Manufacturing Matters: A Case Study of Alabama

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Abstract

Over the last fifty years, the United States has been marked by two important secular trends. One is a continuous increase in income inequality. Second, the nation has transitioned through three periods of manufacturing: (a) "The Industrial Period" during 1945-1979, (b) the "Deindustrialization of America" during 1980-2000, and (c) the "Re-industrialization of America" during 2000-present, as it began to shift to an economy largely dominated by service and knowledge jobs, with a major reduction in labor-intensive manufacturing. This study examines the relationship between manufacturing employment and income inequality in the state of Alabama to test the hypothesis that manufacturing plays a key role in moderating inequality. In particular, we consider whether manufacturing or other economic and demographic factors are determinants of the rising income inequality in Alabama. We control for other factors that are also likely to be related to rising income inequality. We employ empirical techniques that are best suited to address potential econometric problems in the empirical work. In general, our results indicate that manufacturing does indeed play a key role in moderating inequality. Other key findings are that more educated communities have less inequality, that rural areas have especially high inequality, that counties with a high proportion of African Americans face disproportionately high inequality, and that the poorest counties have the highest level of inequality

1. Introduction

Over the last fifty years, the United States has been marked by two important secular trends. One is a continuous increase in income inequality (Bartels, 2008; Dadush, Dervis, Milsom, & Stancil, 2012; Danziger & Gottschalk, 1995). Second, the nation has transitioned through three periods of manufacturing: (a) "The Industrial Period" during 1945-1979, (b) the "Deindustrialization of America" during 1980-2000, and (c) the "Re-industrialization of America" during 2000-present, as it began to shift to an economy largely dominated by service and knowledge jobs, with a major reduction in labor-intensive manufacturing (Bluestone & Harrison, 1982; Gordon, 2016; Thurow, 1992, 1996; Vatter & Walker, 1996). This study examines the relationship between manufacturing employment and income inequality in the state of Alabama to test the hypothesis that manufacturing plays a key role in moderating inequality. The paper has four sections. The first outlines the changing nature of manufacturing in the U.S. and Alabama; the second discusses the linkage between the transformation of manufacturing and the growing income inequality in America over the past half century; the third describes our methodology; and the fourth presents the results from the Alabama case study.

> The debate over whether the effects of inequality are primarily good or bad is beyond the scope of this paper. In brief, on the one hand, some analysts contend that high inequality represents a failure in development because a considerable number of people in a society are not benefitting from the operations of the economy and, more indirectly, because high inequality will probably inhibit human capital development (Bartels, 2008; Hacker and Pierson, 2010; Phillips, 1990; Sen, 1999; Stiglitz, Sen, and Fitoussi, 2010). Other scholars sharply refute this interpretation, arguing that inequality in social outcomes reflects inequality in human abilities that it is necessary to create the incentives which promote economic growth, and that trying to reduce inequality with welfare programs reduces the resources which can be devoted to productive activities (Block, 1990, 2000; Buchanan, 2013; Murray, 2005; Rothbard, 1979).

2. The Transformation of U.S. Manufacturing

The nature of the U.S. economy changed dramatically during the second half of the 20th century in two fundamental ways as America became an advanced technological society. First, manufacturing became much more capital intensive; and, second services assumed an ever increasing share of economic activity (Burea & Kaboski, 2012). In particular, over the last fifty years, the U.S. has transitioned through three periods of manufacturing: "The Industrial Period" during 1945-1979, the "Deindustrialization of America" during 1980-2000, and "Re-

industrialization of America" during 2000-present.

There is little controversy over the general dynamics of the competitive fortunes of the U.S. economy over the last century and a half. At the end of the Civil War, America was well behind Europe in economic development. What followed, though, was an era of surprising economic dynamism and rapid industrialization. By the beginning of the new century, the United States was challenging a faltering England as the strongest economic power in the world. Following the upheaval and devastation of two World Wars, American emerged as a true economic superpower whose economic predominance rivaled any that had existed before, in part because of the destruction of the rest of the industrialized world by World War II. In the late 1940s, for example, the U.S. accounted for 40% to 50% of global GDP. The economic recovery of the rest of the world during the quarter of a century of the postwar era, consequently, provided many opportunities for American exporters and multinational corporations (Gilpin, 1987; Gordon, 2016; Thurow, 1992).

