

Past Successes of Regional Economic Growth Policy

To many regional planners, the Silicon Valley of northern California, Boston's Route 128, Austin, Texas, the Research Triangle, and Delaware represent blueprints for successful economic development. Because of their tremendous growth in a host of different industries beginning in the 1950's, these areas of economic vitality consistently draw the attention of those searching for models of regional growth. However, it should be recognized that, although some aspects of their respective growth models can be applied in other parts of the country, special circumstances were necessary for these regions to thrive. Therefore, these growth models cannot be applied in a uniform fashion.

Silicon Valley

Frederick Terman, a professor and dean of engineering at Stanford University in the late 1940=s first envisioned the Silicon Valley. After he revamped the engineering program at Stanford in the image of the Massachusetts Institute of Technology and built a nationally-recognized graduate program in electronics, Terman embarked on a campaign of "Asteeple building" (Leslie and Kargon, 1996). Instead of competing directly with established universities and regions, it was decided that northern California would concentrate on the technical niches where it had an advantage. By hiring many of the brightest electronics veterans from World War II, Terman built a well-respected research program that, he hoped, would attract top students as well as federal funding and private support.

Interaction between local electronics companies and former and current Stanford students was emphasized. Industrial researchers were encouraged to teach specialized graduate courses, and

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corporate employees could earn their degrees while working full time. In 1951, the Stanford Industrial Park was constructed in what would become the most successful effort to foster interaction between academic and industrial interests. The tenants included such high- technology firms as Hewlett-Packard, Varian, and Lockheed Missiles and Space (Leslie and Kargon, 1996). Companies such as these were largely responsible for the tremendous economic growth that followed.

While the Silicon Valley growth model obviously proved very successful as a catalyst for economic growth in the region, several unique circumstances existed at the time that permitted the plan to achieve such heights. First, many of the high-technology firms present in the area during the late 1950's and early 1960's were dependent on post-World War II defense spending. Second, the heightened entrepreneurial activity resulted in numerous small firms. Because many of the executives at these firms were former classmates at Stanford, significant amounts of inter-firm communication took place that allowed every firm to benefit. One semiconductor executive stated, "This is a culture in which people talk to their competitors. If I had a problem in a certain area, I felt no hesitation to call another CEO and ask about the problem - even if I didn't know him," (Saxenian, 1994). Regions in which this free flow of ideas and trade secrets is not permissible or acceptable would obviously have a difficult time implementing the Silicon Valley growth model. For instance, Terman attempted to copy his success in New Jersey, with Princeton, and Texas, with Southern Methodist University, only to be met with minimal success as the necessary conditions of entrepreneurial activity and firm interaction were not fulfilled (Leslie and Kargon, 1996).

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Route 128

The blueprint for regional economic development employed in Boston had some features in common with northern California. First and foremost, Boston had one of the world's foremost technical institutions in MIT. Also, leading high-technology companies of the day such as Digital Equipment Corporation (DEC), Unitrode, Teradyne, and Computervision lined Route 128, which was dubbed "America's Technology Highway." Therefore, one critical aspect of the Silicon Valley growth model, namely the close interaction between a highly respected research institution and industrial firms, was also found in Boston (Saxenian, 1994).

However, Route 128 lacked the essential feature that made the Silicon Valley such a success - free flow of technical ideas. Communication between different electronic firms in the area was almost nonexistent. Whether it was the conservative social traditions and attitudes of New England or the relative geographical dispersion of the firms compared to Silicon Valley, executives did not endorse the notion of sharing trade secrets. Furthermore, the lack of small firms reduced the entrepreneurial activity in the area (Saxenian, 1994). While Route 128 experienced significant economic growth between the 1960's and 1980's, the experiences of Silicon Valley and Route 128 suggest that industrial systems built on cooperative regional networks are more flexible and dynamic than those in which research and development is confined to individual firms. While the Silicon Valley continues to change and expand, economic growth in the Boston area has slowed somewhat.

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Austin, Texas

Regional economic growth in Austin differed from the models utilized in the Silicon Valley and Boston. Austin's growth strategy initially emphasized regional competitive advantages, especially the labor force and local amenities. In the 1970's the economy of Austin was based largely on the production of semiconductors and other technical components. Because the area was endowed with relatively low cost resources as well as significant local amenities, it was successful in attracting component producers. In the 1980's, the emphasis of regional planning shifted as the region began to concentrate on technology and manufacturing. The perceived strengths of the region changed also as Austin stressed its training and education programs along with its technology partnerships. Despite shifting strategies several times, over 300,000 new jobs were created in the region between 1975-1995 (*Next Century Economy*, 1998).

Although the region experienced significant regional job growth over that time period, the economy still faced a number of threats entering 1996. First, the area's poverty rate approached 15 percent, which was significantly higher than the rate of comparatively sized cities such as Phoenix, Portland, or Salt Lake City. Also, there were signs that the quality of life in Austin may have been deteriorating. For instance, traffic congestion rose rapidly in the 1990's and, consequently, commute times were increasing. Finally, Austin was facing a growing number of low-wage earners who could not maintain their standard of living because of education differentials (*Next Century Economy*, 1998).

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To combat these potential threats to economic prosperity, the area once again shifted regional growth strategies. In 1996, Austin began to emphasize a cluster-based economy. Such an economy capitalizes on agglomeration effects that promote activity by reducing consumer search time and increasing interaction between producers and suppliers. The primary clusters were composed of the following high technology industries: electronics and semiconductors, software, multimedia, film, transaction services, logistics and distribution, biomedical products, and computers and peripherals. Regional planners also concentrated on strengthening the strategic alliance with the University of Texas at Austin, which would serve as a key source of technological resources for the region's industry clusters.

Research Triangle

In the early 1950's, when tobacco, cotton, and timber began to decline as important crops in North Carolina, the value of land began to fall. A perceptive developer, Romeo Guest, began to acquire land in the hopes of building a research park that would attract huge multi-national corporations. In 1953, Guest unveiled his plans to establish a "research triangle" that would be situated between Duke University, North Carolina State University, and the University of North Carolina at Chapel Hill. However, despite the presence of three sizable research universities and a large tract of inexpensive land, firms were hesitant to relocate to the park.

In 1959, the Research Triangle Institute came into existence and the fortunes of the park began to change. The institute was owned by the three universities, and it was an entirely independent

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research institute conducting contract research for outside agencies, mostly within the federal government (Kenward, 1989). The institute acted as a legitimate research organization, and, in 1960, the first company, Monsanto, moved into the park. Growth continued at a constant pace until 1965 when IBM announced plans to build a research facility in the park. In 1965, only 6 firms called the Research Triangle Park home. That number increased to 16 in 1970, 32 in 1980, and 50 in 1989 (Kenward, 1989).

The underlying premise behind the “research park growth model” is that a region’s long-run economic viability depends upon its ability to generate and maintain a group of businesses capable of creating innovative products that can penetrate the consumer market. For regions confronted with a general economic slowdown or recession, research parks represent one way to stimulate the local economy. On the other hand, regions that have been successful in promoting regional growth view research parks as a way to augment their offerings. In general, research parks are intended to be catalysts for the growth of innovative, science-based firms (Goldstein and Luger, 1992).

