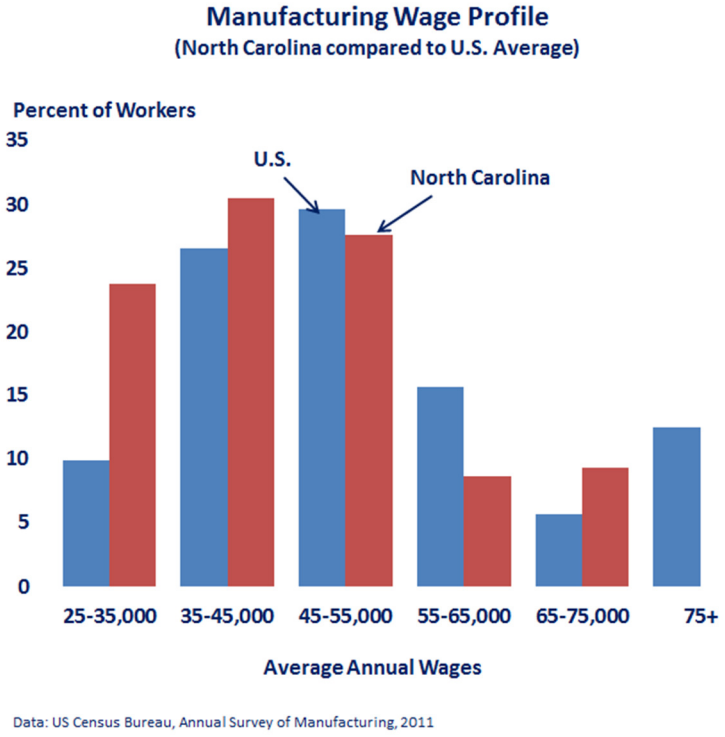
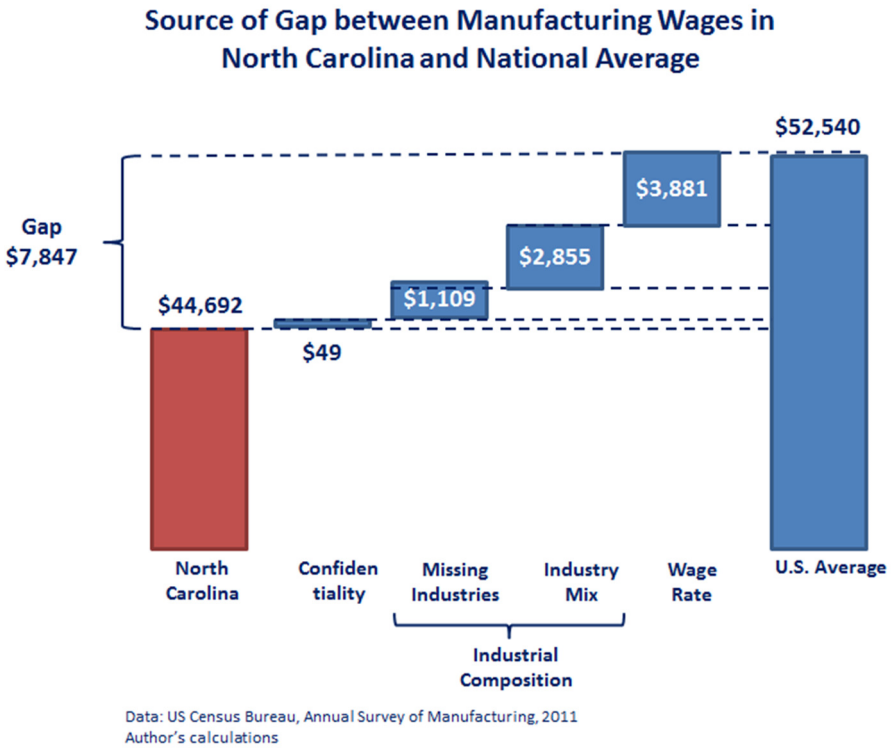
Manufacturing constitutes a significantly higher share of the North Carolina economy, at 19.3 percent, than it does for the United States as a whole, which stood at 11.6 percent in 2011. North Carolinians employed in the manufacturing sector, however, receive a wage significantly below the national average. In 2011, the average wage in manufacturing in North Carolina was $44,692. For the U.S. as a whole, the average wage in manufacturing was $52,540 – a gap of $7,847. Closing North Carolina's manufacturing wage gap would be equivalent to a nearly 18 percent pay raise for the average worker in manufacturing.