Domestically, fears of reverting to the Great Depression reset America's economy to a demand-side economy (Garfinkle, 2006). The first three decades of the postwar era were characterized by relatively equal balance of blue-collar workers and white-collar workers that fulfilled industrial job demands and generated large amounts of revenues for the national treasury. Simultaneously, labor unions secured contracts and benefits for their members in the industrial sector and provided general prosperity among all levels of the workforce. The wealth established through the expanding manufacturing sector with its increasing wages stimulated a growing standard of living among the middle class, providing people with a single-home mortgage, stable jobs, and pensions, a dynamic true for people at all levels of education. The emergence of the affluent middle class, in turn, created a growing demand for more and newer consumer items (Bluestone & Harrison, 1982; Lindsey, 2009; Vatter & Walker, 1996). For example, during the period of 1950 to 1979, Lindsey (2009, 37) concluded that "the American middle class experienced the greatest period of wealth creation and general prosperity in the history of the nation."

Deindustrialization is a process of systematic social and economic change caused by the removal or reduction of industrial capacity or activity in a country or region, especially the manufacturing sector (Lever, 1991). Until the 1980s, America was on the cutting edge of labor-intensive manufacturing employment. The 1980's, however, marked the beginning of the deindustrialization of America. This period experienced vanishing manufacturing employment, fluctuating productivity gains, lower consumer demands, increasing global competition, and an expanded service sector. By the beginning of the decade, sluggish growth and massive disinvestment in America's manufacturing sector became the common story and reality.

The underlying problem started to be recognized in the early 1980s, when the American middle class started being hit by the double whammy of global competition and labor-replacing technology (Bluestone and Harrison, 1982; Brady and Wallace, 2001; Danzinger and Gottschack, 1995; Lever, 1991; Russo and Linkon, 2009). As we just saw, globalization had generally helped the U.S. economically during the industrial era. However, during the 1960s American producers started to move the labor-intensive parts of their operations offshore to take advantage of decreasing transportation costs and the much lower wage levels that prevailed in developing countries (Alderson, 1997, 1999; Bluestone & Harrison 1982; Brady & Denniston, 2006; Brady & Wallace, 2001; Clark & Clark, 2016, 2020; Duesterberg & Preeg, 2003; Green & Sanchez, 2007; Kollmeyer, 2009; Kollmeyer & Pichner, 2013; Reich, 2010; Ross & Trachter, 1990; Wood, 1994, 1995). This serious loss of manufacturing jobs was exacerbated by the impact of automation in reducing factory employment (Editorial Board, 2017; Gillespie, 2017; Krause, 2017).

The current reindustrialization debate has introduced a new dynamic to global production efforts. Global corporations are returning to parts of America and particularly the South, but this looks quite different from the industrial period of America. The new face of manufacturing in America is high-tech robotics and machinery that replace the need for massive human labor. Although manufacturing is returning, it now accounts for only a small portion of the American workforce. For example, U.S. manufacturing employment fell from 19.6 million in 1979 to 11.8 million in 2011 (U.S. Department of Labor, 2011). The new reindustrialization period in America has overall less industrial employment, unstable productivity gains, higher unemployment, and more welfare dependency than the industrial period (Reich, 2010).

Alabama's manufacturing was traditionally concentrated in light industries, especially textiles and apparel, although steel was important as well. Deindustrialization saw the loss of most of the textile industry, as well as a considerable drop in steel production. For re-industrialization, Alabama has been quite successful in obtaining several world-leading automotive production plants. Over the past decade, global automotive firms, such as Mercedes Benz, Honda, Hyundai, Toyota, and Mazda located in Alabama. In addition, Alabama successfully recruited Airbus, General Electric Aviation, and Remington. The new large-scale industry in Alabama is predicted to have a major economic impact at the state and local level. On the other hand, Alabama's total employment in the manufacturing sector is fairly low compared to two decades earlier, despite the states' ability to recruit new innovative global corporations. Over the two decades that bracketed the turn of the century, the number of jobs in the state's manufacturing sector plummeted by 30% (Flynt, 2004; U.S. Department of Labor, 2012).