Research Triangle Park has served as a tremendous stimulus to the Raleigh-Durham economy. In 1989, the park’s various research firms employed 34,000 people. Furthermore, a study revealed that the Research Triangle created 20,000 jobs that would not have existed without the park. That net effect of 54,000 jobs represents more than 10 percent of the entire Raleigh-Durham workforce (Brewer, 1994). It was also estimated that Research Triangle Park adds \$1 billion to the surrounding three-county region (Holmes, 1989). This success, however, required a great deal of patience as nearly 40 years have elapsed since the park’s inception. Furthermore, this prosperity was directly attributable to

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a number of unique factors such as the existence of three research universities in one area and a tremendous amount of low-cost land. Also, in an effort to retain these firms, the park offers its companies nearly one-third off their property taxes, amounting to approximately \$12 million annually (Elstrom et al., 1997).

Delaware

Despite the fact that Delaware enjoyed robust growth throughout the 1980s, the local economy was based largely on manufacturing. With huge manufacturing firms such as E.I. du Pont de Nemours & Co., Inc. Hercules Incorporated, General Motors, and Chrysler Corporation, the emphasis was mainly on the chemical and automobile industries. Realizing that Delaware's economy was somewhat vulnerable to an economic downturn, state planners began to diversify its base. Therefore, in 1981, Delaware passed the Financial Center Development Act (FCDA). This piece of legislation improved the state's business climate by eliminating usury ceilings and lowering the tax rates on bank income.

The diversification effort continued and, in 1995, the state introduced legislation that was designed to keep Delaware competitive in the face of changing interstate banking laws. In 1996, a tax credit was established that benefited Delawareans with new banking jobs; that same year, a new tax bracket was established for banks achieving taxable income above \$650 million. To say that these initiatives have been successful would be to underestimate their impact. The credit card industry is now a vital part of the Delaware economy. These efforts have resulted in an estimated 26,000 new jobs and nearly \$100 million in annual bank franchise tax revenue for Delaware. In 1996, Delaware's per capita income was \$27,724, which was the fifth highest figure in the nation. And these benefits are

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expected to continue as Delaware is now home to seven of the country's top fifteen credit card banks (State of Delaware Comprehensive Annual Financial Report, 1997).

As in the previous four cases, Delaware's growth can be at least partially attributable to a host of unique factors. First of all, these banking laws were introduced at a time when interstate banking regulations were just beginning to be relaxed. If such a regulation were introduced in today's world of huge super-regional and national banks, it would have significantly less impact. Also, fiscal incentives have become very popular in recent years and, therefore, the fiscal initiatives passed in Delaware would not be nearly as effective today. Both of these facts reinforce the notion that successful growth models cannot be applied in a uniform fashion. Regional planners must consider the current business climate as well as the unique situations facing every state.

Past Failures of Regional Economic Growth Policy

The number of failed regional economic growth initiatives is far greater than the number of successful measures. The majority of these growth policies have been modeled after the Silicon Valley, and many have even gone so far as to include the "silicon" moniker in their name. Unsuccessful growth initiatives include such obscure efforts as the Silicon Bayou, Silicon Desert, Silicon Forest, Silicon Mountain, Bionic Valley, Laser Lane, and Ceramics Corridor. These efforts, which represent a fraction of the total number of failed attempts, are not generally recognizable and for good reason: none of them has been as successful as the Silicon Valley, Route 128, Austin, Research Triangle or Delaware's FCDA.

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In each of these failed attempts, regional planners must have initially seen some characteristics that hinted at potential regional growth. If these areas were devoid of such factors, one can assume that these planners would have avoided the effort altogether. Therefore, if a significant part of the groundwork was in place for a successful growth initiative, what caused the various policies to fail? These measures failed in large part because of seven key shortcomings.

First, a region must have a prepared and educated labor force present at the time the effort is initiated. The majority of these efforts hinged on attracting high-tech firms and industries. Therefore, pools of professional and technical employees on which to draw must be available. High-tech firms, which must be at the forefront of innovation and product development, simply cannot wait for an educated labor pool to materialize.

Second, many of these initiatives have not been considered successful because insufficient time has elapsed. Some of these efforts will eventually be successful; however, it will take time. As Malecki (1987) notes, the Research Triangle had its beginnings as a state-supported research park in 1959. However, it took nearly 20 years for the area to begin competing with other regions for major research and development grants. Similarly, the foundations of the Silicon Valley were being laid long before the media dubbed it as such. Therefore, in many cases, these initiatives have not been given enough time in order to properly gauge their degree of success or failure.

Third, some of these policies targeted firms or industries that simply do not create as many jobs as other firms or industries. For instance, the ceramics industry, the target of a growth initiative in New York, does not employ as many people as does the high-tech field. The high-tech industry is the

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most probable source of innovations, successful entrepreneurs, new firms, and new industries (Malecki, 1987). Because of this fact, the high-tech industry would be considered a far more viable and desirable target for growth policies.

Fourth, regions that implement growth initiatives must have the necessary infrastructure present. Evidence suggests that infrastructure is the most important element of growth, especially science-based development (Raymond, 1996). Three types of infrastructure investment appear to be especially critical to the success of growth policies (Malecki, 1987). First, investment in local infrastructure (i.e. schools, utilities, public services) serves to maintain existing enterprises. Second, because professional workers depend heavily on personal communication with associates, investment in transportation infrastructure is necessary. Beyond merely improving highways and roads, locally accessible airports are also critical. Finally, investing in infrastructure that improves the quality of life is important. Recent efforts in Baltimore, Columbus, and Pittsburgh have focused on refurbishing and brightening the business district. All of these efforts serve to attract and hold new firms.

The fifth factor that has led to the failure of different growth initiatives is the inability to take the “second step” towards development. Malecki (1987) states that “a catchy name will not attract high-tech industry.” In many regions, it appears that, while an earnest desire to recruit new industries may exist, the necessary planning and foresight is absent. This results in stalled or aborted regional growth efforts.

Cultural and institutional barriers constitute the sixth cause of failure. Interfirm communication and consultation played an integral role in the development of Silicon Valley (Saxenian, 1994). This led to

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the transferal of ideas and solutions, thereby facilitating innovation and product development. However, such a free flow of ideas between competitors does not exist in every industry or geographic location. While this is often a result of a desire to maintain intellectual property rights or trade secrets, it is just as often attributable to cultural factors.

Seventh and finally, a number of growth initiatives failed due to unique factors. For instance, regional development efforts in New Jersey and Texas in the 1950's failed due, in part, to a lack of government research funding. Other measures have failed because of a they have lacked access to venture capital or ties with a major research institution (Malecki, 1987). These seven shortcomings serve to reinforce the notion that growth models must be applied with regional characteristics and strengths, as well as the current business climate, in mind.

