

*Did New Deal and World War II Public Capital Investments  
Facilitate a 'Big Push' in the American South?*

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# *Did New Deal and World War II Public Capital Investments Facilitate a 'Big Push' in the American South?*

## **Abstract**

The “big push” theory claims that publicly coordinated investment can break the cycle of poverty by helping developing economies overcome deficiencies in private incentives that prevent firms from adopting modern production techniques and achieving scale economies. Despite a flurry of research, however, scholars have offered scarce few real world episodes that seem to fit the theoretical model. We argue that the postwar economic rebound of the American South, which followed large public capital investments during the Great Depression and World War II, is such an application. By increasing the rates of return to private investment, the infusion of public capital provided a major impetus for the rapid postwar industrialization of the Southern economy. Both econometric analysis and survey data from firms who moved South in the years immediately following the war strongly support the notion that big push dynamics were at work.

*--“In some degree, the South has been traditional because it was poor. At the same time, it has also remained poor in part because it was traditional.” (William H. Nicholls, the 1959 Presidential Address of the Southern Economics Association)*

Nicholls’ statement above is indicative of many aspects of the American South between the Civil War and the mid-20<sup>th</sup> century. The South had an underdeveloped transportation infrastructure because it was poor and the South was poor because it had a bad system of transportation. The South had substandard schools because it had so little money to devote to education and the region was poor because it lacked good schools. The South was slow to develop modern power plants because of a lack of economic incentive to develop such capacity and the South provided few economic incentives for modernized industrial firms to locate there because it lacked power. The South lacked buying power because it relied on agriculture and small-scale production and the South was non-industrialized because it lacked buying power. In the terminology of the economic development literature, the pre-World War II South confronted several aspects of the “vicious circle” or “poverty trap” that befalls many developing economies.

According to the “big push” theory of economic development, publicly coordinated investment can break the underdevelopment trap by helping economies overcome deficiencies in private incentives that prevent firms from adopting modern production techniques and achieving scale economies. These scale economies, in turn, create demand spillovers, increase market size, and theoretically generate a self-sustaining growth path that allows the economy to move to a Pareto preferred Nash equilibrium where it is a mutual best response for economic actors to choose large-scale industrialization over agriculture and small-scale production. The big push literature, originated by Rosenstein-Rodan [1943, 1961], was initially motivated by the postwar reconstruction of Eastern Europe. The theory subsequently appeared to have had limited empirical application and was largely abandoned in the early 1960s. This literature has been resurrected in several recent contributions including Murphy, Shleifer, and Vishny [1989], Matsuyama [1992], Hansen [1995], Rodriguez-Clare [1996], Skott and Ros [1997], Gans [1998], Yamada [1999], Ros [2000] and Trindade [2005]<sup>1</sup>. Yet, scholars have found few real-world examples of such an infusion of investment helping to “push” an economy to high-level industrialization equilibrium.

We argue here that the “Great Rebound” of the American South, which followed large public capital investments during the Great Depression and World War II, is one such application. Although 1930s New Deal programs are typically presented in the context of their attempt to bring relief and recovery to the U.S. economy through demand-stimulating public expenditures, the long-term economic effects of these and subsequent wartime expenditures were profound for the South. Specifically, and consistent with big push theoretical literature, the infusion of public capital—roads, schools, waterworks, power plants, dams, airfields, and hospitals, among other infrastructural improvements—fundamentally reshaped the Southern

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<sup>1</sup> For a recent survey of poverty trap models, including the big push literature, see Azariadis and Stachurski (2005).

economy, expanded markets, generated significant external economies, increased rates of return to large scale manufacturing, and encouraged a subsequent investment stream. These improvements helped create the conditions that allowed the region to break free from its low-income, low-productivity trap and embark on its rapid postwar industrialization.<sup>2</sup>

In this paper, we develop an extension of the big push model, consistent with the stylized facts of the early- to mid-twentieth century South, whereby public capital investments facilitate big push dynamics. We also present empirical evidence that a state's growth in public capital between 1933 and 1945 had a strongly positive impact on growth in manufacturing immediately after the War. Finally, contemporary surveys of industrial firms that moved to the South in the three years following World War II reveal locational decisions that strongly support the notion that public capital infusion of the Depression and War created big push dynamics.

## I. AN OVERVIEW OF THE “BIG PUSH” THEORETICAL LITERATURE

The big push theory claims that with respect to production techniques, developing economies can have two locally stable Nash equilibria—one, “industrialization,” in which mass production and increasing returns to scale technologies are employed, and another, “no-industrialization,” in which production revolves around small-scale agriculture and cottage industries. In its classic version [Rosenstein-Rodan, 1943], the presence of plant-level economies of scale, characteristic of mass production methods, is the source of pecuniary external economies. The choice of technologies characterized by increasing returns involves significant demand spillovers from each industrializing sector to all others. These spillovers imply that while it may be unprofitable for any sector to unilaterally industrialize, simultaneous industrialization of several sectors would be profitable for each. Thus, if a developing economy

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<sup>2</sup> While other scholars such as Field [2003, 2006] note the importance improvements in depression-era public capital had upon subsequent productivity advances in the U.S., this paper differs in its emphasis upon big push dynamics in the South's economic development.

under these conditions finds itself in its “no-industrialization” Nash-equilibrium, it could be trapped there indefinitely. Breaking free from this low-income trap requires a “big push” in the form of simultaneous large-scale investments which will increase output capacity in multiple sectors, create external economies, enlarge the market, and create a self-sustaining growth path of industrialization.

Murphy, Shleifer, and Vishny [1989] formalized this argument with a multisectoral, closed economy model of horizontal pecuniary externalities.<sup>3</sup> The model assumes that each final goods sector has a competitive fringe of firms that produce with constant returns to scale (cottage industries) and a monopolist with access to increasing returns to scale (mass production) technology. The monopolist in each sector operates and industrializes only if it is profitable to do so. An industrializing monopolist’s profits are distributed to its workers and/or shareholders, which increases spending and, in turn, the potential market size and profits of industrializing monopolists in all other sectors. Under certain conditions, then, while it is not profitable for any one sector’s monopolist to unilaterally industrialize, the presence of such positive pecuniary externalities implies that the greater the number of sectors that industrialize, the greater the profits to the potentially industrializing monopolists of all sectors. There are then two Nash equilibria: one in which all sectors industrialize and one in which none do.

The authors also present a model with vertical pecuniary externalities showing how investments in infrastructure projects, subject to increasing returns, which allow industrializing firms to more cheaply transport goods and expand markets, can coordinate a big push. In this case, private sector investment in, for example, a railroad will only be profitable if many firms industrialize and it will only be profitable for many firms to industrialize if the railroad is built.

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<sup>3</sup> Fleming [1955] distinguished between “horizontal” and “vertical” pecuniary external economies, depending on whether interdependence takes place through the interrelated markets of final goods industries (horizontal spillovers), or through industries interacting as suppliers and customers (vertical effects).

Again, two Nash equilibria exist, one in which the railroad is built and industrialization occurs, and another where neither of these happens. Government subsidization of railroad construction, therefore, may be a means to “push” the economy out of the low-income trap and into the preferred Nash equilibrium. Murphy, et. al. note that railroads are, in fact, just one of several infrastructure projects that might require public subsidies to help a developing economy break out of the no-industrialization trap. They list power plants, roads, airports, and training and education facilities as others.

The model of Murphy et. al. assumes a closed economy. Rodriguez-Clare [1996] and Skott and Ros [1997] develop models of an open economy with non-tradable inputs in which a big push scenario can arise.<sup>4</sup> The policy implications offered by Skott and Ros include stimulating the production of public capital (or “social overhead capital”) such as power, transportation, communications, or training facilities as a means of breaking the underdevelopment trap. Thus, big push dynamics are not restricted to cases where firms, themselves, coordinate entry. It is this aspect of big push theory—a brisk government expansion of public capital stimulating widespread adoption of large-scale manufacturing techniques—that can lend insight into the postwar development of the American South.

The big push literature consists almost exclusively of theoretical studies—only recently have scholars explored potential real world examples of big push dynamics taking an economy from a poverty trap to an industrialization equilibrium. Among these are Voigtlander and Voth [2005] on the industrial revolution in England, Rodrik [1995] and Trindade [2005] on South

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<sup>4</sup> The source of external economies is different in these two contributions. In Rodriguez-Clare, productivity gains arise from increasing differentiation of intermediate goods as the market for these inputs increases. In Skott and Ros, external economies arise from the presence of increasing returns to scale in the production of infrastructure. In this respect, the model in Skott and Ros is closer to the infrastructure model of Murphy et al. An early model with increasing returns to scale in the production of non-traded inputs is presented in Faini [1984]. The focus of Faini [1984], the conditions for cumulative divergence of regional growth rates, is quite different, however, from the analysis of multiple equilibria and the big push.

Korea and Taiwan, and Sauer, Gawande and Li [2003] on East Asia and Eastern Europe. Other recent empirical literature using samples of countries to identify poverty traps and historical take-offs as a result of a big push includes Berthelemy [2006] and Easterly [2006]. This paper offers another such example.<sup>5</sup>

## II. A BIG PUSH MODEL WITH PUBLIC CAPITAL

A classic criticism of the initial big push model of Rosenstein-Rodan [1943] is that in a small open economy facing exogenously given terms of trade, whether an investment is profitable or not depends on those terms rather than on the horizontal demand spillovers from other tradable goods industries [Bhagwati, 1985]. This criticism does not apply, however, when the source of external economies is the existence of non-tradable inputs produced under increasing returns (for a discussion, see Ros, 2000, ch. 13). As the American South was an open economy, the relevant models to understand its poverty trap and Great Rebound are those with non-tradable inputs and vertical pecuniary externalities.<sup>6</sup> In this section, we discuss in more detail the big push dynamics relying on one such model. The model, presented formally in the Appendix, extends the infrastructure-based big push model of Murphy et. al [1989] to the case of an open economy and, besides making more general assumptions about technology, goes beyond the open economy model in Skott and Ros [1997] in developing the conditions for multiple

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<sup>5</sup> Additionally, Ades and Glaeser [1999] examine data from developing nations in the 20<sup>th</sup> century, as well as the 19<sup>th</sup> century United States, and find that economic growth is positively correlated with the extent of the market. Other studies have documented processes of divergence in per capita incomes for different time periods and country samples [Maddison, 1995; Pritchett, 1997; DeLong, 1997; Jones, 1997; Ros, 2000]. While these contributions are perhaps only tangentially related, the empirical findings are consistent with the barriers to growth generated by small markets and the existence of poverty traps highlighted in the big push literature.