The distribution of manufacturing wages in North Carolina compared to the national average paints an interesting picture. North Carolina has a much higher share of manufacturing employment at the lowest ends of the wage spectrum; more than that twice the share of manufacturing employment is located in the $25,000 to $35,000 category as the national average and has slightly more in the $35,000 to $45,000 category. Nationally, there is a higher share of employment in the next two wage categories, but then North Carolina again has a notably higher share in the well-paying $65,000 to $75,000 range. About 12.5 percent of the U.S. manufacturing workforce, however, makes more than $75,000 a year on average, while North Carolina has no industries in this category.[1]



[1] Note that this does not imply that there are no manufacturing jobs in North Carolina that pay more than $75,000 annual. These are industry average wages, thus North Carolina has no industries that pay more than $75,000 on average.

This different wage profile in North Carolina manufacturing compared to the national average can be decomposed into two broad components: industrial composition and wage rates. Industrial composition occurs if North Carolina has a smaller (larger) share of its manufacturing workforce in industries that have wages above (below) the national average. Alternatively, North Carolina may have the same distribution of industries as the national average, but pay lower wages in those industries. As it turns out, those two possibilities contribute nearly identical shares to the gap in manufacturing wages between North Carolina and the national average.



Data and Methodology

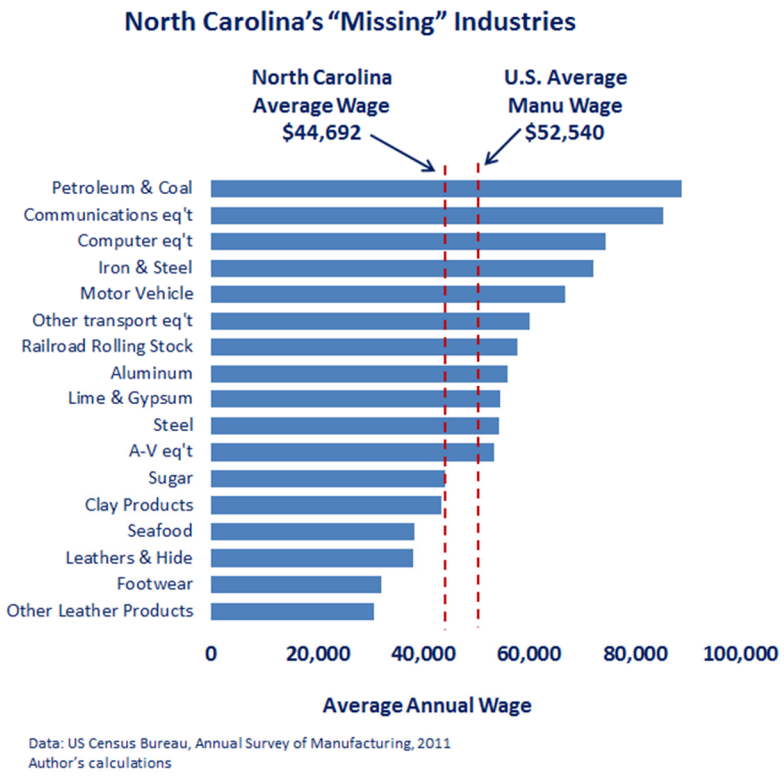
Data on wages is taken from the Annual Survey of Manufacturing (ASM) for the year 2011. Wages are calculated as total payroll divided by total employment.[2] The analysis is conducted at the four-digit North American Industrial Classification System (NAICS) level. The level of analysis can potentially impact on the results. The greater the degree of industry detail, the more important will be the role of industry composition. The reverse is also the case, as can be imagined at a very aggregate level, such as all of manufacturing; there is no role for industry composition. The four-digit NAICS level is the preferred level of detail at the state level as any greater detail results in significant issues of confidentiality in the data. For North Carolina, at the four-digit NAICS level, there is some confidential data; however, that missing data makes an almost negligible contribution to the manufacturing wage gap, accounting for only $49 of the total.

[2] Includes all forms of compensation, such as salaries, wages, commissions, dismissal pay, bonuses, vacation and sick leave pay, but does not include employers' social security contributions or other non-payroll labor costs, such as employees' pension plans, group insurance premiums, and workers' compensation.