Foundations of Economic Growth

The tremendous economic development in regions such as the Silicon Valley and Route 128 allow regional planners to witness the impact that successful growth strategies can have. However, the relative failures just discussed force planners to realize that growth strategies cannot be applied uniformly across different parts of the country. Regional strengths and characteristics must be considered. However, by analyzing such models as the Silicon Valley, a number of essential elements become evident. Therefore, in order to induce regional economic development in Delaware, the determinants of growth must be investigated and understood.

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People

The first element required for regional economic growth in Delaware is a skilled, educated, and motivated labor force. A region simply cannot grow without a sufficient supply of labor to produce goods and create demand within the region. Tremendous natural resources, a magnificent infrastructure, and a beneficial tax code will all be wasted without such labor.

One of the ways in which the regional labor force can be described is in terms of education or skill level. There exists a pervasive belief that the workforce of tomorrow will be more educated than that of today. Although the magnitude of the increase in education levels is difficult to determine, recent advances in technology and computers will certainly engender a need for more education. It follows that, because the level of skill (proxied by education) demanded in the marketplace will be greater, those regions with a more educated workforce will be more likely to experience above-average economic growth. Therefore, Delaware's workforce needs to be educated and prepared for growth. Many studies have sought to determine the link between education and economic growth. For example, Bartik (1989) concluded that the high school attainment level has a significant positive relationship with a state's entrepreneurial activity. Similarly, Deich (1989) finds a positive relationship between the high school attainment rate and single-plant firm births in manufacturing between 1972-77. This attainment rate also had a significant positive effect on branch plant openings for manufacturing. Porterfield (1990) attempts to determine the effects of higher education on regional

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economic development. He concluded that the concentration of college-educated adults has a strong positive effect on growth in producer services employment.

Bradley and Taylor (1996) conducted a detailed analysis of the relationship between human capital formation and regional economic performance. The primary focus of this study was on the interaction between the vocational education and training system in Britain and economic performance. The training program currently in place has forced the country into a low skill equilibrium where the majority of workers possess inadequate skills and education. For example, Prais (1993) demonstrated that the percentage of the labor force with intermediate qualifications was 25 percent in Britain in 1989 as compared with 40 percent in France (1988), 57 percent in the Netherlands (1989), and 63 percent in Germany (1988). As a result of these lower levels of education, low quality products abound. Obviously, with the global movement towards quality products and total quality management (TQM), such poor products will undermine economic growth in the region. Bradley and Taylor argue that it is the interaction between the education system and the socio-economic system that determines the economic performance of a locality. Furthermore, they conclude that regions, countries in this case, with poor socio-economic infrastructure and economic performance also tend to suffer from an inadequate educational system. Because the poor educational system has negative ramifications for long-term economic prosperity, the process becomes self-reinforcing.

These studies concerning the effects of education on the economic growth potential of a region are far from unanimous, however. Some researchers feel that the link between education and economic growth is not a significant one. For instance, Schmenner et al. (1987) find that the percentage of the

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state workforce that completed high school has a negative, albeit insignificant, relationship with the probability of attracting serious consideration for a manufacturing branch plant. Also, McNamara et al. (1988) conclude that the percentage of the workforce attaining a high school diploma has a significant negative impact on the probability of attracting a new manufacturing plant.

Beyond the education level of a workforce, the entrepreneurial spirit inherent within a region's people is frequently cited as a factor necessary for economic development. In Delaware, we need look no further than E.I. du Pont de Nemours & Co., an innovator in the chemical industry, and more recently W.L. Gore & Associates, which invented Gore-Tex material to see the importance of entrepreneurship. Once researchers were able to distinguish between jobs provided by autonomous firm births and the expansion of existing businesses, it became apparent that a large proportion of new jobs are created by the creation of autonomous, small and medium enterprises. While these gains are often offset by losses associated with firm deaths, the net gain is positive (Reynolds, 1994). Furthermore, some feel that a considerable degree of job turbulence is healthy. A stagnant job market could indicate that the region lacks structural change and, in the long run, will experience below average economic growth. In addition to improving a region's economic outlook, new firms bring innovations to the marketplace which transform every consumer's life by expanding consumer choice.

One manner in which to gauge the relationship between entrepreneurial activity and economic growth is to analyze the correlation between various measures of the two over time. Reynolds (1994) examined the correlation between firm birth rates for 1984-1986 and 1986-1988 and job growth (per

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100 existing firms and per 10,000 jobs in the same industry sector) for the concurrent period, immediately following period, and period following a two-year lag. While this may be considered a fairly simple measure of association, it does provide a base on which to build future analysis. Nearly all the correlations are positive, which indicates that some positive relationship does exist between entrepreneurial activity and economic growth in Delaware.

As it was stated previously, analyzing the correlation between firm births and economic growth is a fairly simplistic approach. Therefore, Reynolds expanded his study and attempted to isolate the independent effect of entrepreneurial activity by comparing two different models. The first model examines various regional characteristics, which include demand, agglomeration, unemployment, wealth, small firm specialization, and local government spending, and their impact on growth. All of these characteristics are thought to have a positive effect on regional growth. The second model includes these variables as well as a measure of new firm birth rates. Theoretically, if the second set of variables improves the explanatory power of the model, then it would follow that entrepreneurial activity provides an independent contribution to growth. By including firm births, the second model explained more of the variation in growth rates in the metropolitan regions and when all regions were considered.

Schmitz (1989) believes that while entrepreneurial activity is important for economic growth, it is actually the imitation of that entrepreneurial activity that truly spurs on significant development. In previous studies, entrepreneurial activity has been the key factor in economic growth with the imitation of the activity assigned only a minor role. Schmitz' focus on the imitation role of entrepreneurship is

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an extension of growth records in past societies that have not been explained by standard models. Schmitz suggests that the key element in economic growth is the extent to which entrepreneurial activity is directed at implementing knowledge. In conclusion, it is determined that if a region like Delaware has a relatively high proportion of entrepreneurs, it will indeed grow faster than those economies with relatively fewer entrepreneurs.

When combined with the study of the correlation between entrepreneurial activity and growth, this research suggests that the entrepreneurial spirit within a region is a significant determinant of economic development. However, it is also apparent that firm births alone will not provide the impetus for economic growth in Delaware. Therefore, this data suggests that entrepreneurial activity, while necessary, may not be sufficient for growth.

Sites

The second primary determinant of economic growth in Delaware is the availability of suitable business locations. Business locations such as these have characteristics that can typically be separated into three constituent categories. First, promising locations need to have the physical space in which to operate. For the most part, the amount of suitable land within the state is fixed. Second, sites must have the public services necessary to support production. Public services include such things as highways, telecommunications networks, water facilities, and police and fire protection. These are actually different types of infrastructure and, therefore, they will be discussed in the following section. Finally, locations must have the appropriate land-use planning. Land-use planning can be further divided into direct planning, or zoning, and indirect planning, such as incentives and subsidies.