<sup>6</sup> This does not imply that closed economy models are irrelevant since tradable goods are not perfectly tradable and as a result producers face market constraints. Models with technological externalities are also relevant since they are not vulnerable to the criticism cited above. Technological external effects, resulting for example from industrial training or learning by doing, can also be the source of multiple equilibria in open economies (see Ros, 2000, for further discussion).

equilibria and comparing wages and profit rates in the traditional economy and modern economy equilibria.

In the big push literature, investments in public capital increase the marginal return for private investments in modern technologies and expand markets. Nurkse [1953, p. 152], for example, notes that in the absence of roads, railways, telephone systems, power plants, waterworks, schools, and hospitals, “the yield of any injection of private capital may turn out disappointingly small.” Once this “social overhead capital” exists, increases in incentives for industrialization can help break the vicious circle of poverty. In the public capital literature, studies by Aschauer [1989a, 1989b, 2000], Deno [1988], Munell [1990, 1992], Barro [1991], and Easterly and Rebelo [1993], among others, empirically show that investments in public capital significantly increase the rate of return to private capital and stimulate private investment.

In our model, which is designed to conform to the stylized facts present in the American South circa the Great Depression and World War II, a final tradable good can be produced with two different technologies: a traditional, labor-intensive technology, using capital and labor and a modern technology which is capital- and infrastructure-intensive—a sensible assumption given the need for modern power, communications, and roads to coordinate and transport manufacturing production both within and outside of the South. The key difference between the two technologies is that while the modern technology generates a Hirschmanian “backward linkage” with the sectors producing public capital, there are no linkages in the case of the traditional technology. Market structures are such that in the final goods sector firms operate under atomistic competition while in the sector producing public capital producers operate under conditions of monopolistic competition.

### *The choice of technology*

The choice of technology depends on profitability. Profitability, in turn, depends on how many firms adopt a given technology and thus, under certain conditions, the choice depends on which technology happens to be in use.

Let  $r^*_M$  be the profit rate for the final goods producer when the modern technology is in use. This profit rate increases with the capital stock given the wage. The reason is that an increase in the physical capital stock raises the demand for public capital and reduces marginal costs in the sectors producing infrastructure goods. The fall in the relative price of public capital (for a given value of the wage) raises profits in the final goods sector. This is not the case when the traditional technology is in use. There, given the wage, the profit rate ( $r^*_T$ ) is independent of the capital stock since the traditional technology does not use inputs produced under increasing returns.

The choice of technology does not depend, however, on a comparison between the profit rates prevailing in a traditional economy ( $r^*_T$ ) and a modern economy ( $r^*_M$ ). When the traditional technology, say, is in use, the choice depends on the comparison of the profit rate  $r^*_T$  with the profit rate that an individual firm would obtain using the modern technology *in isolation*. The profitability of the modern technology in isolation is not  $r^*_M$  but rather the profitability of the modern technology evaluated at the prices and wages prevailing in a traditional economy ( $r^T_M$ ). Similarly, when the modern technology is in use, the choice of technology depends on the comparison of the profit rate  $r^*_M$  with the profit rate that an individual producer would obtain using the traditional technology in isolation ( $r^M_T$ ), the profit rate of the traditional technology evaluated at the prices and wages of the modern economy.

### *Existence of equilibrium and the poverty trap*

The traditional economy is an equilibrium if  $r^*_T$  is higher than  $r^T_M$ , i.e. if the profit rate prevailing in a traditional economy is higher than the profit rate that an individual firm would obtain using the modern technology in isolation, so that there is no incentive for an *individual* firm to invest in the modern technology. Under our assumptions, a traditional economy equilibrium always exists. The reason is that the traditional technology does not use public capital produced under increasing returns. If it did, there would generally exist a level of the physical capital stock at which the costs of public capital goods would be low enough to make  $r^T_M$  higher than  $r^*_T$ .

In turn, a modern economy equilibrium exists if  $r^*_M$ , the profit rate when the modern technology is in use, is higher than  $r^M_T$ , the profitability of investing with the traditional technology in a modern economy. It is only then that in a modern economy no individual firm will find it profitable to invest in isolation in the traditional technology. The existence of a modern economy equilibrium requires a sufficiently large physical capital stock so that, when the whole of it uses the modern technology, the price of public capital is low enough to make the modern technology self-sustaining. Since a traditional economy equilibrium always exists, it follows that a sufficiently large physical capital stock is also a condition for the existence of multiple equilibria. Then which technology is more profitable depends on the technology in use.

Multiple equilibria are associated with the existence of pecuniary externalities. The presence of increasing returns to scale in the production of public capital implies that production decisions in this sector, and investments in the modern technology, have important external effects. An increase in the output of a component of public capital affects adversely the current demand for other components of public capital, but reduces the price index of public capital and raises both the combined input of public capital and the profitability of the modern technology. Apart from these static effects, there is a dynamic externality: higher profitability of the modern

technology leads to increased accumulation by modern firms and thus to an increase in the future demand for all the components of public capital. On the investment side, atomistic producers consider all prices given and fail to take into account the external effects of a higher capital stock on increased future demand for public capital and a lower future price of the combined public capital input.

As a result of these dynamic pecuniary externalities, an insufficiently large capital stock, i.e., an initial mass of modern firms below a critical level, that makes the adoption of the modern technology viable keeps the economy in a traditional equilibrium when all firms follow behavior that is individually rational. Alternatively, rather than a critical mass of modern firms in the tradable goods sector, we may think of a threshold level of investments in public capital below which the adoption of modern technologies is not viable. Because the mass of investments in the modern technology is small, the demand for public capital is low and the components of public capital are produced at a high cost, thus keeping the profitability of the modern technology low. Thus, in this trap, despite the low wages prevailing in the traditional economy, firms lack incentives to adopt the modern technology in the absence of a sector producing public capital. At the same time, there is no incentive for the production of public capital given the high costs of production in the absence of demand from modern firms. This is why a big push—aimed *either* at increasing the rate of accumulation of modern firms above the individually rational level, *or* at raising the supply of infrastructure (or both)—becomes necessary to ensure industrialization.

### *The two equilibria compared and the big push*

Let us assume that multiple equilibria exist and compare the wage and profit rates in the two equilibria. When a modern economy equilibrium exists, the profit rate in this equilibrium is higher than in the traditional economy equilibrium. The existence of a modern economy equilibrium does not guarantee, however, that the wage in this equilibrium is higher than in the

traditional economy equilibrium. This requires the aggregate capital stock to be larger than a critical level. In this case, a modern economy equilibrium will exist and feature both a profit rate and a wage rate higher than in the traditional economy equilibrium.

If this condition is fulfilled, a shift from the traditional to the modern technology will move the economy to a Pareto superior equilibrium. In such a big push, the economy undergoes a sudden expansion of public capital and modern firms together with an increase of industrial profits and wages (and thus of per capita incomes). Moreover, after this initial sudden expansion, the economy will be growing at a faster rate than the previously traditional economy to the extent that the profit rate is higher.

### III. FACTORS IN THE SOUTH'S LACK OF INDUSTRIALIZATION PRIOR TO 1945

It is clear that prior to World War II, the American South was an underdeveloped economy, largely isolated from the rest of the nation. Wright [1986], in fact, calls the pre-1940s South a “quasi-nation,” citing a startling lack of commodity flows between the region and the rest of the U.S. as well as the persistence of a distinctive Southern socioeconomic culture. “There is,” according to Wright [1986, p. 4], “a ‘Southern economy’ [with] a history of its own.”

This history did include periodic attempts toward economic modernization. For example, the so-called “New South” movement, which proposed that the region leave behind its historical ties to plantation agriculture and industrialize, began in the late 1870s when several Southern businessmen attempted to coordinate significant capital investments in the region. By the 1880s, however, Mertz [1978, p. 221] notes the movement was little more than a “promotional campaign,” generating relatively few tangible results.<sup>7</sup> While states north of the Mason-Dixon Line witnessed widespread adoption of mass production and large scale techniques—in both

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<sup>7</sup> A notable exception to this was the growth in the Southern textile industry in the late 19<sup>th</sup> and early 20<sup>th</sup> centuries.

agriculture and industry—production methods in the Southern economy changed relatively little over the course of the following six decades. In the context of a multiple-equilibria big push model of economic development, this failure may be viewed as an example of infrastructure investments remaining below the threshold level necessary to make the widespread adoption of modern industrial technologies viable.

In fact, past research has shown that infrastructural inadequacies impeded Southern industrialization as early as the middle of the nineteenth century. Atack [1977, 1987] and Bateman and Weiss [1981] note that compared to other regions, especially the Northeast, the Southern economy faced limitations imposed by pecuniary external diseconomies. Specifically, these authors note, while Southern manufacturing firms could potentially realize many of the internal economies associated with the technology of the time, they were at a stark disadvantage relative to Northern producers in terms of external influences such as transportation or financing cost. Furthermore, Bateman and Weiss show that the region’s historically-observed “failure to industrialize” resulted not purely from comparative advantage, but from deliberate actions by some politically powerful planters who thought they stood to lose from the emergence of a sizable manufacturing sector. While such political influences were unsuccessful in the long-term, they may have imposed constraining path dependencies on the creation of infrastructure suitable for nonagricultural development. That said, while public infrastructure in the Northeast and Midwest evolved to serve the demands of a modern industrial sector, Southern infrastructure remained more suited to the traditional agricultural economy of the Old South well into the twentieth century.

Figure I illustrates the socioeconomic differences between states above and below the Mason-Dixon Line at the onset of the Great Depression. Not only were infant mortality and illiteracy—two standard proxies of economic backwardness—significantly higher in the South than elsewhere, but strikingly, the South was the least urbanized region in the nation, more rural

than even the Great Plains and Mountain regions. Likewise, in terms of income and manufacturing, the South lagged far behind the rest of the nation in 1929. In that year no Southern state was among the ten largest manufacturing states.<sup>8</sup> Table I shows that value added per capita in manufacturing in the Southern regions was lower by a factor of four than that of the Middle Atlantic, New England, and East North Central regions. Per capita income in the South, likewise averaged less than half that of the rest of the country.<sup>9</sup> At the onset of the Great Depression, the South was predominantly agricultural, rural, and, relative to the rest of the country, backward.