Industrial Composition

As previously noted, industrial composition accounts for about half (51 percent) of the gap in manufacturing wages between North Carolina and the national average. Fourteen percent, or $1,109, of that gap can be attributed to missing industries. These are industries that exist in other states but which do not exist in any significant quantity in North Carolina. Some of these missing industries will pay relatively low wages, while others will pay above average wages. In the case of North Carolina, however, there are more high-paying industries that are absent than lower-paying ones, and thus these missing industries contribute to North Carolina's manufacturing wage gap. Attracting industries to North Carolina that pay above average wages will raise the average manufacturing wage rate in the state.

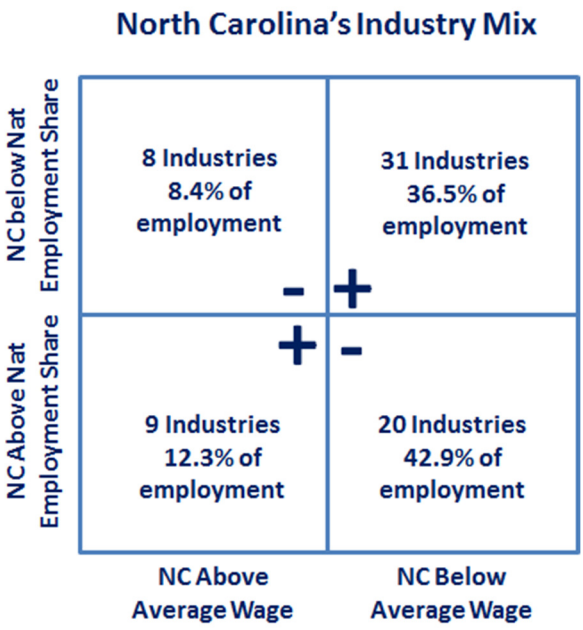
In some cases, it may not be possible to attract a particular industry. The industry with the highest wage rate that does not exist in North Carolina is petroleum and coal product manufacturing for example – an industry that is linked to the existence of natural resources and is therefore not likely to move to North Carolina any time soon. There are others, however, that may be more likely candidates such as communications equipment manufacturing, or computer and peripheral products manufacturing – the next highest paying manufacturing industries that do not currently exist in North Carolina.[3]



North Carolina is the ninth largest state in the United States in terms of economic size. As such, it has a relatively large and diversified economy and therefore it is not surprising that missing industries account for only 14 percent of the manufacturing wage gap. Much more important is the industry mix – North Carolina has a relatively high share of manufacturing employment in industries that pay wages that are below the national average. The mix of industries in North Carolina accounts for 36 percent of the overall manufacturing wage gap, or about $2,855 per year.

[3] It is important to note that the purpose of this analysis is simply to identify the gap and does not attempt to ascertain the ability to attract a specific industry to North Carolina.

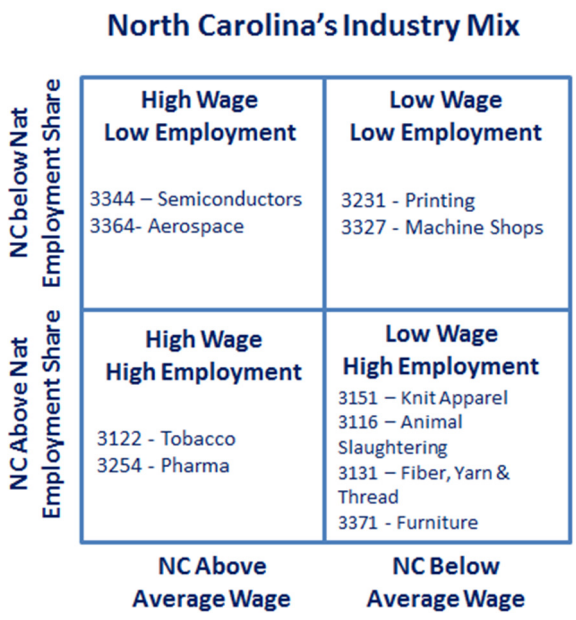
There are four ways in which industry mix contributes to North Carolina's manufacturing wage gap. There is a positive contribution (i.e., a closing of the gap) if an industry pays a wage that is above the national average and those industries have a higher employment share in North Carolina than the national average. This is reflected in the lower left quadrant of the adjacent matrix. This quadrant contains 9 industries and 12.3 percent of total employment in North Carolina. These might be thought of as industries that are highly desirable and in which North Carolina has signs of strength. Examples include tobacco and pharmaceuticals. This quadrant potentially represents strengths that can be built on if there is room for the industry to expand.