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Because indirect land-use planning is covered later, this discussion will focus on direct land-use planning, specifically zoning. Zoning is the oldest and most easily recognized form of regional planning (van Kooten, 1993). It essentially involves assigning certain rights to land owners. For example, parcels of land that are designated as residential areas cannot be used for commercial or industrial purposes. Zoning has been criticized on a number of grounds. First, it is considered to be ineffective (van Kooten, 1993). For instance, critics of zoning point to Houston as an example of an unzoned city that developed similar land-use patterns as those found in Dallas. Second, zoning is aimed explicitly at protecting the value of private property, which has little in common with promoting efficient land use. Third, zoning is negative in that it specifies only what cannot be done. Finally, the zoning process tends to be manipulated by wealthy property owners (van Kooten, 1993).

Despite these criticisms, zoning does have several implicit benefits. First, the goals of zoning tend to be environmental in nature. Second, outdoor recreational benefits are also tied to land-use issues. Hunting, hiking, camping, and amenities (a foundation of growth which will be discussed later) are all related to the utilization of land. Third, zoning helps in the distribution of a regions population. And finally, land-use controls aid in the preservation of agricultural land (van Kooten, 1993).

Despite the criticisms and benefits of zoning, two issue emerge. In order for economic growth to take place, land-use regulations must be clearly delineated and information regarding different sites must be readily available (Dale, 1997). Without clear land-use regulations, firms are hesitant to relocate for fear of violating ordinances. Also, planners and developers need information regarding available sites for development as well as more complex data such as contaminated land (Dale, 1997).

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Both of these measures assist in promoting economic growth and, therefore, are vital components of zoning regulations.

Infrastructure

Infrastructure represents the third essential determinant of regional economic development in Delaware. Infrastructure is typically thought of as those facilities either owned by the government or government-regulated utilities that are used in the delivery of public goods and services. Therefore, public capital serves as an umbrella category that is composed of many different types of infrastructure. While highways are the most palpable manifestation of transportation infrastructure, this group also includes roads, canals, railroads, and airports. Sanitation infrastructure is composed of sewage systems and water treatment facilities. And, as the 21st century approaches, telecommunication and electronic infrastructures are becoming critical to economic development in Delaware.

The importance of infrastructure, or public capital, for economic growth stems primarily from its effect on private firm=s location decisions. Private industry views public capital, such as highways, sanitation systems, telecommunications systems, and railroads, as inputs in the production process that lead to output. However, unlike private inputs which must be purchased on a per unit basis, public inputs are provided by Delaware=s government and financed predominantly through taxes. Since the quantity of public capital utilized is only very loosely related to each individual firm=s taxes paid, public capital represents what could be considered an unpaid input. Furthermore, assuming that

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individual private firms have little control over the level of infrastructure spending, public capital is actually exogenous from the firm's perspective (Duffy-Deno and Eberts, 1991).

Most studies concerning the effects of infrastructure investment use a composite number to measure changes in roads, telecommunications, sewer, and the like. Fox (1990), however, presents a different framework in which to discuss the benefits of infrastructure. Concentrating on the demand side effects of infrastructure construction, he observes that building infrastructure increases the regional demand for private inputs and stimulates the multiplier effects within the economy. Furthermore, the multiplier effects will be greater if the necessary funding originates outside the region. Garrison (1994) concludes that the greatest benefit of infrastructure is its ability to serve as a catalyst for development and increased productivity in Delaware through improving efficiency.

The link between infrastructure investment and regional economic development has been the subject of much research. While few economists doubt the positive effects of public capital investment, a considerable amount of disagreement does exist as to the precise magnitude of those effects. Using aggregate data, Aschauer (1989) estimates a production function for aggregate private output as a function of labor, nonresidential private capital, public capital, time, and manufacturing capacity utilization. He concludes that the elasticity of output with respect to public capital to be 0.39, which means that a 10 percent increase in public capital is usually accompanied by a 3.9 percent increase in output. Munnell and Cook (1990) showed a smaller yet still quite significant effect of public capital on productivity. By segregating the public stock into several constituent categories, the authors found the elasticity of output with respect to public investment to be 0.15, the largest portion of

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which is attributable to highway investment. Both of these models have been criticized, however, on the grounds that they do not account for statistical problems such as serial correlation and nonstationarity.

Harmatuk (1996) felt that the effects of infrastructure investment on aggregate output derived by Aschauer and Munnell were exaggerated, and he attempts to correct for the previous problems by utilizing disaggregated data and correcting for the statistical problems of stationarity and cointegration. The final model estimated by Harmatuk has an elasticity of net nonmilitary public investment equal to 0.03. The extremely small standard of error of this estimate suggests that while net nonmilitary public investment has a significant impact upon output, the effect is almost certainly less than 0.39.

Duffy-Deno and Eberts (1991) also criticized previous models, albeit on different grounds than Harmatuk. They felt that prior regional growth studies typically used capital expenditures as a proxy for capital stock instead of estimating capital stock directly. Their model attempts to correct the problems of previous research. First, Duffy-Deno and Eberts estimate a system of two equations that incorporates three dimensions of the relationship between infrastructure investment and personal income: (1) public infrastructure as an input into the production process, (2) public investment as a construction activity, and (3) the level of public infrastructure as a consumption good in households= utility functions. Next, the authors construct estimates of the existing public capital stock using the perpetual inventory technique for a sample of metropolitan areas. Finally, the relationship is estimated using a two-stage least-squares model in an effort to avoid simultaneity bias. The results of the model suggest that the level of public infrastructure in Delaware has a significant effect on personal income.

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The authors find that the effect of public investment on income results primarily through the construction of public capital stock (either replacement or additions). Public capital stock investment increases income by increasing employment and wages in the construction industry. The coefficient could also account for a multiplier effect through other parts of the local economy. Overall, Duffy-Deno and Eberts conclude that a 10 percent increase in public expenditures increases per capita income by 0.37 percent using ordinary least squares estimates and by 1.1 percent using two stage least squares estimates.

Institutional Environment

The fourth influential determinant of regional economic growth is the institutional environment. Also referred to as the "business climate", institutional environment encompasses a host of critical laws and incentives which are designed to attract firms from outside Delaware as well as encourage growth of existing companies within the state (i.e. "grow our own" strategy). With the recent increase in competition for relocating firms, states have begun to modify their respective regulations to appeal to such firms. Because firms attempt to maximize profits, regional planners strive to find ways to reduce the firms' costs. These attempts can be separated into four major categories: incentives, fiscal policy, labor market considerations, and enabling, or intellectual property, regulations.

Incentives have traditionally been thought of as economic development regulations or policies that attempt to provide financial (as well as other) encouragement for companies to relocate or expand within Delaware's borders. Such incentives are predominantly provided through fiscal policy, and include such items as industrial revenue bonds, property tax abatements,

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state loans, and industrial training. In the 1970's, however, "new wave" regional economic development policies began to move to the forefront (Bartik, 1991). Such policies support different types of innovation and change: research, industrial modernization, and technological advancement. These policies also tend to encourage interaction, even consultation, between firms and the local government. Examples of such policies are small business development offices, research-oriented industrial parks, technology transfer programs, and government-financed loan programs, most of which can be found in Delaware (Bartik, 1991).