In a well-known 1938 letter to the Conference on the Economic Conditions in the South, President Franklin Roosevelt singled out the South as “the Nation’s No. 1 economic problem.” Citing a lack of demand spillovers, Roosevelt expressed the classic low-income, low-productivity poverty-trap problem for the region saying that, “On the present scale of wages ... and buying power, the South cannot ... succeed in establishing new industries.”<sup>10</sup> This sentiment was repeated by the Roosevelt Administration in *The Report on the Economic Conditions of the South*, which declared, “The purchasing power of the southern people does not provide an adequate market for its own industries nor an attractive market for those of the rest of the country.”<sup>11</sup>

As a low-wage region within the United States, standard convergence theory suggests that the South should have been quite attractive to either Northern or local industrialists. In fact, Carlton [1979] and Moriarty [1980] show that relatively low labor costs were a key factor behind the South’s *postwar* success in attracting manufacturing. But this begs the question, why did low wage rates not attract industry prior to World War II? A potential answer is that although low

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<sup>8</sup> U. S. Bureau of the Census, *Census of Manufactures: 1939*, Washington, D.C, Government Printing Office, p. 42.

<sup>9</sup> *Historical Statistics of the United States* (1975), Part 1, Series F 287-296.

<sup>10</sup> Quoted in Mertz [1978, p. 230].

<sup>11</sup> Carlton and Coclanis [1996 p. 77].

wage rates may attract businesses when transportation, energy, and other relevant infrastructural costs are low, the Southern economy *did not generally offer such incentives prior to the public capital investments of the New Deal and World War II.*

In particular, the South lacked a transportation system that cheaply connected its underdeveloped markets to Northern ones. To illustrate, Southern road and rail systems prior to World War II were largely geared toward connecting Southern markets to international ones—more specifically to ports such as Norfolk, Wilmington, Charleston, Savannah, Brunswick, Mobile, and New Orleans—rather than Northern markets such as Chicago, New York, Pittsburgh, or Cleveland. *The Report* notes that freight rates were 39 and 75 percent higher in the Southeast and Southwest regions respectively than in the industrialized Northeast.<sup>12</sup> According to *The Report* these rate differentials reflected an inability to spread costs due to the lack of traffic on Southern rail lines. Again, the classic poverty trap was present—the South could not afford to “export” goods to the North because freight rates were high and freight rates were high because of a lack of movement of goods from the South to the North.

Aside from a relatively poor system of transportation infrastructure, other factors clearly hindering Southern industrialization included a lack of modern energy production and a poor system of communications. Despite encompassing almost one-third of the nation’s land area and population, the sixteen states that comprised the South Atlantic, East South Central, and West South Central regions produced only one-fifth of the nation’s electricity and had less than one-sixth of the nation’s miles of telephone wire in 1930.<sup>13</sup>

*The Report* further documented the South’s relative backwardness in 1938. For example, 26 percent of households in Southern cities or towns were without indoor flush toilets, twice the nationwide figure of 13.1 percent. From an education standpoint, in 1936 Southern states spent

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<sup>12</sup> These numbers are from the 1938 *Report on the Economic Conditions of the South* [Carlton and Coclanis, 1996, pp. 76-77].

<sup>13</sup> See Table III notes for sources.

an average of \$25.11 per pupil—less than half the average amount spent in the rest of the nation. With respect to Southern higher education, the combined endowments of Harvard and Yale were larger than the total combined endowments of all colleges and universities in the South.<sup>14</sup>

#### IV. THE GREAT REBOUND

Although the pre-World War II South was, by the modern definition of the term, a developing nation, the “Great Rebound” the postwar South underwent is extraordinary. Barro and Sala-i-Martin [1992] and Michener and McLean [1999] show that the South’s rebound is the key factor behind the acceleration of convergence from 1940 onwards that has been observed in U.S. data on state per capita incomes.<sup>15</sup> After six postbellum decades with little if any convergence in per capita income between Southern and non-Southern regions, Wright [1986, p. 239] concludes that “the southern ‘takeoff’ is most appropriately dated from World War II.”<sup>16</sup> Figure II shows that the development of a large-scale manufacturing sector was a major event within the South’s Great Rebound. In real dollars, value added per capita in manufacturing doubled in the Middle Atlantic states and tripled in the East and West South Central regions between 1939 and 1954. The manufacturing revolution in the South was so extensive that, as

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<sup>14</sup> All data presented in this paragraph are from the *Report on the Economic Conditions of the South* [Carlton and Coclanis, 1996, pp. 57-62].

<sup>15</sup> See also Kim (1995, 1998) which looks at trends in regional specialization in the US economy and attributes the South divergence in the 19<sup>th</sup> century to an unfavorable industrial structure, heavily concentrated in agriculture, and national convergence in the 20<sup>th</sup> century to the significant convergence that took place in industrial structures among US regions, resulting in part from the industrialization of the South.

<sup>16</sup> See also Wright, pp. 53-59, for a more detailed discussion why the data generally show that convergence did not begin with World War I.

shown in Figure III, the region, which accounted for only 14.1 percent of value added in manufacturing in 1929, led the nation in manufacturing production by the mid-1980s.<sup>17</sup>

What triggered the South's economic transformation, and particularly its shift to large scale manufacturing after nearly a century of relative economic stagnation? Wright [1986] cites four factors that have traditionally been advanced to account for this phenomenon—labor and capital market equalization, federal spending during and after World War II, the “Sunbelt” effect of a pleasant climate, and the “clean slate” effect of not having been encumbered by old industrial institutions and methods. Connolly [2004] adds improvement in human capital in the postwar South due to the influx of skilled labor during the 1940s and 1950s to the list of candidates for the Southern rebound.<sup>18</sup> We consider our hypothesis—that infrastructure investments during the Great Depression and World War II helped transform the South from the nation's top economic problem to one of the nation's top economic opportunities for industrial capitalists—to be at least somewhat complementary to each of these explanations. The public capital improvements undertaken during the 1930s and 1940s helped facilitate the integration of labor markets that Wright and Connolly cite as being critically important. Furthermore, while the South had long been a “sunbelt” with a relatively “clean slate,” public capital improvements in the years leading up to 1946 created the *preconditions* for the Great Rebound and the foundation upon which these and other postwar changes were realized. This is indeed the essence of the big push theory.<sup>19</sup>

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<sup>17</sup> The 1929 data are from the 1947 Census of Manufactures while the 1987 data value added data come from the 1987 Census of Manufactures.

<sup>18</sup> For more on the Second World War's indirect effects on Southern economic development through its influence on regional higher education and labor participation of women and African-Americans see the collection of essays edited by McMillen (1997).

<sup>19</sup> Some Southern sectors, notably cotton textile and cigarette production, were industrialized prior to 1930. Not all sectors were identical, as big push theoretical models assume, and some increasing returns to scale technologies were so superior to their small-scale counterparts that these sectors could unilaterally industrialize without the benefit of demand spillovers from other industries. This does not, however, preclude the notion that insufficient demand spillovers were present for wide-scale Southern industrialization to occur—a situation amenable to a big push remedy.

## V. NEW DEAL AND WORLD WAR II SPENDING, NORTH AND SOUTH

An analysis of federal spending in the South relative to the rest of the country, presented in Table II, reveals that Southern states received a smaller infusion of federal funds compared to their counterparts during the New Deal and World War II. Specifically, between 1933 and 1939, Southern states received 38 percent fewer New Deal expenditures per capita than the rest of the country. This trend continued into the war years as expenditures by the Federal Works Agency, a collection of New Deal alphabet agencies that continued into the 1940s, and federal military spending on war supply contracts and industrial facilities were around 16 and 45 percent lower, respectively, in the South than the rest of the country.

Although this comparative analysis has been the primary focus of literature on the New Deal and World War II political economies, it is less important in the context of determining whether the results of these funds, over \$1,250 per person in the South between 1933 and 1945, could have helped move the region to the Nash equilibrium in which economic actors chose industrialization over cottage industries and agriculture.<sup>20</sup> For this to be the case, our model suggests that much of this spending should have been directed toward public capital projects rather than direct relief spending. Consistent with this notion, Bateman and Taylor [2002] argue that although the South received fewer per capita funds, the economic impact of these dollars could have been higher than those spent in non-Southern regions if these funds went disproportionately toward public capital projects such as roads, schools, power plants, hospitals, and other physical infrastructure, rather than direct relief or non-public capital producing projects.

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<sup>20</sup> For an overview of the New Deal and wartime political economy literature see Wallis [1998] and Bateman and Taylor [2003].

Such a regional variation in the nature of expenditures would have been sensible since the economic and military challenges of policy makers differed substantially between the Northern and Southern regions during the 1930s and 1940s. While the industrialized North had a severe unemployment problem, the underdeveloped South so lacked productive capacity and infrastructure that it (1) was relatively isolated from the otherwise macroeconomic depression of the 1930s and (2) was in a relatively poor position to help with the war production and mobilization of the 1940s. That is not to say that the South did not experience absolute poverty during the Great Depression, but rather, the South had already been in a relative state of poverty since the end of the Civil War. Clearly, the destructive effects of the economic depression were felt much less in the South than in the Northeast or Midwest. To illustrate, while Figure I showed the relative backwardness of the South, Figure IV shows that the South was the region least afflicted by unemployment in 1940.<sup>21</sup> These regional differences clearly created the need for geographic asymmetry in federal public policy. Keynesian demand stimulation could arguably succeed in the developed Northern industrial economy, but would miss the mark in the Southern one, which suffered from long-term structural problems. As North Carolina Senator Josiah Bailey noted, “There is too much poverty in the South ... we will not get rid of it by giving people money.”<sup>22</sup>

Policymakers clearly recognized the regional dichotomy. While not in the terminology of the time, the distinction was largely one between the need for demand- and supply-side stimuli. Though most historical analysis of Roosevelt Administration expenditures focus upon the Keynesian demand-side of the equation, there was a large infusion of supply-side policies, through public capital creation by the New Deal alphabet agencies, during both the economic depression of the 1930s and the military conflict of the 1940s. Partitioning demand-targeting

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<sup>21</sup> Note that this measure of unemployment counts “relief” workers as unemployed.