3. Industrial Transformation and Inequality

For the last several centuries, economic development has been generally associated with industrialization or the transition from an economy based on agriculture and the work of artisans to one based on industry. In fact, through World War II, the few countries that industrialized generally grew rich, while the rest of the world remained mired in massive poverty. The nature of industrialization, of course, changed dramatically over the 19th and 20th centuries in terms of what industry was the most advanced or technological driver. The Industrial Revolution started with light industries, such as textiles and shoes, moved forward to such heavy industries as iron and steel, then moved into mass production with automobiles and other consumer durables, and finally peaked with the high tech industries and high quality industrial products. By the last third of the 20th century, post-industrial societies began to emerge in the developed world whose economies centered on services and the processing of information. In traditional economies, productivity increases are relatively small, but productivity (and consequently GDP) growth "take off" (Rostow, 1960) once industrialization starts. However, the advantages of the most advanced industrial nations will eventually be undercut as they move beyond high tech industry to a postindustrial society whose economy is dominated by the service sector where productivity gains come much more slowly than in manufacturing (Gilpin, 1987; Kuznets, 1976; Rostow, 1960; Thurow, 1992; Toffler and Toffler, 1980, 1995).

The deindustrialization era attracted extensive media coverage of plant closings across the U.S. Every newscast seemed to contain a story about a plant closing down, another thousand jobs disappearing from a community, or the frustration of blue-collar workers unable to find jobs providing enough income to support their families. In addition, related businesses like restaurants, clothing stores, industrial suppliers, barbershops and many other small businesses vanished from communities. Deindustrialization produced short-term and long-term socio-economic effects within states and localities. In the short-term, deindustrialization increased the number of unemployed or displaced workers. In the long-term, declining manufacturing contributed greatly to a huge jump in communities littered with poverty, uneven income distribution, and crime (Alderson, 1997, 1999; Autor & Dorn, 2013; Autor, Katz, and Kearney, 2008; Bluestone & Harrison, 1982, 1988; Brady & Wallace, 2001; Fallick, 1996; Friedman, 2011; Hacker and Pierson, 2010; Lever, 1991; Peck, 2011; Russo & Linkon, 2009; Reich, 2010; Smith, 2012; Thurow, 1992, 1996; Wood, 1994).

Moreover, manufacturing employment decline generates a great deal of hardship for many workers and their communities. The social science literature suggests that high levels of poverty are highly correlated to community decline following plant closings, not to mention rising domestic violence, high school drop-out rates, and declining tax revenues. Communities need the wage and tax base provided by fixed capital investment in large scale manufacturing to support their households, schools, parks, clubs, hospitals, and civic and religious institutions. Cumulatively, these trends contributed to what Bluestone and Harrison (1988) call The Great U-turn, a reversal of the long-run pattern of decreasing income equality in the United States.

Deindustrialization, reindustrialization, and the economic changes associated with them may exacerbate inequality in a number of ways. De-industrialization destroyed many well-paying jobs; reindustrialization created far fewer jobs than had been destroyed and focused on skills that the old blue-collar workers did not possess; and the expanding service sector was marked by much greater inequality in skills and salaries than basic manufacturing had been (Alderson, 1999; Autor & Dorn, 2013; Autor, Katz, and Kearney, 2008; Burea & Kaboski, 2012; Chevan & Stokes, 2000). These structural changes explain much of the growing inequality in America, but another factor is important as well. This is the popularity of the business "low road" strategy of stressing cost minimization especially in salaries as the best method of increasing profits, which has clearly hurt the incomes of the working class (Clark & Clark, 2011, 2020; Harrison, 1994).

4. Data, Methodology, and Results

This study utilizes a panel research design model to observe the influence on inequality exerted by manufacturing employment and a set of political, demographic, and socio-economic factors, using a county-level data set from the state of Alabama. This technique is appropriate for our analysis because it provides a means of quantitatively examining historical processes over a period of time. Because panel data create methodological problems for ordinary least squares (OLS) regression, this study utilizes the Random-effects (REM) model, which treats county specifics as a random component of the random-error (Beck & Katz, 1995; Wilson & Butler, 2007). Our analysis is based on U.S. Census Bureau (2012) data for Alabama's 67 counties for each year from 1970 through 2010. The dependent variable is the Gini coefficient of income inequality, which measures how much the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution. The Gini ratio is a statistical measure of income equality ranging from 0 to 1. A measure of 1 indicates perfect inequality; that is, one person has all the income and rest have none. A measure of 0 indicates perfect equality; that is, all people have equal shares of income. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line.