Data: US Census Bureau, Annual Survey of Manufacturing, 2011
Author's calculations

The upper right quadrant also contributes to closing the manufacturing wage gap as these pay below-average wages, but they are underrepresented in North Carolina's economy. Containing 31 industries and representing 36.5 percent of employment, this quadrant represents a significant portion of manufacturing in North Carolina. Examples include printing and machine shops. In a sense, these are the least interesting industries as North Carolina does not possess an apparent strength in those industries and they are not particularly desirable in terms of the wages that they pay.

The opposite is the case for industries in the upper left quadrant. These are industries in which wages are above the national average but represent a relatively small share of North Carolina's economy. Only 8 industries fall into this quadrant, representing 8.4 percent of employment. These are highly desirable industries but which North Carolina currently is not a strong player in. Examples include semiconductors and aerospace. This quadrant can be thought of as indicating highly desirable industries and in which North Carolina demonstrates some potential (as opposed to industries that are completely absent). Further analysis would be necessary to identify the potential for expanding these industries in North Carolina.



Data: US Census Bureau, Annual Survey of Manufacturing, 2011
Author's calculations

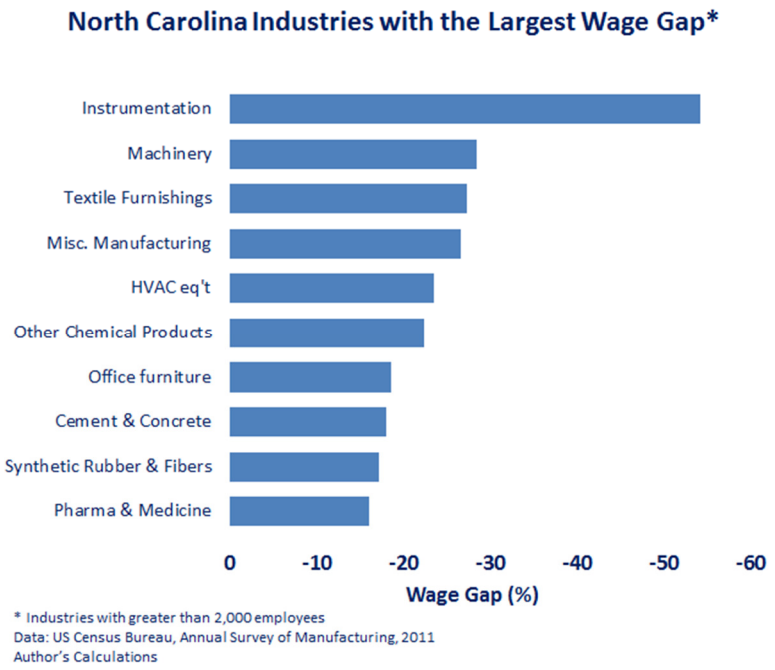
The most important quadrant, as it contributes most to North Carolina's manufacturing wage gap, is the bottom right quadrant. This quadrant includes industries that pay a wage that is below the national average and in which North Carolina has an above-

average employment share. This quadrant contributes most to North Carolina's manufacturing wage gap because it is the largest in terms of employment at 42.9 percent of the total. This quadrant includes many of the sectors for which North Carolina has been historically known for such as textiles and apparel, furniture and hog farming. Many of these also tend to face a high degree of competition from low cost imports. Sectors in this quadrant may be best served by strategies that involve improving wages such as through increasing productivity, by "moving up the value chain" within these industries, or by shifting out of those industries altogether.

Wage Rate

The previous section focused on the national average wage rate and classified industries as paying above-average or below-average wages. A separate issue is the difference in wage rate for a given industry in North Carolina compared to the national average. Of the 68 four-digit NAICS industries that are active in North Carolina, 51 pay wages that are below the national average, while only 17 have wage rates above the national average. The fact that North Carolina pays a lower wage for similar industries accounts for 49 percent of North Carolina's manufacturing wage gap, or about $3,881 of the $7,847 gap.