<sup>22</sup> Carlton and Coclanis, [1996, p. 20].

expenditures from supply-side ones, however, is not easy, nor is separating the long-term effects of government spending on public capital from the immediate consumption stimulation these expenditures provided. For example, the Works Progress Administration (WPA), the quintessential “relief” agency of the New Deal, responded to widespread joblessness through the creation of government employment programs. While the agency’s administrator, Harry Hopkins, was often criticized for funding “make-work” projects that were unlikely to have much long run economic benefit, WPA workers built or improved 565,456 miles of roads between July 1935 and December 1940, providing a boost to the nation’s long-run productive capacity.<sup>23</sup>

In fact, numerous New Deal agencies provided vehicles through which a supply-side agenda could be pursued. In contrast to the WPA, the Public Works Administration (PWA) generally responded to specific need-based applications from communities for public capital projects such as the building of schools, hospitals, libraries, waterworks, flood control projects, and hydroelectric power. Likewise the Tennessee Valley Authority (TVA) followed a largely supply-side agenda with its primary mission of the harnessing of the Tennessee River in the 201 Southern counties covering parts of seven states. In addition to lowering transportation costs and reducing the risk of flood in the region, the TVA created a low-cost source of hydroelectric power that helped the region attract substantial private investment in the decades that followed.

The Bureau of Public Roads (BPA), renamed the Public Roads Administration (PRA) in 1939, provides another example of an alphabet agency that supplemented its job-creating goals with a clear supply-side agenda. The BPA created employment throughout the 1930s by having its workers construct bypasses, highways, and other infrastructural improvements. During World War II, the PRA became militarily critical when it expanded and built hundreds of “strategic” roads in which the transport of war-related capital took place. For example, the agency built the \$10 million Baton Rouge Bridge and the so-called “Airline Highway”—a four lane elevated

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<sup>23</sup> Burns and Williams [1971, p. 51].

highway that connected Baton Rouge to New Orleans over the top of previously untraversable swamps.<sup>24</sup> The PRA likewise strengthened several roads and bridges along the Mississippi River to help connect the New Orleans war production center and port with the industrial Midwest. According to the Federal Works Agency's 1941 *Annual Report*, [p.1] such projects were "necessary to relieve the pressure on the arteries of the arsenal of democracy."

That is not to say that the wartime "New Deal" was restricted to preexisting alphabet agencies such as the PRA, WPA, and PWA. Two exclusively wartime alphabet agencies, the War Public Works (WPW) and War Public Services (WPS), built and expanded public capital such as waterworks, schools, roads, hospitals, and day care centers in cities that saw a large influx of defense workers such as Detroit, San Diego, Mobile, and New Orleans. While all of these federal projects created a "demand-side" source of jobs and income, many New Deal and wartime projects went further by creating important and lasting sources of public capital.<sup>25</sup>

Consistent with this, Field [2003, 2006, 2007] contends that the 1930s was the "most technologically progressive decade" of the 20<sup>th</sup> century as the period saw large gains in multifactor productivity which helped produce "a golden age of labor productivity growth and living standard improvement" in the decades that followed [2003, p. 1400.] Field states that the longstanding emphasis upon New Deal spending being inadequate from a demand-side perspective in combating the Great Depression "obscures the likelihood that ... public investment nevertheless had significant impacts on the supply side" [2003, p. 1408]. He emphasizes the importance of New Deal improvements to transportation infrastructure such as roads and municipal airports as well as investments in water, sewer, and housing that paved the way for the postwar boom. In fact while the private capital stock fell during the 1930s, Field

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<sup>24</sup> Federal Works Agency [1940, p. 105].

<sup>25</sup> Some New Deal programs such as the National Youth Administration, the Civilian Conservation Corps., and job-training programs within the WPA also focused largely on the supply-side aspect of improving human capital.

(2006) presents an “augmented” measure that includes public capital and shows that the capital stock rose significantly during the decade. According to Field, these public capital investments engendered positive production externalities upon the private sector and contributed to productivity growth in the 1930s and beyond. In the following section, we document the extent this infusion of public capital occurred within the Southern economy.

## VI. THE INFUSION OF PUBLIC CAPITAL IN THE AMERICAN SOUTH DURING THE DEPRESSION AND WAR

During the depression and war years, the public capital improvements in the American South were both immense and favorably disproportionate to the rest of the nation. The big push literature has repeatedly emphasized the importance of three broad categories of infrastructure investments—power, transportation, and communications—that could help bring about a rapid move toward industrialization by breaking the traditional economy equilibrium. This in mind, Table III documents improvements in production of electric power, miles of surfaced roads, and miles of telephone lines, in the non-Southern states as a whole, the three Southern regions, and in individual Southern states. The table also includes improvements in hospital bed capacity, representative of more general improvements in public capital that could make the South more attractive for industrializing high-wage industries.

Between 1930 and 1945 surfaced roads doubled in the Southern states from 222,738 miles to 444,190. These improvements allowed faster and cheaper movement of goods and factors, both within the South, and between the South and the rest of the nation which saw a similar growth in its transportation capacity. Southern communications systems also underwent dramatic upgrades. Miles of telephone wire increased over 50 percent from 13,376 to 20,340 between 1932 and 1944—non-Southern states saw only a five percent increase during this time period.

Perhaps nowhere were public capital improvements as large, or as potentially important for the postwar boom in Southern manufacturing, as those associated with power production capacity. In 1930, the South produced 19.8 billion kilowatts of electricity. In 1945, production had increased nearly four-fold to 75.2. To illustrate the relative magnitude of this growth, the rest of nation saw power production grow only 2.6-fold during the same time period. These power improvements are largely attributable to New Deal electrification programs such as those within the TVA, PWA, WPA, and the Rural Electrification Administration, as well as electrification projects related to war-production such as those within the WPW.

The South also underwent important improvements in basic health and human service infrastructure. Hospital capacity more than doubled from 201,841 beds in 1933 to 471,719 beds in 1945, while the rest of the nation saw a capacity increase of less than 50 percent. Improvements in each of these public capital sources—both in absolute terms and relative to the rest of the nation—would clearly have made the postwar South a more attractive option for large-scale business than the prewar South had been.

In addition to the factors documented in Table III, the New Deal agencies' construction of new post office buildings increased mileage of rural free-delivery postal routes by 7, 9, and 10 percent respectively in the South Atlantic, East South Central, and West South Central regions between 1936 and 1945. Likewise, the number of universities, colleges, and junior colleges rose 43, 37, and 23 percent in the respective regions between 1934 and 1944.<sup>26</sup> These increases in the stock of public capital, not to mention the difficult to measure *qualitative* improvements to the public capital stock—e.g. better surfaces on roads, more reliable power sources, etc.—undertaken during the New Deal and World War II eras, increased the potential rate of return to private investment and the extent of Southern markets.

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<sup>26</sup> Sources for the post office and higher educations statistics are the 1937 and 1947 editions of the *Statistical Abstract of the United States*.

## VII. EMPIRICAL TESTING: ROLE OF PUBLIC CAPITAL GROWTH, 1930-1945, IN MANUFACTURING GROWTH, 1947-54

That investments in public capital would improve an economy's ability to industrialize hardly seems controversial, although the magnitude of the role played by these improvements in subsequent Southern industrialization is of strong interest. More importantly, since other explanations have been put forth for the South's postwar economic transformation, it is necessary to create an empirical framework for testing our "big push from public capital" hypothesis alongside others. The dependent variable whose growth we wish to explain is value added per capita in manufacturing in each of the 48 states, specifically we examine the percentage growth rate of this variable between 1947 and 1954. The choice of years is constrained by the availability of this data which were collected only periodically and reported in the *Census of Manufacturing*. Still these two years are well suited to examine whether the causes of the manufacturing boom immediately following the war were consistent with public capital growth in the years prior facilitating big push dynamics.

To test our hypothesis we create a state-level public capital stock index employing the four measures reported earlier, miles of surfaced roads per square mile, miles of telephone wire per square mile, kilowatts of electricity production per capita, and number of hospital beds per capita. We are interested how both the growth rate of public capital during the Depression and War years, conditioned upon its overall stock in 1945, affected the subsequent growth in a state's manufacturing sector. To create the *Growth Rate in Public Capital Stock Index, 1930-1945*, we simply calculate the percentage growth rate in each of the four variables, aggregate them, and divide by four to create an average.<sup>27</sup> The average growth rate in the index for all 48 states was

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<sup>27</sup> Note that only roads and power are 1930 to 1945. Telephone wire is 1932 to 1945 and hospital beds are 1933 to 1945.

165 percent. To create the *Public Capital Stock Index 1945*, we scaled each of the four measures so that the average value equaled 100, aggregated them, and again divided by four to create an index with an average value of 100. The state with the highest index was New Jersey with a value of 295.3 and the state with the lowest was North Dakota with 35.2.

Our regressions also employ variables to test four alternative hypotheses for growth in manufacturing in the South in the postwar era. First, to account for standard convergence theory, we include *Value Added Per Capita in Manufacturing in 1947*, under the hypothesis that states starting from less manufacturing would naturally converge over time toward more. Second, to account for the hypothesis that manufacturing moved South because of low wages, we include the *Average Annual Wage in Manufacturing 1947*.<sup>28</sup> Third, to account for the “Sunbelt” hypothesis that favorable weather (as well as the invention of air conditioning to control for hot summer months) played an important role in postwar development, we include the *State’s Average Temperature* from 1931 to 1960.<sup>29</sup> Finally, to test the hypothesis that manufacturing jobs moved to where unionization was low, we include, *State Union Density*, which measures the percent of nonagricultural workers organized. Unfortunately, such state-level union data are available for only two years circa the time period of interest—1939 and 1953 [Troy, 1957]. Between 1939 and 1953 the percentage organized rose from 21.5 percent to 32.6 nationwide. Much of this jump likely occurred during World War II, suggesting that the 1953 measure might be superior for approximating the level in 1947. On the downside however, the magnitude of the 1953 data point may not be entirely exogenous from growth of manufacturing between 1947 and 1954. We took the average of the two time periods as our proxy for union density in 1947,

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<sup>28</sup> Unfortunately there is no measure of hourly manufacturing wage rates at the state level for this time. We created this variable by dividing total manufacturing wage and salary payments in 1947 by the number of manufacturing employees. The data are from the 1950 *Statistical Abstract of the United States* (Table 919).

<sup>29</sup> *Statistical Abstract of the United States*, 1972, Table 284. Most states reported average annual temperature of one city. For those states that reported temperatures of multiple cities, we took the average of all cities.

however the regression results are qualitatively unchanged whether we use 1939, 1953, or the average of these years.

Table IV reports the results of six regressions testing the competing hypotheses for the growth in manufacturing in the immediate postwar era. Specification (1) broadly supports the convergence hypothesis as it shows that states with a lower *Value Added Per Capita in Manufacturing in 1947* saw the largest growth rate in that measure between 1947 and 1954. This results holds in specification (2) when wage, temperature, and unionization variables are also included. Specification (2) also shows support for the notion that favorable weather played some role in manufacturing movement in the postwar era as states, such as those in the South, with higher average temperature saw larger growth in manufacturing. Surprisingly, *Average Annual Wage in Manufacturing 1947* has the wrong sign as it suggests that high labor costs were not an obstacle to manufacturing growth in the immediate postwar era. Finally, there is no evidence that *State Union Density* played a role in growth in manufacturing, although the coefficient does have the expected sign.