Alabama is plagued by comparatively high inequality in America. For example, Table 1 shows that it had the

sixth highest Gini Coefficient among the U.S. states and the District of Columbia in 2008, trailing only California, Connecticut, Louisiana, New York, and Washington, D.C. In contrast, its level of unemployment is much less extreme. In 2008, for example its unemployment rate of 5.0% put it almost exactly in the middle of the distribution of the states (see Table 2). This implies, then that there is something odd and out of the ordinary in the income distribution in Alabama.

Table 1: Alabama's Rank on Income Inequality (as Measured by the Gini Coefficient) Among the 50 States and District of Columbia, 2008

STATE	GINI	STATE	GINI
Washington, DC	.5420	Montana	.4667
New York	.5220	Missouri	.4646
Louisiana	.4990	Oklahoma	.4645
Connecticut	.4949	Washington	.4591
New York	.4899	Colorado	.4586
Florida	.4852	Oregon	.4583
		Nevada	.4577
Alabama	.4847	Kansas	.4550
Mississippi	.4828	Vermont	.4539
Georgia	.4813	North Dakota	.4533
Kentucky	.4813	Indiana	.4527
New Jersey	.4813	Delaware	.4522
Illinois	.4810	Maine	.4519
Texas	.4800	Idaho	.4503
Tennessee	.4790	Maryland	.4499
Massachusetts	.4786	Wisconsin	.4498
Rhode Island	.4781	Minnesota	.4496
North Carolina	.4780	South Dakota	.4495
New Mexico	.4769	Nebraska	.4477
South Carolina	.4735	Iowa	.4451
Arkansas	.4719	Hawaii	.4420
Arizona	.4713	Wyoming	.4360
West Virginia	.4711	New Hampshire	.4304
Virginia	.4705	Alaska	.4081
Michigan	.4695	Utah	.4063
Pennsylvania	.4689		
Ohio	.4680		

Source: U.S. Bureau of Labor Statistics. 2009.

www.iiste.org

Table 2: Alabama's Rank on Unemployment Rate Among the 50 States and District of Columbia, 2008

State	Unemployment Rate	State	Unemployment Rate
South Dakota	3.0	Washington	5.3
Wyoming	3.1	Massachusetts	5.3
North Dakota	3.2	Minnesota	5.4
Nebraska	3.3	Maine	5.4
Utah	3.4	Pennsylvania	5.4
New Hampshire	3.8	New York	5.4
Oklahoma	3.8	Arizona	5.5
Hawaii	3.9	New Jersey	5.5
Virginia	4.0	Connecticut	5.7
Iowa	4.1	Indiana	5.9
New Mexico	4.2	Missouri	6.1
West Virginia	4.3	Georgia	6.2
Maryland	4.4	Florida	6.2
Idaho	4.4	North Carolina	6.3
Kansas	4.4	Oregon	6.4
Montana	4.5	Tennessee	6.4
Louisiana	4.6	Kentucky	6.4
Wisconsin	4.7	Ohio	6.4
Vermont	4.8	Illinois	6.5
Colorado	4.8	Alaska	6.5
Delaware	4.9	Nevada	6.7
Texas	4.9	South Carolina	6.7
California	4.9	Mississippi	6.9
		Washington, DC	7.0
Alabama	5.0	Rhode Island	7.8
		Michigan	8.4
Arkansas	5.1		

Source: U.S. Census Bureau. 2009.

Table 3 lists the five independent variables in the analysis along with their hypothesized relationship with inequality. Our key explanatory factor is the percentage of manufacturing employment which should have a negative association with inequality. Second, the percentage of blacks in a county should be positively correlated with inequality because of the general relationship between race and inequality, which should be especially strong here due to the historical barriers that African Americans have had to overcome in Alabama (Flynt, 2004). Third, income per capita should have a positive association with inequality because once development has reached a certain point, greater affluence results in lower inequality in the developed world (Kuznets, 1955). Fourth, more education should help a workforce get more skilled and higher paying jobs. Thus, inequality should be positively associated with the percentage of the population who did not finish high school. Finally, because of rural areas' lagging economic position in America and Alabama (Albrecht, Albrecht, & Albrecht, 2000; Duncan, 1999; Flynt, 2004), rural counties in Alabama should have especially high levels of inequality.