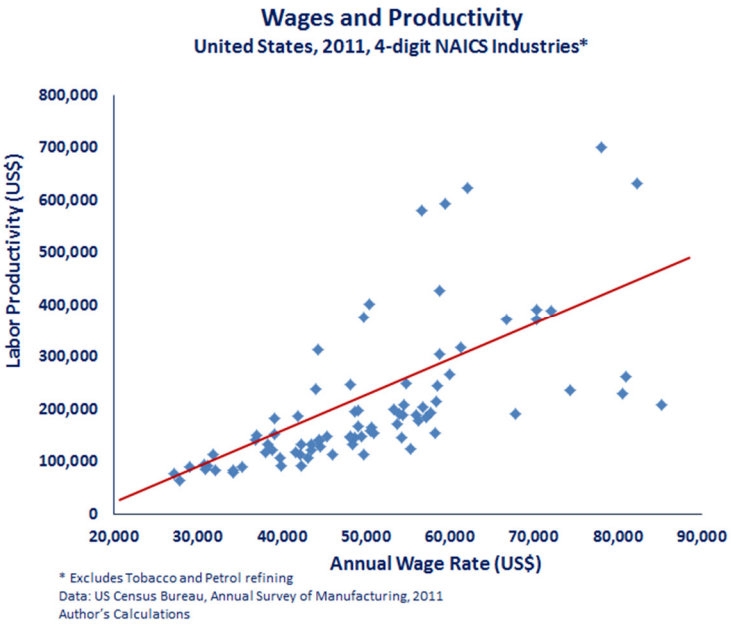
With 75 percent of industries in North Carolina paying a wage rate that is below the national rate, the trend could be considered pervasive. The adjacent chart shows the ten industries with the largest gap while focusing only on those industries of a significant size, defined here as those with more than 2,000 employees in North Carolina. The industry with greatest gap at more than 50 percent is Instrumentation (navigation and scientific equipment), followed by agriculture and construction machinery manufacturing, and textile furnishing mills.



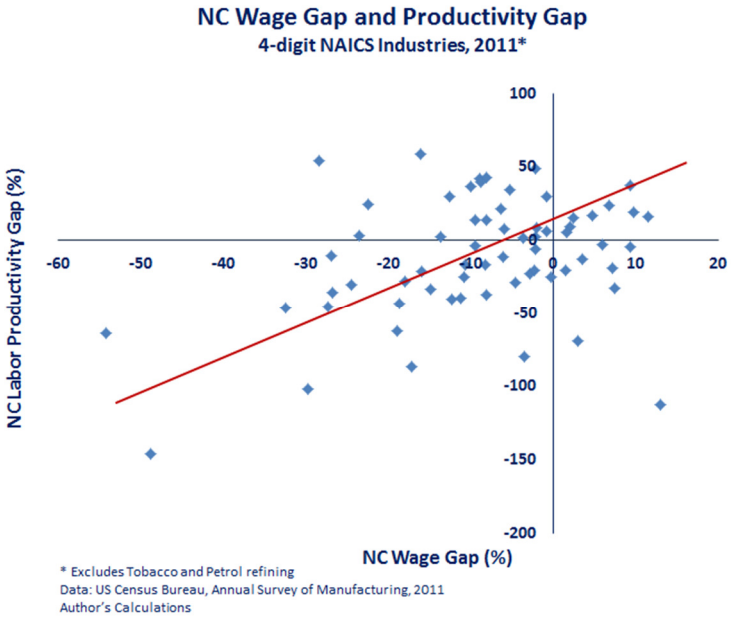
There are a large number of reasons why industries in North Carolina pay less than their counterparts in other states. There may be significant differences in the industries themselves that might be revealed at greater levels of disaggregation. This could include industries in other states focusing on higher-valued activities within the industry. An example of this is synthetic rubber and fibers. Disaggregating that industry reveals that a larger share of North Carolina's production is linked to its textile heritage and thus focuses on the lower-paying synthetic fiber portion of the industry, while nationally, the higher paying synthetic rubber portion of the industry is more predominant.

One possible explanation for North Carolina's wage gap is that productivity may be lower in North Carolina. Productivity here is labor productivity – the value of output produced per worker. Productivity may be higher in a given industry for a wide range of reasons such as that industry makes greater use of automation, hires more skilled workers, benefits from economies of scale or even that the firms are better run. Productivity is an important driver of wages as firms and industries with higher productivity will be able to pay workers higher wages without losing competitiveness.