Specifications (3) and (4) include the public capital indices alongside the variables representing the major alternative hypotheses for the South's postwar manufacturing growth. Specification (3) shows that the higher the *Public Capital Stock Index 1945* the more manufacturing growth a state saw in the immediate postwar era. Of highest interest to us, however, is the effect the *growth rate* of public capital during the Depression and War era, conditioned upon its 1945 stock, had upon subsequent growth in manufacturing. This effect is captured in specification (4). The results of this regression show strong support for the notion that the growth in postwar manufacturing was a function of the *Growth Rate in Public Capital Stock Index, 1930-1945*. In fact, when growth in public capital is included in the regression, the standard convergence coefficient loses significance. Importantly, this suggests that convergence

in the immediate postwar era was largely driven by growth in public capital in the years preceding.<sup>30</sup>

The coefficient on manufacturing wage rates in 1947 continues to be positive and significant. Still, this regression does not control for the quality of labor—it could be that, other factors constant, areas that saw rapid growth were those with more skilled labor, which would be correlated with the higher wages. Specification (5) adds percentage of the population over the age of 25 with a high school degree in 1940 as well as the growth in this measure between 1940 and 1950 to control for the quality of labor in each state. The coefficients on each of these measures are positive and significant and their inclusion causes the positive wage coefficient to lose significance. Finally, specification (6) drops all variables that are not statistically significant.

Using specification (6) as our preferred one, the results in Table IV suggest that a doubling of growth rate in public capital stock between 1930 and 1945 would cause a 13 percent increase in a state's manufacturing growth rate between 1947 and 1954. Since, as shown in Table III, Southern states saw a larger percentage increase in public capital during the New Deal and World War II than non-Southern ones, this analysis offers strong empirical support to the hypothesis that public capital growth in the South contributed greatly to the region's postwar manufacturing boom.<sup>31</sup> In the context of Barro and Sala-i-Martin [1992], Michener and McLean [1999], and Kim [1995, 1998], this also implies that 1930s and 1940s public capital

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<sup>30</sup> We are clearly losing some information by aggregating our four types of public capital into one index. An alternative estimation method whereby we run the regression in specification (4) with a separate variable for each type of public capital would run into multicollinearity problems since the state-level growth in public capital categories are strongly correlated. In unreported regressions, we examine the effects of each of the four public capital measures one at a time. From this exercise we find that growth in miles of telephone wire and kilowatts of power production are the most important in terms of explaining subsequent manufacturing growth.

<sup>31</sup> An avenue of future research would be to extend this analysis from the state to the county level. Unfortunately, county-level level data on key measure of public capital are not readily available.

improvements were an important factor driving the observed convergence of state-level income in the postwar era.<sup>32</sup>

While regression results can offer support to our hypothesis, an empirical methodology relying upon the correlation of the growth in public capital and growth in manufacturing variables cannot positively demonstrate that the causality of this relationship rested upon big push dynamics. For example, Field's [2003, 2006] contention that New Deal era public capital improvements paved the way for productivity improvements nation-wide in the postwar era is independent of big push dynamics breaking a region from a poverty trap. To make a convincing case for a big push, one must show that the public capital investments were both a primary reason that manufacturing firms sprang up in the South after the Second World War and show that this created demand spillovers that generated a self-sustaining growth path toward the preferred Nash equilibrium. While this is a daunting task, in the next section we present evidence from a firm-level survey that shows, consistent with the big push and public capital model developed earlier, that these improvements in the stock of public capital played a direct role in *initiating* a widespread movement towards Southern modernization and created a self-sustaining growth path.

## VIII. WHY DID MANUFACTURING FIRMS CHOOSE THE POSTWAR SOUTH?

### NPA SURVEY RESULTS

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<sup>32</sup> In an unreported regression, we duplicate specification (5) but change the time frame on the dependent variable to the 30 year period 1947-1977 to see how these variables do at explaining growth in manufacturing over a longer time span, as has typically been the focus of past studies. The results show evidence for the convergence hypothesis as value added in manufacturing 1947 is negative and significant at the 1 percent level, while temperature, union density, 1947 wage, and public capital growth between 1933 to 1945 are all insignificant. The only other variable that is significant—a negative coefficient on the percent of population with high school degree in 1940—is also broadly consistent with the convergence hypothesis.

In 1949, the National Planning Association (NPA) conducted a survey of “important manufacturing concerns” that had built 88 new plants in the South since the end of World War II. The committee hoped “to find out directly from businessmen the ways in which certain factors influence their selection of plant locations” (McLaughlin and Robock, 1949, p. 4). Generally, the plants studied cost at least \$100,000 to build, and many cost over \$10 million. The result of this effort was an NPA report entitled *Why Industry Moves South: A Study of Factors Influencing Recent Location of Manufacturing Plants in the South*.

The NPA study concluded that, “The major force attracting plants to the South in recent years has been the growing volume of expenditures of both final consumers and industry. As the market becomes large enough to support an economic sized plant, a new plant can be established to capitalize on the advantage of nearness to the market” (ibid, p. 32). That such factors were found to be the primary force driving firms’ locational decisions is consistent with a “big-push” model in which industry relocation created a self-sustaining growth path to industrialization. As the market grew, more plants moved South, and as more plants moved South, the market grew in a virtuous cycle. In support of this general conclusion, the NPA study presents a plethora of industry-specific evidence pointing toward the 1930s and 1940s injection of public capital creating big push dynamics which facilitated the initial expansion of Southern manufacturing.

To illustrate, the improved Southern transportation system, and the reduced transportation costs that came with it, were cited by many respondents as factors instrumental to their decision to locate in the South. Among these was the Armstrong Cork Company which choose to locate an asphalt tile plant in Jackson, Mississippi because it said that this site would minimize transport costs to nearby Southern markets [ibid, p. 84]. Interestingly, Jackson saw considerable improvements to its transportation infrastructure during the war as it was an important hub on the so-called “Perishing Network” of militarily strategic roads. Among other improvements, in 1940, the PRA modernized its roads and built a bypass around Jackson to speed the transport of

military cargo. While militarily important, the project, from a civilian perspective was called “the most important single highway project ever undertaken in Mississippi” [Federal Works Agency, 1940, p. 103].

As an example of cheaper water transportation costs attracting industries to the South, the report notes that du Pont opened a new plant on the James River near Richmond, Virginia because it could inexpensively receive water-shipments of sulphur from Texas via the Atlantic [McLaughlin and Robock, 1949, p. 45]. This was made possible directly through the public capital improvements that immediately preceded it. In the late 1930s the Works Progress Administration, working with the U.S. Army Corps of Engineers, built the Richmond Deepwater Terminal which deepened the James to allow a city 100 miles inland to become an ocean port that could receive ships up to 560 feet long [Federal Works Agency, 1941, p. 15].

Equally significant, many of the surveyed businesses said that they moved South because of low-cost electric power such as that created by the Tennessee Valley Authority.<sup>33</sup> One anonymous company—many companies refused to give the NPA permission to reveal their name in the study—noted that by locating in a TVA area, “their savings in power costs as compared with operations in the North would pay for the entire cost of the plant over a 10-year period” [McLaughlin and Robock, 1949, p. 53]. Additionally, the Wolverine Tube Division of the Calumet and Hecla Consolidated Copper Company noted that it chose to build an \$8 million plant in Decatur, Alabama specifically because of low-cost TVA power. Another example of the attraction of low-cost power was the location of the Belding Hemingway Company in Morristown, Tennessee who likewise declared to have been lured South primarily by TVA power rates [ibid, p. 82].

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<sup>33</sup> Around 30 percent of surveyed plants indicated they moved South because of materials and resources. Among these was low-cost electric power, though the NPA did not specify what portion of this 30 percent was for power.

The report also highlighted firms indicating that newly-created public capital—specifically vacant Southern plants built during the War for military production—factored heavily into their locational decision.<sup>34</sup> For example, International Harvester used a converted war plant to open a new tractor-production plant in Louisville, Kentucky [ibid, p. 40]. Likewise, among the firms surveyed was a sulphuric acid production facility in Tuscaloosa, Alabama, whose initial capacity had been created for wartime production in the early 1940s [ibid, p. 45]. At least two other respondents indicated that inexpensive converted war production plants lured them to the South.<sup>35</sup> Note that the movement towards manufacturing in the immediate postwar South was not the result of a *planned* simultaneous expansion of multiple industries creating markets for each other. Rather, it appears that big push dynamics were at work through the public capital mechanism developed in our model.<sup>36</sup>

Interestingly, only a quarter of firms in the NPA survey cited “labor-factors” such as low-cost and plentiful labor as an important reason for locating in the South. As previously mentioned, however, studies conducted in the 1970s and 1980s found such factors to be of great

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<sup>34</sup> Gordon [1969] has highlighted the long term economic importance government owned, privately operated capital formation during World War II which was sold off to the private sector after the war.

<sup>35</sup> For a recent collection of essays detailing the emergence and development of specific industries such as aircraft, automobiles, forest products, carpets and petrochemicals in Southern states between the 1940s and 1970s, see Scranton [2001]. While many of these essays highlight the effect of government policies implemented in the decades after World War II that helped Southern manufacturing continue to thrive, our focus is more narrowly on the “big push” toward industrialization that occurred immediately after the war.

<sup>36</sup> The general conclusion of the NPA survey of 88 firms’ rationale for locating in the South immediately after the War is consistent with the findings of later studies by Wheat [1973] and Cobb [1982, 1984]. Wheat, in an empirical study of the causes of state and regional growth between 1947 and 1963, concludes that markets were the key to Southern industrial expansion and that “market influence” explains 55 to 75 percent of the regional variance of growth in the United States for that time period [p. 183]. For Wheat, “market influence” included factors such as transportation costs from Northeastern manufacturing centers and consumer demand (measured empirically though per capita income). Likewise, Cobb [1982, p. 227], in his conclusion to the chapter “Why Industry Came South,” notes that “population growth and the resultant expansion of consumer markets made the major contribution to the emergence of the Sunbelt South.”

importance to firms' locational decisions in the three decades that followed the war. Together this suggests that labor-factors are most important to the locational decision only after regions have sufficient public capital, but that such factors, in themselves, are an unlikely catalyst for the initial stages of industrialization. After all, the South had low-cost and plentiful labor relative to the rest of the nation prior to 1946 yet manufacturing concerns did not generally flock to the region until after this time.<sup>37</sup>

In summary, the 1949 survey documenting manufacturing firms' reasons behind locating in the South provides compelling evidence that improvements to public capital such as roads, bridges, rivers, and ports during the 1930s and 1940s lowered transport costs and made Southern locations more attractive to industry in the immediate postwar era.<sup>38</sup> Furthermore, the study emphasizes that advances in power and communications, which further lowered the cost of doing business in the South, were key factors that helped lure firms to the region. Taken together, these infrastructural improvements sparked a big push in Southern industrialization. Once the non-industrialization trap was broken, the report implies that demand spillovers made the movement toward industrialization self-sustaining.