When a firm considers relocating, its management must confront several issues. Where should the company move in relation to customers? To suppliers? To competitors? The answers to these questions differ depending on the nature of the industry. Some industries, such as the automobile and steel industries, have historically concentrated their expansion within a single geographic area, namely Detroit and Pittsburgh. Other firms, such as gas stations for instance, attempt to locate as far away from competition as possible in an effort to differentiate themselves. These different lines of business, however, have a common underlying motive: profit maximization. Location theory states that firms will select those locations that result in maximum profits (O'Hallachain and Satterthwaite, 1992). Furthermore, because most firms face pricing pressures resulting from fierce competition, attention is focused on reducing costs. Incentives such as tax abatements and the like represent a way in which firms can reduce costs and increase profits. Therefore, they are a popular way in which to attract economic development. Theoretically, it appears that solid reason exists for local incentives to be a determinant of

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economic development. Walzer and P'ng (1995) examined the relationship between incentives and manufacturing employment between 1982-1987. Four types of incentives were considered: tax abatements, deferred tax payments, loan subsidies, and issuance of tax-exempt bonds. As expected, lowering the cost of capital through the use of loan subsidies and the issuance of tax-exempt bonds had a significant change on manufacturing employment. These two incentives provide ways for firms to lower their costs and, therefore, maximize revenues. It was somewhat of a surprise, however, that tax abatements and deferred tax payments were both insignificant in the model. Some researchers feel that property taxes do not represent a significant cost to firms; as a result, tax abatements are only considered symbolic of the local government's economic support. O'Uallachain and Satterthwaite (1992) also found the relationship between incentives and regional economic growth to be mixed. They concluded that the variation in taxes and subsidies are not significantly related to the location of either high-technology manufacturing or most services. On the other hand, the existence of university research parks, considered a proxy for focused economic development programs, is associated with increased job growth.

Fiscal policy is the second major category within regional institutions. While taxes were discussed briefly as a type of incentive, fiscal policy is a much broader topic with five distinct categories (Bowman, 1995). First, categorical exemptions from the tax base represent incentives that exclude entire classes of otherwise taxable assets from the tax base. As of July 1992, forty-two states, including Delaware, excluded at least a portion of business inventories, the most popular exemption, from the property tax base (Bowman, 1995). Second, targeted tax incentives represent

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a manner in which tax relief is restricted to particular industries or geographical locations. Third, local discretionary property tax relief allows local governments to offer their own set of property tax incentives to stimulate economic growth. Fourth, specific project-related incentives are only applicable to certain projects. Finally, miscellaneous tax incentives include such items as exemptions for economic revitalization areas, urban renewal projects, and historic property preservation (Bowman, 1995).

Fiscal policy incentives are an extremely popular method of economic development. By offering tax incentives like those described above, regional planners attempt to attract firms to Delaware with the potential of reducing costs. Some people, however, see a problem with using fiscal policy as a way to attract new industries or firms. Because the competition for attracting relocating firms is so fierce, some suggest that successful tax incentives will merely be replicated by surrounding states until fiscal policy is eventually a ubiquitous factor in location decisions.

The empirical results of the relationship between tax incentives and ensuing economic development have been mixed. Many researchers have argued over the appropriate method of analysis and relevant data. However, some interesting relationships have emerged. First, Wasylenko and McGuire (1985) concluded that manufacturing location decisions appear to be more sensitive to taxes than nonmanufacturing decisions. This is a reasonable finding given that manufacturing firms tend to have significant amounts of capital, which is a taxable asset. Second, Gyourko (1987) determined that capital-intensive industries are more sensitive to taxes on capital

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than other industries. Once again, this is an expected result. These findings cause Bartik (1991) to comment:

"The long-run elasticity of business activity with respect to state and local taxes appears to lie in the range of -0.1 to -0.6 for intermetropolitan or interstate business location decisions, and -1.0 to -3.0 for intrametropolitan business location decisions. That is, if a given small suburban jurisdiction within a metropolitan area raises its taxes by 10 percent, it can expect in the long run a reduction in its business activity by from 10 to 30 percent. If an entire metropolitan area or state raises its taxes by 10 percent, the estimated long-run effect would be a reduction of business activity between 1 percent and 6 percent."

The third category of institutions is state labor regulations. Labor regulations in Delaware should support workers and encourage them to relocate or migrate to a region. As a result, a state will have an attractive labor pool from which to hire employees. However, labor regulations should also consider prospective employers in that regulations that mandate higher wages and the like could discourage development. Relevant labor laws involve such issues as arbitration, collective bargaining, drug testing, labor standards, and "right-to-work" laws (Estreicher and Collins, 1988). While all the labor regulations that affect economic development cannot be discussed here, a few of the most important issues will be examined.

In 1947, the Taft-Hartley amendments to the 1935 National Labor Relations Act allowed states to pass "right-to-work" laws. These regulations effectively banned the union shop, a provision that required employees to financially support the local union. A large number of states adopted such laws in the late 1940's and early 1950's; today, only twenty one states, located

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primarily in the south and Rocky Mountains, have such "right-to-work" (RTW) laws on the books (Moore, 1998).

Two different, yet complementary, explanations are given for the passage of RTW laws. Palomba and Palomba (1971) theorize that the passage of such regulations enhances the attractiveness of the state's labor force to new industry and promotes a faster rate of economic development. Moore and Thomas (1974) argue that existing employers support RTW laws even if they fail to attract new industries because such regulations slow the growth rate of unions. Both hypotheses support the notion that RTW laws are beneficial in the eyes of employers and, therefore, important factors in attracting new firms.

Garofalo and Malhotra (1992) studied the economic effects of RTW laws, and they concluded that such laws reduce the unionization rate by approximately one-third. For most RTW states the price of labor is between 10 percent and 18 percent lower than the price of labor in non-RTW states. Furthermore, RTW laws tend to lower the cost of capital between 9 percent and 19 percent (Garofalo and Malhotra, 1992). Newman (1983) also found that RTW laws have a significant positive effect on employment growth in 11 of the 13 industries studied. He also found the effect to be stronger on labor-intensive industries than on capital-intensive industries.

These results suggest that labor laws that attempt to reduce costs in some manner or encourage increased worker productivity can be quite successful in stimulating economic development in Delaware. Whether it is enacting right-to-work laws that reduce the costs

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associated with union labor or mandating worker drug testing to improve productivity, these laws help in attracting relocating firms.

A final institutional environment factor is the regulation of intellectual property rights such as patents, trade secrets, copyrights, and research and development. Intellectual property rights protection within a region can either be weak or strong with viable arguments on both sides. Those who argue for weak protection argue that strong protection permits monopolistic behavior as well as the hoarding of patents in order to prevent competition. On the other hand, the case for strong protection is reinforced by survey evidence which suggests that, at least in the U.S., protection stimulates innovation (Mansfield, 1986).