The first scatter-chart, adjacent, plots data for four-digit NAICS industries at the national level and clearly shows a strong relationship between an industry's wage rate and its level of productivity per worker (measured as dollars of output per worker). Those industries closer to the origin (lower left) pay lower wages, but also have lower productivity levels. As one moves away from the origin, both wages and productivity increase. The dispersion around the line of best fit also increases as one moves away from the origin as would be expected. The correlation coefficient on wage rates and productivity at the national level is 0.65, indicating a strong positive relationship.



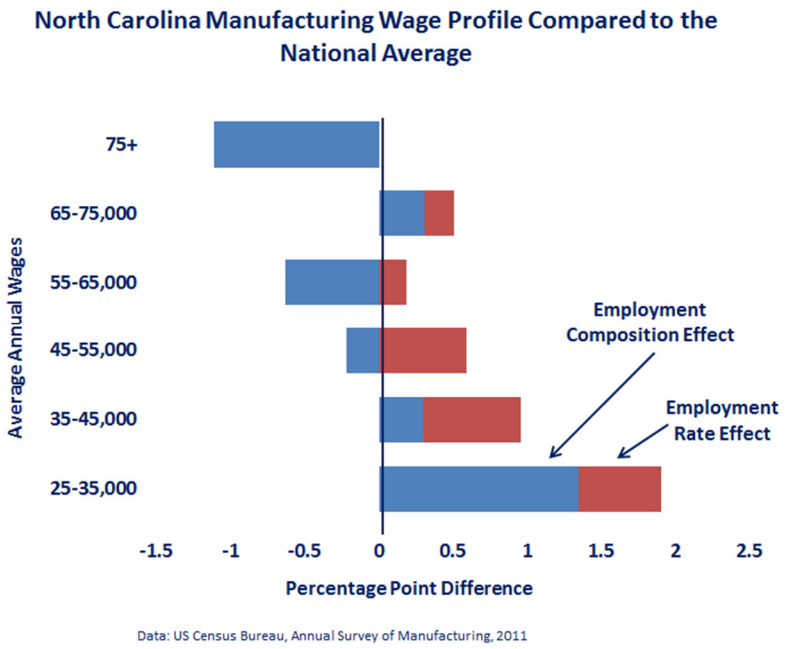
The second scatter-chart plots North Carolina's manufacturing wage gap by industry against the difference between that industry's productivity nationally compared to in North Carolina. As the chart shows, those industries that are less productive than the national average tend to also pay lower wages than the national average and vice-versa. The correlation coefficient, however, is only 0.35, indicating that the relationship does exist and it is in the direction that would be expected, but there are other factors going on as well. These other factors that contribute to a



lower wage rate in North Carolina compared to the national average might include differences in labor laws or lower costs of living among others.

Competitiveness

The discussion up to this point has focused on identifying the potential causes of the large gap in manufacturing wages between North Carolina and the national average. As documented, roughly half of the gap, is due to the composition of the manufacturing industry in North Carolina – an under representation of high-paying industries and an over-representation of low-paying industries. The other half of the gap is the result in seemingly similar industries in North Carolina paying an average wage that is less than the national average. Some might argue, however, that the identified wage gap is a good thing; the wage gap represents a competitive advantage for North Carolina that makes the state a more attractive location for firms to invest which in-turn improves employment opportunities for North Carolinians. The evidence suggests that there is some truth to such as view as North Carolina's wage gap could in part be driving the relatively high share of manufacturing in the North Carolina economy.[4]