## IX. CONCLUSION

The big push theory, formalized in the seminal article by Murphy, Shleifer, and Vishny [1989], shows the possibility of multiple equilibria, one of which is a traditional economy

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<sup>37</sup> In addition to investments in public capital, the adoption of modern techniques can be stimulated by high wages to the extent that an increase in the wage reduces the profitability of the traditional technology by more than that of the modern technology. An exogenous increase in wages may thus contribute to a big push by reducing the mass of investments required to make the modern technology viable. Indeed, such a mechanism for Southern industrialization has been proposed by Wright [1986], although not in the context of a big push.

<sup>38</sup> Transportation improvements in the South, many of which began during the 1930s and 1940s, were cited as important factors for firm location in the decades following the war as well. For example, a 1971 poll of South Carolinians found that 68 percent believed that "good highways and other transportation facilities" were important to their state's economic development [Cobb, 1982, p. 216].

characterized by small-scale agriculture and cottage production. Simultaneous industrialization of several sectors, however, can create sufficient demand spillovers such that widespread industrialization is also an economy-wide Nash equilibrium. Switching to this preferred Nash equilibrium can be accomplished through a “big push”—simultaneous large-scale investments, which create demand spillovers, enlarge the market, and generate a self-sustaining growth path toward large-scale production. We develop a model with such big push dynamics whereby investments in public capital, which increase the rate of return to private investment, can facilitate a widespread push toward industrialization.

Though a flurry of research has followed Murphy, et. al., scholars have uncovered few real-world examples of big push dynamics shifting an economy to the preferred Nash equilibrium of industrialization. Rather than an examination of currently developing nations, we offer an example from recent history: the Great Rebound of the American South—in its own right an underdeveloped nation prior to the mid-20<sup>th</sup> century—which followed large public capital investments during the Great Depression and World War II. The infusion of public capital—roads, schools, waterworks, power plants, dams, airfields, telephone lines, and hospitals, among other infrastructure improvements—increased rates of return to private investment and generated significant external economies which fundamentally reshaped the Southern economy.

Our regressions show that the growth of public capital between 1930 and 1945 was a driving force behind states’ growth in manufacturing between 1947 and 1954, the years that the South began a manufacturing growth trajectory that would make it the leading manufacturing region in the country by the 1980s. Perhaps more importantly with respect to demonstrating a big push, evidence from a National Planning Association survey of firms that moved South just after 1945 strongly suggests that the public capital improvements undertaken during the New Deal and World War II provided the important impetus for the widespread adoption of mass

production techniques which lead to demand spillovers and created a self-sustaining growth path in the decades that followed.

APPENDIX. AN OPEN ECONOMY BIG PUSH MODEL WITH VERTICAL PECUNIARY EXTERNALITIES

In this appendix, we develop an extension of the big push models of Murphy (et. al.) [1989] and Skott and Ros [1997] in which public capital investments, such as those undertaken during the New Deal and World War II, could create a clear big push dynamic steering an economy from a traditional economy equilibrium into a Pareto preferred large scale manufacturing one.

In our model, a final tradable good can be produced with two different technologies indicated by subscripts T (traditional) and M (modern). A traditional, labor-intensive technology uses capital (K) and labor (L) to produce output T. We assume that the modern technology is capital- and infrastructure-intensive. Modern firms use physical capital (K) and public capital (I) to produce output M. The physical capital good is imported at a given international price (equal to one in terms of the domestically produced tradable good). Assuming a Cobb-Douglas specification, we have:

$$M = K_M^\alpha I_M^{1-\alpha} \quad 0 < \alpha < 1$$

$$T = K_T^\beta L_T^{1-\beta} \quad 0 < \beta < 1,$$

with  $\alpha > \beta$ . I represents the input of non tradable public capital such as power plants, transport and communications infrastructure, training facilities, schools, hospitals, and other types of public capital investments:

$$I = \left( \sum (1/n) I_i^\sigma \right)^{1/\sigma} \quad 0 < \sigma < 1,$$

where n is the number of components of public capital, assumed to be given. Production of these components is subject to internal increasing returns:

$$(1) \quad I_i = L_i^\mu \quad \mu > 1,$$

where  $L_i$  is labor input. For simplicity, we assume only modern technology uses public capital and ignore direct labor input in this technology.

In the final goods sector, firms operate under atomistic competition and maximize profits taking output and input prices as parametrically given. In sector I, producers operate under conditions of monopolistic competition and face downward sloping demand curves:

$$(2) \quad I_i^d = D p_i^{-\vartheta} \quad \vartheta > 1,$$

where  $D$  is a position parameter and  $\vartheta$  is the price elasticity of demand facing individual producers. This elasticity is a function of  $\sigma$ ,  $\alpha$ , and  $n$ , and, for a large  $n$ , is given approximately by  $1/(1-\sigma)$ . The inequality in (2) follows from the parameter restrictions  $0 < \alpha < 1$  and  $0 < \sigma < 1$ .

From the conjectured demand function (2) and the production function (1), the optimal pricing decision for the  $I_i$ -producer is a markup over marginal cost:<sup>39</sup>

$$(3) \quad p_i = (1 + \pi) \omega,$$

where:  $1 + \pi = [\vartheta / (\vartheta - 1)] \quad \omega = w / \mu I_i^{(\mu-1)/\mu}$

$w$  is the wage rate,  $\omega$  is the marginal cost of labor, and  $\pi$  is the mark-up over marginal cost.

Equations (2) and (3), by setting  $I_i = I_i^d$ , can be solved simultaneously for  $p_i$  and  $I_i$ .

### *Profitability and the choice of technology*

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<sup>39</sup> To simplify, we assume that the number of non tradable inputs is large enough, so that intertemporal aspects can be ignored. With a small number of infrastructural goods, the monopolistic producers of these goods would face an intertemporal optimization problem: the current price would affect the profitability of the modern technology which in turn could influence capital accumulation by modern firms and thereby future demand for I-goods. With many I-goods this intertemporal link is weakened and the decisions of an individual producer have only minor effects on the aggregate output of infrastructural goods and the profitability of the modern technology.

When the traditional technology is in use, the profit rate ( $r^*_T$ ) and the wage ( $w^*_T$ ) in the tradable goods sector are:<sup>40</sup>

$$(4) \quad r^*_T = \beta [(1-\beta) / w]^{(1-\beta)/\beta}$$

$$(5) \quad w^*_T = (1-\beta) (K_T / L_T)^\beta$$

where  $w$  is the wage measured in units of the final good. Assuming full employment of capital and labor (so that  $K_T$  and  $L_T$  are equal to the total capital stock,  $K$ , and labor force,  $L$ , respectively), equations (4) and (5) combined yield:

$$(6) \quad r^*_T = \beta (L/K)^{1-\beta}$$

When the modern technology is in use, the profit rate is:

$$r^*_M = (M - \sum p_i I_i) / K_M = \alpha (I/K_M)^{1-\alpha}.$$

The demand function for public capital is given by<sup>41</sup>:

$$I = [(1-\alpha) / p_I]^{1/\alpha} K_M,$$

where  $p_I$  (=  $n p_i$  under symmetry) is the (minimum) cost of a bundle of public capital components yielding  $I = 1$ . Assuming symmetry ( $p_i = p_j$  and  $I_i = I$ ), this equation together with equations can be solved for  $I$ ,  $p_I$  and  $D$ . The solution for  $I$  is:

$$I = [G (1/n) (1/w) K_M^\alpha]^{1/f}, \text{ where: } G = (1-\alpha) \mu (\sigma - 1) / \sigma, f = \alpha - (\mu - 1) (1-\alpha) > 0$$

which describes a symmetric, short-run equilibrium solution for  $I$ . Given a conjectured value of the multiplicative constant  $D$ , the first-order conditions for profit maximization determine ( $p_i, I_i$ ) as a function of  $D$ . The actual value of  $D$  depends on the pricing decisions of the firm's rivals. As shown in Skott and Ros [1997], stability requires the (empirically plausible) condition:  $f > 0$ .

---

<sup>40</sup> Equation 4 is derived from the definition of the profit rate  $r = (p_T - w L_T) / p_K K_T$ , using the equality between the wage and the marginal product of labor and choosing units so that the price of final output,  $p$ , is equal to the price of the capital good,  $p_K$ , with  $p = p_K = 1$ .

<sup>41</sup> See Skott and Ros [1997].

Substituting into the equation for  $r^*_M$ , we get:

$$(7) \quad r^*_M = \alpha K_M^{(\alpha-f)/f} [(1/n) G / w]^{(1-f)/f}.$$

The corresponding wage rate is derived as follows. Employment in the I sector is:

$$L_I = \sum L_i = \sum I_i^{1/\mu} = n I^{1/\mu}$$

or, using the solution for I above:  $L_I = [(1/n)^{1-f} G K_M^\alpha (1/w)]^{1/f}$ .