Gould and Gruben (1996) examined the relationship between intellectual property rights and economic development using an index of patent protection developed by Rapp and Rozek (1990). The index ranks the degree of patent protection on a scale of one (no patent protection) to six (fully consistent with minimum standards of protection). Gould and Gruben find that stronger protection of intellectual property rights corresponds to higher rates of economic development. Evenson and Ranis (1990) also conclude that intellectual property rights play a significant role in development.

In conclusion, Delaware's institutional environment or "business climate" can be a significant determinant of the level of economic development. Incentives, fiscal policy, and labor regulations provide ways for firms to reduce costs and, therefore, maximize profits. The protection of intellectual property rights encourages firms to innovate by eliminating the fear that others will

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replicate such advancements. Furthermore, Delaware should consider having a single office where prospective firms could obtain information regarding the business climate. Such "one-stop shopping" would make the process of relocating significantly easier and would, therefore, encourage growth.

Amenities

The fifth element considered essential for regional economic development is the existence of regional amenities. Amenities can include such things as pleasant climate, cultural and recreational opportunities, local public services, public education, and a low crime rate. Economic theory suggests that amenities can serve to attract labor as well as private firms, and, therefore, support economic growth and development.

Krugman (1993) discusses the role of *First nature* and *Second nature* conditions present during the rise in importance of the city of Chicago. *First nature* conditions refer to the geographic resources present while the term *Second nature* is reserved for agglomeration economies. Krugman suggests that what *First nature* failed to provide for the city in terms of natural advantages, the agglomeration economies of the *Second nature* more than compensated. Therefore, Chicago's role as a transportation hub, along with its concentration of production, provided the incentive for still further concentration of production. Kohler (1997) feels that, while the first and second natures are certainly important in regional economic development, the *Third nature* (i.e. regional amenities) is also integral to growth. It is consumers' preferences that make

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these regional amenities relevant determinants. Furthermore, migration and capital inflow into Delaware is not only determined by the state's absolute attractiveness, but also by its relative attractiveness compared to surrounding regions.

Clark and Cosgrove (1991) use a host of amenity variables to explain the wage differentials among workers in various geographic locations. Their list of amenity variables includes the following: climatic conditions, urban scale-related amenities, number of major-league sports teams, murder rate, air quality, population, and outdoor recreation. Clark and Cosgrove anticipated that amenities reduce wages, while disamenities would increase wages, *ceteris paribus*. The results of the model indicate that wages in any given region reflect the level of amenities or disamenities present. The authors conclude that workers who live in areas with above average rainfall, and in cities with high murder rates or low levels of air quality receive higher wages. Locations with higher living costs also had higher wages as expected. The findings of this paper suggest that Delaware's amenities are very relevant factors in explaining the level of economic activity within a region. Because it is assumed that private firms migrate to regions where profit can be maximized, the relatively lower wages paid in areas with significant amenities serve to attract new businesses. The increased amenities within the region offset the wage differential in the eyes of workers.

In a study concerning the relationship between residential amenities and firm location, Gottlieb (1995) uncovered several important implications for economic development. First, the relationship between amenities and firm location is better described as avoidance of disamenities than as attraction to amenities. Specifically, reducing the level of violent crime was isolated as a

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key factor in attracting new firms. Secondly, regional planners should consider separating amenities into two groups: those that matter at the worksite (i.e. violent crime) and those that matter only at the sites of likely residences (i.e. pollution). This separation implies that the amenities available in the surrounding areas are also extremely important when attempting to encourage growth. Finally, Gottlieb concluded that amenities were likely to affect the composition of employment, but not necessarily the density of employment. Agglomeration economies, which will be considered in the following section, are still considered the most important variable in a firm's site selection.

Agglomeration Economies

The notion of agglomeration economies, or circular and cumulative causation, was first presented by Myrdal (1957). And, although he was actually considering the interactions between Caucasians and African-Americans in the 1950's, Myrdal was the first researcher to realize the implications that size and momentum could have for economic development:

The point is not simply that many forces are working in the same direction. They are, in fact, not doing so. In general, there are periods when opposing forces balance one another so that the system remains in rest until a push or pull is applied at one point or another. When the whole system starts moving after such a shock, the changes in the forces work in the same direction, which is something different. And this is so because the variables are so interlocked in circular causation that a change in any one induces the others to change in such a way that these secondary changes support the first change, with similar tertiary effects upon the variable first affected, and so on.

Kaldor (1970) also noticed the historical relationship between the growth of productivity and efficiency and the growth in the scale of activities. Furthermore, he began to explicitly

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enumerate the advantages arising from the growth of industry: the development of skill and know-how, the opportunity to differentiate processes, specialization in human activities, and ease of communication. Kaldor argues that the principle of cumulative causation is essentially the existence of increasing returns to scale in its broadest sense. These increasing returns favor “rich” regions and inhibit growth in “poor” regions.

Cost savings in transportation and the sharing of urban infrastructure have often explained agglomeration. However, one of the most significant benefits of agglomeration economies is the fact that employers in such regions have access to vast pools of specialized labor, and the costs and time of search for both parties is lower. Kim (1987) concludes that this specialization reduces the training cost of labor, or at least minimizes the loss of productivity resulting from the mismatch between workers and firms. Consequently, as the size of Delaware’s economy increases, the average productivity of labor should increase also.

Agglomeration economies have significant implications for the location decisions of new firms entering the industry. It appears logical that a new firm’s decision to enter a market should be based, at least partly, on the observed behavior of other firms in that industry. If spatial location were not an important determinant of economic success, then we would expect to see firms spread across the country in a uniform manner. On the other hand, if location is considered a critical success factor, then this should be reflected in the decisions of firms. For instance, because acquiring information regarding optimal locations can be so expensive, many firms are naturally drawn to locations where other firms already exist. By following other firms, new companies can

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reduce or entirely eliminate the search costs involved with industrial location (Pascal and McCall, 1980).

The advantages of agglomeration economies, however, transcend mere specialized labor pools and reduced search costs. By locating in an established urban setting, firms can maximize information-intensive business contacts. Davelaar and Nijkamp (1989) argue that it is these types of interactions that spawn innovation, particularly product innovation. Urban economies promote frequent consultation, discussion, and collaboration that allow for increased efficiency. Henry (1992) contends that it is these synergistic effects which exceed what can be accounted for by reduced transaction costs and vertical integration.

A significant amount of empirical research has been performed on the relationship between agglomeration economies and regional economic development. Head et al. (1995), for instance, examined the location choices of 751 Japanese manufacturing plants built in the United States between 1980-1995. They concluded that the coefficients interpreted as agglomeration effects are very statistically significant and appear to increase the attractiveness of a location by a respectable percentage.≡ Smith and Florida (1994) also demonstrate that the location of large automobile assembly plants figured prominently in the location decisions of over 200 automobile parts firms.