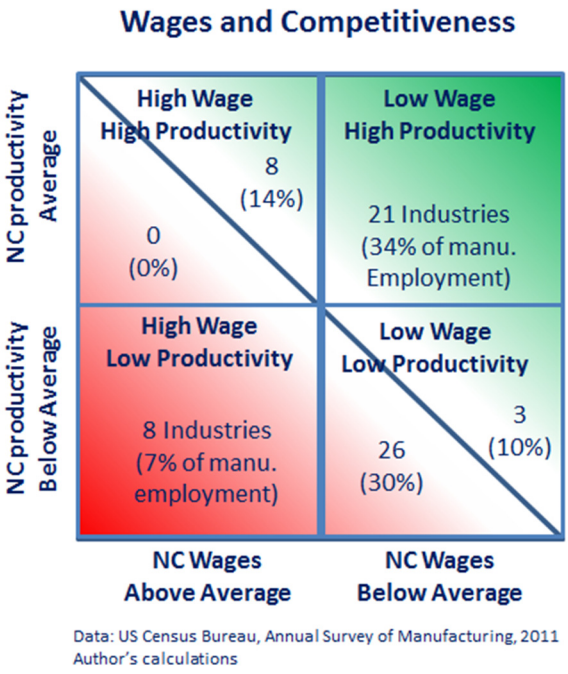
As of 2011, 11.1 percent of North Carolina's employment was in the manufacturing sector. This compares to 8.9 percent for the U.S. economy overall – a difference of 2.2 percentage points. That difference can be decomposed into two effects; The first is the Employment Composition Effect and the Employment Rate Effect. The former captures, as was discussed earlier, the fact that North Carolina has a greater share of employment in lower-wage sectors than the U.S. average. The latter takes into account that North Carolina has a larger share of the employed population working in manufacturing. As illustrated in the chart adjacent, if North Carolina has the same share of employment in manufacturing as the national average (the composition effect), North Carolina would have a much larger share of the population working in the lower-end wage categories, the only exception being the $65,000-$75,000 wage category. This is seen by composition effect being on the positive side of the scale for lower-wage categories and negative for high-wage categories. This effect is partially overcome though with the larger share of employment in

[4] There are many possible dimensions to such an analysis: relative to its population, are a higher share of North Carolinian's in the labor force relative to the national average (i.e. higher participation rate), of those in the labor force are a higher share employed (i.e. lower unemployment rate), and of those employed, are a greater share in manufacturing and receiving a higher wage. In addition, one would want to take into account cyclical factors that would impact on all of these trends as well as all of the other factors that might be expected to impact on these trends.

manufacturing and is illustrated with all of the bars being on the positive side of the ledger. Both effects, however, are generally in the same direction leading to the overall interpretation that the added employment is generally concentrated at the lower-end of the wage spectrum. To put this another way, if competitiveness is largely based on having low wages, then it is not surprising that the benefits will largely accrue where low wages are most important.

A different perspective is look more directly at the issue of competitiveness. Competitiveness here is defined as the difference between labor productivity and wages. The larger the gap between labor productivity and wages in North Carolina compared to the national average, the more competitive is that industry. The diagram below categorizes industries into four quadrants based on their wages and productivity. The top-left quadrant contains those industries that have wages that are above the national average but also productivity that is above the national average. The bottom-right quadrant, by contrast contains industries where both wages and productivity in North Carolina are below the national average. This, however, is not sufficient to capture competitiveness. If both wages and productivity are 10 percent above the national average, there is no impact on competitiveness. Thus, only industries above the 45 degree line can be considered to be competitive with the distance from the line reflecting the degree of competitiveness.

Above the 45 degree line in the top-left quadrant might be considered the ideal. Industries in this area pay wages in North Carolina that are higher than the national average, but these industries also remain competitive by having productivity that exceeds the national average by an even greater amount. Of the sixty-six industries for which both productivity and average wage rates exist for North Carolina, only 8 fall in this area representing 14.4 percent of North Carolina's manufacturing employment. The single largest industry is plastic product manufacturing. That with the largest pay premium is motor vehicle body manufacturing – likely related to NASCAR. Interestingly, not a single industry falls below the line in this quadrant.



The entire quadrant in the top-right can be considered to be competitive as wages are below the national average in North Carolina while productivity is above average. 21 industries representing 34.8 percent of North Carolina's manufacturing employment

The lower-left quadrant contains industries that might be considered uncompetitive by the measure that we are using. Not only do they pay wages in North Carolina that are above the national average, but their productivity is lower. It is therefore not surprising to find only eight industries in this quadrant representing only 7.1 percent of North Carolina's manufacturing employment.

The bottom-right quadrant contains both largest number of industries and the largest share of North Carolina's manufacturing employment. Within that quadrant, three industries can be found above the competitiveness line which indicates that while they suffer from below average productivity, they remain competitive by paying below average wages. Although these three industries represent a relatively large, 10 percent of North Carolina's manufacturing employment, it is in fact dominated by a single industry; meat product manufacturing, which is likely related to the pork industry in North Carolina's case. It is also notable that, although above the competitiveness line, neither wages nor productivity fall very far from the line for that industry suggesting that the competitiveness effect is not very strong.