When the modern technology is in use and assuming full employment, the wage is the solution to  $L_I(w, K_M) = L$ . This yields:

$$(8) \quad w^*_M = G (1/n)^{1-f} K_M^\alpha / L^f$$

Substituting from (8) into (7), setting  $w = w^*_M$  and  $K_M = K$ , we get:

$$(9) \quad r^*_M = \alpha (L/n)^{1-f} / K^{1-\alpha}.$$

The profitability of the modern technology in isolation is not  $r^*_M$  but rather the profitability of the modern technology evaluated at the prices and wages prevailing in a traditional economy ( $r^T_M$ ). This is obtained from substitution of (5), which shows the wage in a traditional economy, into (7) showing the profitability of the modern technology as a function of the wage. Assuming full employment, this yields:

$$(10) \quad r^T_M = \alpha K_M^{(\alpha-f)/f} [(1/n) G (L/K)^\beta / (1-\beta)]^{(1-f)/f}.$$

Similarly, the profitability of investing with the traditional technology in a modern economy ( $r^M_T$ ) is obtained from substitution of (8) into (4):

$$(11) \quad r^M_T = \beta [(1-\beta) n^{1-f} L^f / G K^\alpha]^{(1-\beta)/\beta}.$$

### *Existence of equilibrium and condition for multiple equilibria*

The traditional economy is an equilibrium if  $r^*_T$  is higher than  $r^T_M$  so that there is no incentive for an *individual* firm to invest in the modern technology. Comparing (6) and (10) makes clear that in our model a traditional equilibrium always exists. In a traditional economy,

$K_M$  equals zero which implies that  $r_M^T$  is also zero while  $r_T^*$  remains positive no matter how large the capital stock. The reason is the assumption that the traditional technology does not use public capital produced under increasing returns. If it did, there would generally exist a level of the physical capital stock at which the costs of I goods would be low enough to make  $r_M^T$  higher than  $r_T^*$ .<sup>42</sup>

A modern economy equilibrium exists if  $r_M^*$  is higher than  $r_T^M$  so that in a modern economy no individual firm will find it profitable to invest in isolation in the traditional technology. Comparing (9) and (11) yields the following condition for the existence of a modern economy equilibrium:

$$(12) \quad K^{\alpha-\beta} > K^{*\alpha-\beta} = (\beta/\alpha)^\beta [(1-b)/G]^{1-\beta} n^{1-f} L^{f-\beta}.$$

The existence of a modern economy equilibrium requires a sufficiently large physical capital stock so that, when the whole of it uses the modern technology, the price of public capital is low enough to make the modern technology self-sustaining. Since a traditional economy equilibrium always exists, it follows that (12) is also a condition for the existence of multiple equilibria. Then which technology is more profitable depends on the technology in use.<sup>43</sup>

### *The two equilibria compared and the big push*

Let us assume that the condition for multiple equilibria is fulfilled and compare the wage and profit rates in the two equilibria. Comparing (6) and (9) shows that for  $r_M^*$  to be higher than  $r_T^*$  requires:

$$(13) \quad K^{\alpha-\beta} > K_1^{\alpha-\beta} = (\beta/\alpha) n^{1-f} L^{f-\beta}.$$

---

<sup>42</sup> It is clear, however, that the mass of investments by modern firms (as a proportion of the total capital stock) required to make the modern technology viable falls as the total capital stock increases. This is because the relative price of I goods (given the wage) depends on the *level* of investments in the modern technology. In other words, a larger capital stock facilitates the shift to a modern economy.

<sup>43</sup> If condition (12) is not fulfilled, a unique traditional economy equilibrium exists.

Comparing (12) and (13), we can establish that  $K^* > K_1$ .<sup>44</sup> It follows that when a modern economy equilibrium exists ( $K > K^*$ ), the profit rate in this equilibrium is higher than in the traditional economy equilibrium (since  $K$  then is also higher than  $K_1$ ).

Inspection of (5) and (8) shows that for  $w_M^*$  to be greater than  $w_T^*$  the aggregate physical capital stock must be such that:

$$(14) \quad K^{\alpha-\beta} > K_2^{\alpha-\beta} = (1-\beta) n^{1-f} L^{f-\beta}/G.$$

From (12) and (14), we can establish that  $K_2 > K^*$ . The existence of a modern economy equilibrium does not guarantee that the wage in this equilibrium is higher than in the traditional economy equilibrium. This requires the aggregate capital stock to be larger than  $K_2$ . In this case, with  $K > K_2$ , and therefore  $K$  larger than  $K^*$  and  $K_1$ , a modern economy equilibrium will exist and feature both a profit rate and a wage rate higher than in the traditional economy equilibrium. Thus, if condition (14) is fulfilled, a shift from the traditional to the modern technology will move the economy to a Pareto superior equilibrium.

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<sup>44</sup> The assumption of  $\alpha > \beta$  and the second order condition for a profit maximum among  $I_i$  producers ensure this inequality.

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**Table I**  
Value Added Per Capita  
in Manufacturing by Region, 1929

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New England	396.78
Mid Atlantic	387.50
East North Central	394.25
West North Central	140.63
<i>South Atlantic</i>	<i>160.60</i>
<i>East South Central</i>	<i>93.50</i>
<i>West South Central</i>	<i>78.06</i>
Mountain	99.97
Pacific	234.66

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Source: 1947 *Census of Manufactures* and  
1930 *Census of Population*.

**Table II**  
Per Capita Federal Expenditures, 1933-1945

	South	Non-South
New Deal, 1933-39	\$318.04	\$513.49
Federal Works Agency, 1940-45	\$68.33	\$80.40
Military, 1941-45	\$875.49	\$1578.89

*Sources:* New Deal expenditures, 1933-1939 are from Don Reading, "New Deal Activity and the States, 1933-39," *Journal of Economic History* 33 (1973): 792-810. Federal Works Agency expenditures are from Federal Works Agency, *Annual Reports* (Washington D.C.: United States Government Printing Office, 1940-1945). Military expenditures are on war supply contracts and industrial facilities and come from Paul H. Anderson, *State, Regional and Local Market Indicators, 1939-46*, Office of Domestic Commerce, Economic Studies No. 67 (Washington D.C., 1948).

**Table III**  
Public Capital Improvements in Southern States and Rest of the US

	<b>Surfaced Roads</b> (miles)		<b>Telephone Wire</b> (thousands of miles)		<b>Production of Electricity</b> (millions of kilowatts)		<b>Hospital Capacity</b> (number of beds)	
	1930	1945	1932	1944	1930	1945	1933	1945
<b>US Total, Less South</b>	<b>470,821</b>	<b>1,050,661</b>	<b>74,302</b>	<b>77,952</b>	<b>76,104</b>	<b>196,013</b>	<b>825,205</b>	<b>1,267,225</b>
<b>South Atlantic</b>	<b>96,514</b>	<b>161,234</b>	<b>5,760</b>	<b>9,842</b>	<b>10,895</b>	<b>37,514</b>	<b>92,133</b>	<b>221,467</b>
Delaware	1,258	2,936	210	350	18	147	2,132	3,850
Maryland	6,308	10,875	1,046	1,713	1,869	5,001	17,456	29,933
Virginia	12,581	36,665	877	1,644	1,231	5,519	17,209	46,416
West Virginia	5,292	15,690	446	561	2,103	8,765	9,307	16,934
North Carolina	21,956	34,601	707	830	2,298	6,811	15,927	36,205
South Carolina	18,802	15,553	291	390	1,202	3,055	7,637	17,458
Georgia	14,922	29,126	772	1,126	937	3,348	13,283	37,760
Florida	15,395	15,788	706	1,010	688	3,142	9,182	32,911
<b>East South Central</b>	<b>73,406</b>	<b>152,661</b>	<b>2,588</b>	<b>3,631</b>	<b>3,882</b>	<b>18,793</b>	<b>46,362</b>	<b>102,523</b>
Kentucky	17,654	31,778	863	868	719	2,501	13,251	23,039
Tennessee	18,018	47,856	851	1,210	1,037	7,656	14,200	37,037
Alabama	19,784	40,006	580	708	2,065	8,212	10,792	23,833
Mississippi	17,950	33,021	294	341	62	424	8,119	18,614
<b>West South Central</b>	<b>52,818</b>	<b>130,295</b>	<b>5,028</b>	<b>6,862</b>	<b>5,055</b>	<b>18,935</b>	<b>63,346</b>	<b>147,729</b>
Arkansas	8,884	21,223	367	359	108	1,394	8,480	17,357
Louisiana	12,203	21,005	694	1,002	1,067	4,650	12,951	26,519
Oklahoma	5,307	17,883	1,173	1,270	958	2,511	13,249	26,249
Texas	26,424	70,184	2,794	3,522	2,922	10,469	28,666	77,604

Source: All data are from the *Statistical Abstract of the United States* except hospital bed data are from Table 2, "Number and Capacity of Hospitals According to Type of Service, Together with Number of Patients Admitted." in "Hospital Service in the United States: Thirteenth Annual Presentation of Hospital Data by the Council on Medical Education and Hospitals of the American Medical Association." *The Journal of the American Medical Association* (1934), Volume 102, Number 13, pp 1005-1083 (page 1009) and Table 2 "Hospital Facilities by States and by Type of Service" in "Hospital Service in the United States: Twenty-Fifth Annual Presentation of Hospital Data by the Council on Medical Education and Hospitals of the American Medical Association." *The Journal of the American Medical Association* (1946), Volume 130, Number 16, pp 1073-1161 (page 1079).

**Table IV**  
**Examination of Competing Hypotheses**  
**of Postwar Manufacturing Growth**

Dependent Variable:  
Growth in Per Capita Value Added Manufacturing, 1947-1954  
(t-statistics)  
Number of Observations = 48 States

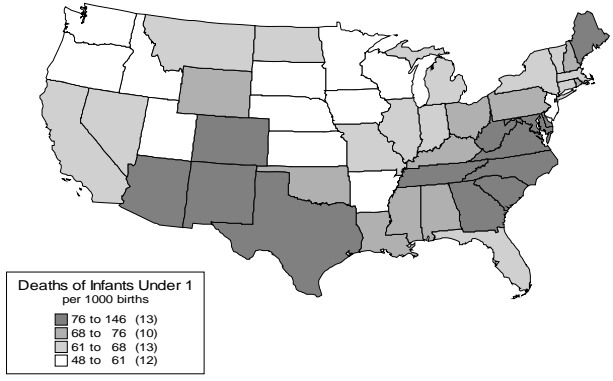
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.69016 (6.57)**	-1.95257 (-2.74)**	-1.62145 (-2.30)*	-1.69913 (-2.80)**	-2.43734 (-4.12)**	-2.2751 (-4.44)**
Value Added Per Capita Manufacturing 1947	-0.00016 (-3.05)**	-0.00021 (-4.13)**	-0.00028 (-4.66)**	-0.00009 (-1.30)	-0.00001 (-0.13)	
Average Annual Wage Manufacturing 1947		0.00076 (3.97)**	0.00063 (3.25)**	0.00056 (3.32)**	0.00018 (0.82)	
State's Average Temperature		0.01758 (2.35)*	0.01557 (2.14)*	0.01610 (2.57)*	0.02349 (3.83)**	0.02384 (4.11)**
State Union Density (Average 1939 and 1953)		-0.00780 (-1.26)	-0.00658 (-1.10)	-0.00580 (-1.12)	-0.00715 (-1.50)	
Public Capital Stock Index 1945			0.00209 (2.07)*	-0.00072 (-0.64)	-0.00193 (-1.79)+	-0.00186 (-2.93)**
Growth Rate Pub. Capital Stock Index, 1933-1945				0.00105 (3.99)**	0.00127 (5.13)**	0.00130 (7.23)**
Percent High School Degree 1940					0.02632 (2.20)*	0.03053 (4.06)**
Growth Rate High School Degree 1940-1950					0.01672 (3.26)**	0.01654 (3.67)**
Adj. R-squared	.150	.346	.392	.552	.633	.639
F-statistic	9.28	7.21	7.06	10.63	11.15	17.64