> Seven other explanatory variables were dropped from the analysis because they do not have a statistically significant independent influence on inequality: total population, % male population, retail sales per capita, interstate access, % federal civilian employment, % federal military employment, and % state and local government employment.
>
> At the highest level of development, greater development brings more inequality (Bartels, 2008; Hoeller, Joumaud, and Koske, 2014; OECD, 2012; Piketty, 2014; Stiglitz, 2013).

Table 3: Summary of Independent Variables

PREDICTOR VARBILE	HYPOTHESIZED ASSOCIATION WITH INCOME INEQUALITY
% Manufacturing Employment	Negative
% Black Population	Positive
Per Capita Income	Negative
% No High School Diploma	Positive
Rural County	Positive

The central concern of this analysis is the linkage between manufacturing employment and income inequality. This leads to the central research hypotheses:

H1 The percentage of manufacturing jobs should be inversely associated with the degree of income inequality in

Alabama counties because manufacturing provides good jobs for the less skilled and educated.

We also developed hypotheses about how four control variables should affect inequality:

H2 Because of the long history of discrimination against African Americans in the state, the percentage of African Americans should be positively associated with inequality.

H3 Because of the normal pattern of development, inequality should be negatively related to income per capita.

H4 Because more education should produce more highly skilled workers, the percentage of residents without a high school diploma should be positively associated with inequality.

H5 Because of the lagging economies of rural areas, there should be a positive relationship between rurality and inequality.

The regression results in Table 4 provide a definitive evaluation of these hypotheses. It should be stressed that the effects attributed to manufacturing employment (or any other explanatory variable) represent its individual influence after the effects of the other four independent variables have been statistically controlled. Also, the numerical scale of the Gini Coefficient, the dependent variable, is not particularly meaningful beyond the fact the higher values denote greater inequality. Consequently, the absolute values of b are almost impossible to interpret. Hence, our analysis focuses on the statistical significance of a relationship. Also, because the range of the Gini Coefficient is a small decimal (e,g., see Table 1), the b's, which represent the change in the Gini index produced by a one-unit increase in the independent variable are small as well.

Table 4: Regression Estimates for the Independent Variables Explaining the Level of Income Inequality (as measured by the Gini Coefficient) in Alabama Counties, 1970-2010 (all coefficients are unstandardized b's)

INDEPENDENT VARIABLE	b
% Manufacturing Employment	-.00125***
% Black Population	.00079***
Per Capita Income	-.0000035***
% No High School Diploma	.1467***
Rural County	.0162***
R^2	.77***

***$p < .001$

Source: U.S. Census Bureau. 2012

The percentage of manufacturing is strongly related to income inequality at the .001 level of significance in the predicted negative in direction. Clearly, therefore, "manufacturing matters" (Cohen & Zysman, 1987; Green & Sanchez, 2007; Uchitelle, 2017) in moderating extreme inequality. Moreover, the four control variables also have strong predicted influences on inequality that are statistically significant at the .001 level. In particular, the proportion of African Americans, the proportion of residents who did possess a high school diploma, and the rurality of a county are all associated with higher levels of inequality, while per capita income has a negative association. Overall, the five independent variables exercise a very strong impact on the level of inequality in Alabama, as indicated by the Multiple R2 of .77.

5. Implications

Our case study of Alabama counties certainly demonstrates that "manufacturing matters" for income inequality at the local level in that state, as counties with higher levels of manufacturing have less inequality even after other major influences are statistically controlled. Thus, traditional manufacturing helps to mitigate the adverse effects of deindustrialization and re-industrialization in the United States. Other key findings are that more educated communities have less inequality, that rural areas have especially high inequality, that counties with a high proportion of African Americans face disproportionately high inequality, and that the poorest counties have the highest level of inequality. Furthermore, this is not just an American problem. Rather, most advanced industrial societies suffer from the same interlinked trends of rising inequality and declining manufacturing employment (Alderson, 1997, 1999; Brady & Denniston, 2006; Kollmeyer, 2009; Kollmeyer & Pichler 2013; Wood, 1994).