Far more significant in this quadrant are the 26 industries representing 30 percent of North Carolina's manufacturing employment that fall below the line. From a competitiveness perspective, for these industries, lower wages are in part compensating for lower productivity. There is, however, a significant degree of variation between industries in this group. While there are a number of industries from the textile and apparel sector that fall within this area, they tend to be relatively close to the competitiveness line…that is close to the national average in terms of wages and productivity. Further out, however, are industries in the wood and pulp sector and a number that may not be as tradable such as machine shops and engraving.

Implementing this framework, it would be expected that North Carolina would have a greater employment share in those industries in which North Carolina is more competitive and vice-versa. This would be reflected in the adjacent scatter plot with an upward trend from the lower left quadrant to the upper right. We can't identify any such trend in the data which is confirmed by a correlation coefficient of 0.06. Based on this evidence it is difficult to make the case that competitiveness, as defined by the size of the gap between labor productivity and average wages, is an important determinant of the location of industry in North Carolina.

It is important to note, though, that labor costs are far from the only component of costs, much less of competitiveness. For many industries, labor costs are not even the most important cost with the costs of intermediate inputs, machinery and equipment, advertising, transportation and many others often comprising the majority of expenses. An additional issue is that wages and productivity are likely not independent of one another. There is the direct link that more productive workers can often obtain a higher wage, but also that wages could influence investment decisions be firms. Lower wages may free-up capital for investing in productivity improving machinery and equipment or innovation. On the other hand, firms may compensate for higher wages by working to improve productivity. Improving productivity is generally a more reliable way to improve competitiveness.

Conclusions

The preceding analysis illustrated that there is a sizable gap in manufacturing wages between North Carolina and the U.S. average. Roughly half of that manufacturing wage gap can be attributed to the mix of industries in North Carolina: a relatively high share of jobs in low-wage industries and fewer jobs in the highest paying industries. The other half of the manufacturing wage gap can be attributed to North Carolina paying a lower wage relative to the U.S. average for what appears to be similar industries.

In terms of industrial composition, the single largest contributing factor is that North Carolina has a higher share of low-wage industries than the national average. These tend to be industries that have

historically been associated with North Carolina such as Textiles & Apparel, Furniture and the related wood industries and Hog Farming. Also contributing to this effect is the lack of high-wage industries, particularly at the highest end of the wage scale.

Potentially more controversially, North Carolina industry also appears to pay wages that are below the national average for seemingly identical industries and the trend appears to be pervasive. It could be claimed that these lower wages make North Carolina a more attractive location to invest and conduct business, a case that is supported by the relatively high share of manufacturing in North Carolina's economy. A very cursory review, however, seems to suggest that those industries that tend to have the greatest cost advantage are not represented to a greater degree in the economy. And if there is an investment attraction effect, it would largely be on the lower-end of the wage scale.

Next Steps

The following are some additional policy and research issues suggested by this analysis:

Industry Attraction: Most states have programs to attract business to their state. Attracting industries that pay above average wages will contribute to closing North Carolina's wage gap. Global value chain (GVC) analysis may be able to inform such efforts by identifying industries that appear to be a good fit based on upstream or downstream supporting industries present in North Carolina or adjoining states, or on the presence of skilled workers that compliment particular industries. It may also be possible to identify gaps in supporting industries, skills, or the economic environment that could be addressed to make North Carolina a more attractive destination for certain industries.

Wage Growth: As this analysis has shown, the average manufacturing wage is significantly lower in North Carolina compared to similar industries in other states. Improving productivity performance is key; not only is productivity closely linked to wages, but it is the only way to improve wages without negatively impacting on competitiveness. GVC analysis would be important to examine the observed wage and productivity gap at more detailed industry levels and identify the potential sources for the gaps. GVC analysis may also be able to identify potential strategies for firms and industries to improve their productivity performance, such as through increased capital investment, innovation or moving up the value-chain.

Services: The current analysis has been performed for manufacturing. Services, however, account for a much larger share of economic activity in North Carolina than does manufacturing. It would thus be important to identify if a similar wage gap exists in the service sector.

Time Trends: The current analysis looks at only a snapshot of manufacturing wages in North Carolina at one point in time. It would be useful to know if the situation has been getting worse or improving over time. A worsening situation would put extra emphasis on finding solutions.