+ Significant at the 10 percent level

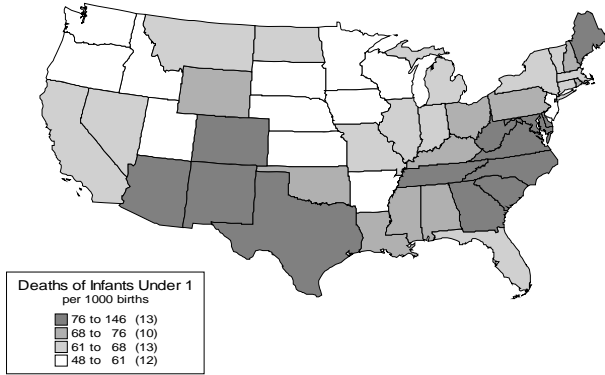
\* Significant at the 5 percent level

\*\* Significant at the 1 percent level

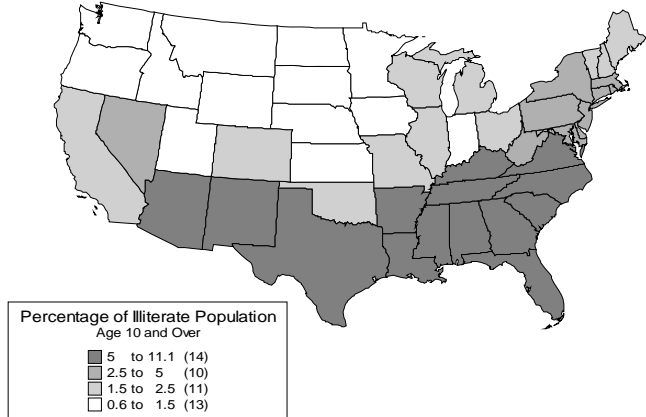
# Infant Mortality, 1929



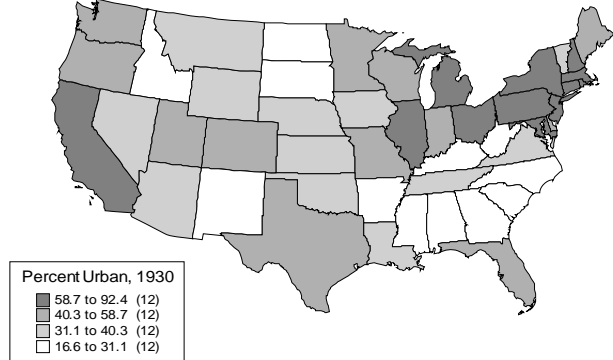
### Infant Mortality, 1929



### Illiteracy Rates, 1930



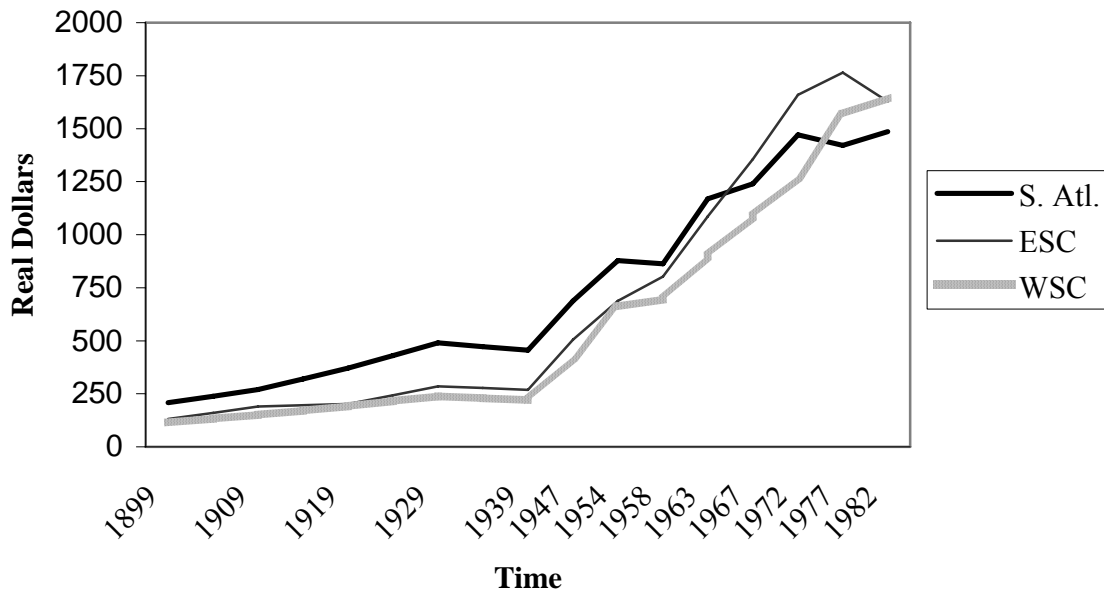
### Percent Urban, 1930



Source: Statistical Abstract of the United States, 1935. For Infant Mortality, South Dakota and Texas are 1932 and 1933 data respectively since 1929 data are not available.

Figure I

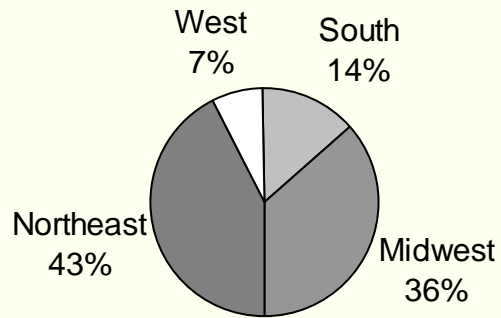
### Real Value Added Per Capita in Manufacturing



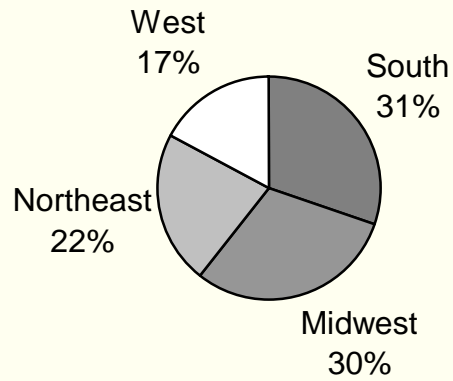
Notes: S. Atl. is South Atlantic, ESC is East South Central, and WSC is West South Central. Value added in manufacturing data are from *Census of Manufactures*, 1947, 1954, 1958, 1963, 1967, 1972, 1977, and 1982. To convert to real dollars, price level data are taken from Balke and Gordon (1986). Years listed on X-axis are the data points.

Figure II

### Value Added in Manufacturing, 1929



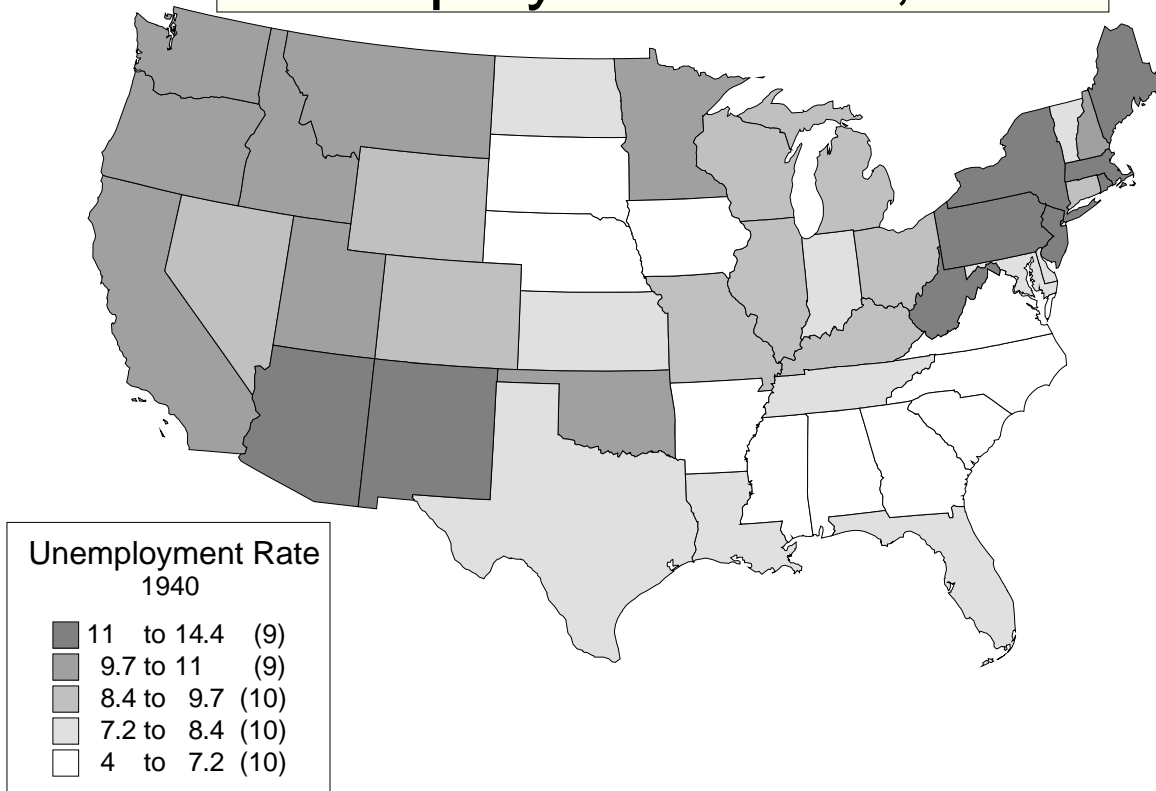
### Value Added in Manufacturing, 1987



Source: *Census of Manufactures*, 1947 and 1987.

Figure III

# Unemployment Rate, 1940



Source: *Statistical Abstract of the United States, 1941*

Figure IV