Empirical findings such as these are certainly not confined to one particular industry or even several industries. Karlsson (1997) studied the importance of agglomeration economies for product development and innovation in three sub-industries within the engineering industry - the machinery industry, the electrical engineering industry, and the instrument industry. He determined

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that the size of the regional labor market, closely related to agglomeration effects, is a statistically significant factor in product development and the adoption of innovations. Moomaw (1988) studied a broad range of eleven different industries and determined that significant agglomeration economies existed in the primary metals, chemicals, printing, and electrical machinery industries. Because these industries benefit from large urban markets, economies of communication, and frequent interactions with supplier and customers, they tend to respond to agglomeration economies.

Realities of Economic Growth

Provided that the state of Delaware had unlimited resources, the growth strategy of choice would be to pursue development in every industry and in every location within the state simultaneously. However, because Delaware has limited resources, it is not able to pursue growth of all kinds in all places. Therefore, the state must utilize its resources in a selective and efficient manner. However, on what basis will future economic growth proposals in Delaware be evaluated?

We propose that initiatives should be evaluated on the basis of their respective benefits and potential costs.

Benefits of Economic Growth

Job Opportunities

The first significant benefit of regional economic growth is the provision of desirable job opportunities for Delawareans. While Delaware is very dependent on the in-migration of workers

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from the surrounding states, the end result of economic growth initiatives is to create jobs for the local population. Bartik's (1994) study of the effects of job growth on local labor markets led to several pertinent conclusions. First, evidence suggests that stronger local job growth has significant labor market benefits for local residents. It was concluded that a 10 percent increase in jobs in a metropolitan area increases local employment rates by 2 percent in the long-run. In other words, around one in five of the new jobs created goes to the original residents with the other four being taken by in-migrants. In addition to job growth, a 10 percent increase in metropolitan employment also increases long-run real wages by 2 percent. This rise in real wages results from local residents obtaining higher-paying positions in expanding industries.

Second, Bartik (1994) concluded that local residents manage to retain these real income gains in the long-run, despite the presence of in-migration. In the short-run, when demand for labor surges but in-migration remains limited, local residents are able to obtain jobs which they may not have been initially qualified to obtain. Because these jobs provide training and skill-building, local residents are made permanently better off.

Next, Bartik found that the increase in real wages is greatest for disadvantaged groups. Therefore, high school dropouts benefit more than college graduates and the lowest-income quintile families gain more than the average family. Finally, in a somewhat related finding, Bartik concluded that the benefits of job growth are significantly greater for jobs with a high wage premium (i.e. jobs that pay well relative to the skills required to perform the job).

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These research findings suggest that economic growth in the state will provide greater job opportunity for Delawareans. Furthermore, the research concludes that the growth will be focused among the relatively disadvantaged groups and have long-run benefits for all groups.

Expanded Tax Base

A second major benefit of economic development is an expanded tax base that allows for more public goods and services. As the local economy grows, new firms are established or relocate to the region. New housing developments come into existence as well. As a result, the state's tax revenues increase which provides the funds for greater investment in public projects such as improved highways or schools. The tax base has two sub-categories: the business tax base and the property tax base. Business taxes are directly related to corporate profits and are greatly affected by the local tax structure. The property tax consists of taxes on residential property (approximately 55 percent of total property taxes in the majority of districts), commercial and industrial property (30 percent) and other properties such as farms and mineral property (15 percent) (Bowman, 1995).

Danielson and Wolpert (1991) studied regional economic growth and the resulting broadening of the tax base that took place in northern New Jersey during the 1970's and 1980's. During this period, the region gained 400,000 new jobs. The localities within the region differ significantly in terms of population, size, wealth, and land use. It also contains suburban towns and rural municipalities that exhibit significant differences in demographic characteristics. In the 1970's, the property tax base had a real growth rate of 24 percent and grew by an additional 75 percent between 1980 and 1987. Furthermore, the business tax base per employee almost doubled

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in real terms (48.7 percent increase) and grew almost three times faster than the rate of job growth (17.3 percent) in the 1980's.

This tremendous broadening of the tax base allows local municipalities to offer expanded public services. Therefore, economic growth in Delaware could likely be translated into better schools, transportation infrastructure, police and fire protection, and utilities. Furthermore, because of agglomeration economies, these public services act to reinforce existing economic activity in the state. Therefore, Delaware's economic growth will tend to be cumulative.

Increased Property Values

A third major benefit of economic growth in Delaware is the increase in residential property values. While the value of land is a function of many different variables, including land characteristics and the characteristics of buyers and sellers, one of the most influential considerations is the level of current and expected economic growth in the area. A general hypothesis helps to understand the relationship between economic growth and residential property values: land values should vary directly with the levels of current and expected future residential demand. In other words, in those regions experiencing rapid growth, higher future expectations will increase current land values (Ottensmann, 1977).

A significant amount of empirical research has been performed regarding the effects of economic growth on property values. Ottensmann (1977) expected a priori that higher median family income allows people to offer more for properties and, therefore, it should have a significant effect. In a regression analysis using 51 Standard Metropolitan Statistical Areas (SMSAs), his

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expectations were supported. It was concluded that a \$100 increase in median income produced a \$20 to \$40 increase in land values. Danielson and Wolpert (1991) also discovered a positive relationship between growth and property values. Once again studying regional growth in northern New Jersey, it was concluded that per capita residential property values had a real growth rate of 29 percent in the 1970's and 71 percent in the 1980's.

The empirical findings provide strong evidence that economic growth positively influences residential property values. Because individuals' homes are normally their most valuable possession, increasing economic activity in Delaware would greatly increase the wealth of individuals, thereby making Delawareans significantly better off. Furthermore, this could have trickle down effects into other areas; as individuals' wealth increases, their spending would likely rise also. This would serve to further stimulate economic activity.

Ensuring Delaware's Future

Because growth is cumulative and reinforcing (Myrdal, 1957), economic growth in Delaware will help to ensure Delaware's future. Economic growth brings with it a number of well-documented by-products discussed earlier: development and specialization of skills, differentiation of processes, and ease of communication (Kaldor, 1970). Furthermore, other agglomeration economies, such as the sharing of transportation infrastructure, also result. All of these factors contribute to make Delaware more attractive to firms that are considering relocating or establishing themselves. Therefore, the growth process can be characterized as circular and reinforcing.

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Increased Consumer Choice

A final major benefit of economic growth in Delaware is the increased consumer choice it creates. This increased choice can be separated into three primary categories. First, economic growth allows consumers to choose from a greater range of products. Because growth tends to increase income levels, consumers can purchase existing products that were considered too costly prior to the growth. However, because growth is also associated with entrepreneurial activity, consumers can also select from a spectrum of innovative products not offered previously.

Second, economic growth also spawns the development of new residential developments. Although many economists feel that this phenomenon, called urban sprawl, imposes a cost on society in the form of increased inefficiency, there is an association between economic growth and development. Therefore, as a result of economic growth, Delawareans have a wider range of places to reside.