These findings strongly suggest that much more attention should be paid to the conditions facing the working class in the increasingly post-industrial economies of the developed world. In the United States, perhaps strangely, neither of the two major parties have developed economic policies that would appeal to the working class. This changed dramatically in the 2016 presidential election when Republican Donald Trump promised to "Make America Great Again" by creating good working-class jobs by a combination of tax cuts for the business and wealthy, deregulation, trade protection, a crackdown on immigration, and jawboning corporations to keep jobs in and/or bring them back to America. However, there are several reasons to question the viability of this program. First, the Trump administration has ignored other important causes of the squeeze on the working class, such as automation and business's "low road" strategy of cost minimization. Second, several of his policy initiatives, such as implementing tariffs and cracking down on immigration, have components that might conflict with one another. Third, some of these policies are also controversial among important constituencies within the Republican Party

(Clark and Clark, 2020).

During the late 20th and early 21st centuries, the United States commenced a transition from an industrial to an information-age economy (Clark and Clark, 2016; Toffler and Toffler, 1980, 1995). In general, there appear to be two probably contradictory strategies for making the best of this unsettling transformation. One would be to turn back the transformation of manufacturing in order to reverse some of its unwanted consequences. Given the questions that have arisen about President Trump's program to do just that, however, the viability of such an effort seems problematic. The other strategy would be to adjust to the ongoing economic change so that more people can benefit from it. Here, our finding that more educated counties have lower income inequality implies that more resources should be devoted to preparing Americans for the emerging 21st century economy. However, this does little, if anything, to help the victims of deindustrialization and re-industrialization. Where we can perhaps look for inspiration for a more effective strategy is to the 1980s efforts of Western Europe (Katzenstein, 1985) and Japan (Calder, 1988) to provide "compensation" to those who had been left behind by economic change.

The reality of manufacturing shifts over the past forty years is obvious, but the path forward is questionable. Policy-makers are faced with creating economic resolutions for the waning middle class through the growth of high-tech manufacturing production yet struggle with developing and retaining an educated workforce that keeps up with the pace of technology developments and demands in the global economy. Modern re-industrialization has the opportunity to raise the local GDP and generate new tax revenue, but the growth of a larger middle class remains uncertain. Reindustrialization with advanced manufacturing will restore some manufacturing production in the US, but this economic strategy may not be the path to prosperity for an underdeveloped workforce.

Many states struggle to respond to the new education and training demands of modern manufacturing. Thus, new education reform, industrial apprenticeships, and tax reform not only have the potential to improve Alabama's local economy and the middle-class standard of living, but also provide positive reinforcement for the economic and political objectives that support a thriving middle-class economy. Education reform is a vital factor in a prosperous middle class, but it is questionable which type of reform is most beneficial to the local economy. Most Governors over the past two decades have listed education reform as a top priority in their policy agenda, which shows that states are aware of the educational gaps and workforce shortages.

Does the future of the global economy rest in safe arms with the new reindustrialization strategy and education reform? States and local governments must ascertain what mix of higher education reform, K-12 reform, career readiness, and high-tech training is the best equation for the growing workforce deficit and waning middle class. In addition, education reform must consider high-tech automation, robotics, and artificial intelligence as a curriculum component in education reform. This policy area must be constructed in ways that not only broaden the middle class but help the victims of deindustrialization and reindustrialization.

6. Future Research

This case study of Alabama strongly suggests that manufacturing matters in the early 21st century. The growing trend in deindustrialization, consequently, represents a clear threat to the prosperity of a significant segment of citizens. What this does, hence, is to making a growing emphasis on workforce development vital for ensuring the wellbeing of the victims of deindustrialization. Middle class prosperity can be achieved through workforce and economic policy efforts that addresses the challenges incurred by deindustrialization and globalization. Specifically, governments should invest in developing the future workforce and preparing citizens to respond to the increasing demand of high-tech automation and automation in all industries. This policy goal can be achieved with the implementation and research of American manufacturing re-investment (Bluestone and Harrison, 1982; Brady and Wallace, 2001; Lever, 1991; Russo and Linkon, 2009), work-based learning policy and Career Pathways educational programs (Solberg, Phelps, Haakenson, Durham, & Timmons, 2012). This research can provide valuable insight to several of the pressing workforce and economic development concerns globally. While the service and knowledge-based industries are not classified as manufacturing, its correlation and support to the manufacturing industry and the overall economy is necessary (Sala-I-Martin et al., 2014).

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