Finally, because of the agglomeration economies discussed earlier, growth tends to reinforce and attract new types of growth. Therefore, once Delaware has gained a “critical mass”, more firms are attracted to the area. As a result, Delawareans have a greater choice of firms and occupations from which to choose. This allows for better and more efficient matching of skills.

Potential Costs of Economic Growth

Congestion

Traffic congestion is one of the most significant costs (if not *the* most significant cost) of economic development in Delaware. As a region grows and expands, the existing transportation system eventually becomes insufficient to handle the increased numbers of vehicles necessary to transport supplies, finished goods, and labor. Bottlenecks and queues develop and slow transportation. If left unremedied, this situation can cause tremendous inefficiency and waste within a region. Beyond the mere inconvenience of longer trips, congestion imposes significant costs in the form of increased travel time, increased fuel usage, and increases in vehicle collisions, all of which serve to increase freight costs and reduce productivity. In addition, increased automobile emissions result in increased environmental costs.

The British Road Federation estimated that in 1985-86 congestion cost over 3 billion pounds (at 1987-88 prices) in the seven largest UK conurbations. Furthermore, nearly half of that figure could be directly attributed to London (Banister, 1994). In 1989, the Confederation of British Industry concluded that congestion cost the economy over 15 billion pounds a year. When one realizes that this figure represents approximately 3 percent of Britain's GDP, it becomes apparent that congestion is a significant economic cost of development (Banister, 1994). However, these figures do not even begin to address the environmental and health costs of congestion, which include a rise in the incidence of asthma and bronchial related cases in congested areas.

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Economic growth, specifically employment growth, is one of the primary causes of congestion. In Delaware, employment grew 14.4 percent during the 1980's, and incomes also increased rapidly. According to the National Transportation Statistics (1997) congestion is increasing most significantly in areas characterized by rapid employment and/or income growth. Economic development is not the only determinant of congestion, however. Dunphy (1997) describes several additional factors influencing travel patterns in the United States. Another important determinant of gridlock is population expansion. Population growth began to slow in the U.S. during the 1980's, dropping below 1 percent per year. However, even at this reduced growth rate, millions of new residents are being added every year. Between 1990 and 1995, the U.S. population rose by nearly 14 million people. The U.S. Census Bureau expects a net gain of approximately 34.9 million persons between 1995 and 2010. Delaware is expected to follow this national trend with a projected population growth of 22 percent between 1995 and 2020 (Bekka, 1997). In a study performed by the Wilmington Area Planning Council, New Castle County is ranked 8th among 21 metropolitan areas in the U.S. in rate of population growth. Clearly this pattern hints at increased congestion in Delaware in the coming years.

The second principal determinant of congestion is a growing dependency on the automobile. As Dunphy points out, during the 1980's, the "family" car, a vehicle used by all members of the family, virtually disappeared, and by 1990, the number of vehicles owned by households had surpassed the number of drivers within households. In New Castle County, for instance, nearly 60 percent of households had two or more vehicles in 1990 (Bekka, 1997).

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Furthermore, Delaware has the highest percentage of driving age population with licenses in the region as well as the region's highest number of registered vehicles per capita. Both figures are above the national average (Bekka, 1997).

Besides economic development, population expansion, and a growing dependence on the automobile, a number of other factors are cited as causes of increased congestion. Demographic shifts, increasing travel distances, zoning regulations, and lack of public transportation have all garnered support as factors contributing to congestion (Dunphy, 1997).

Because congestion has such a pervasive effect on so many aspects of our lives, many researchers have analyzed ways in which to reduce or alleviate the problem. Broadly speaking, the strategies for coping with traffic congestion can be segregated into two categories: those which address the issue of increasing the stock of public capital (i.e. building more roads) and those which support more efficient usage of currently existing highway networks. Boarnet (1997) confronts this issue by examining the link between highway congestion, labor productivity, and output in a sample of California counties for the years 1977 through 1988. Boarnet's model emphasizes that policymakers can increase the service flow from streets and highways either by increasing the street and highway stock or by using the existing stock in ways that facilitate more efficient travel. After analyzing the relevant data, Boarnet reaches two conclusions. First, congestion reduction measures can affect county output. This is obviously a very important realization; if it were not evident that congestion reduction affected regional output, then tax dollars used for such purposes could be diverted to other programs. However, it appears that such measures do improve production.

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Boarnet also concludes that, in many cases, economic benefits from the transportation infrastructure can best be realized by using the existing stock more efficiently. Therefore, by employing such means as highway pricing or toll roads and by encouraging employers to schedule their workdays to reduce congestion, those streets and highways already in existence could be used more efficiently.

Several remedies to highway congestion have received attention in transportation literature. Highway pricing, subsidies for mass transit, high occupancy vehicles, fuel taxes, and parking taxes all have characteristics which could help to alleviate the problem (Bekka, 1997). However, because of consumer opposition, these measures have yet to achieve widespread acceptance.

Although congestion appears to be a growing cost of economic development, there is hope that policy initiatives will lessen the effect of the problem. Provided that some or all of the aforementioned measures are adopted, economic development no longer needs to be associated with traffic congestion and the health and environmental costs that accompany it.

Crime

Increased crime is a second potential cost of regional economic development. The nature of the relationship between growth and crime is the subject of considerable debate. Some feel that the social vitality present in thriving economies puts pressure on the existing police forces as well as other forms of discipline, such as the legal system. This group views the law enforcement capabilities of a state to be capable of handling only a fixed amount of lawlessness; any illegal acts beyond this point cannot be contained, which will encourage still more corruption. Obviously,

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such people view a direct relationship between economic development and crime; crime is, therefore, an externality of economic growth (Hemley and McPheters, 1975).

Another theory states that improved economic performance provides gainful employment for those who would have otherwise turned to lives of crime. Those who would have previously been driven to steal, rob, or murder, become, in the presence of economic prosperity, productive members of society. Actually, a proponent of this hypothesis would probably concede that the link between economic growth and (the lack of) crime is really indirect in nature. The greater per capita income associated with economic growth translates into better schools or vocational training programs. These measures would, in turn, further education, which would discourage crime. Also, illegal acts have a high opportunity cost in a thriving economic environment. Therefore, economic growth indirectly reduces crime rates and makes a region relatively more safe.

Hemley and McPheters (1975) studied the relationship between economic development and crime for the period 1933-1970. They estimated a regression relationship between total crime rate and several different variables measuring production and income. All of the independent variables had the expected effects, although variables associated with per capita and aggregate income explained the most variance in total crime rates over the period. Overall, the association was positive and significant.

Regional economic growth tends to be associated with an increasing number of people, both native and visiting. Such individuals serve two primary functions: to provide human capital and to create a market for goods and services produced in the region. Jarrell and Howsen (1990) believe

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that such large concentrations of people make the apprehension of criminals more difficult and, therefore, encourage illegal activity. Furthermore, criminals can expect to be rewarded with greater payoffs because of the relatively larger number of wealthy individuals.

In their model, Jarrell and Howsen include several variables that account for the intrusion of strangers. Tourism, the presence of a college or university, the presence of establishments that serve alcohol, and close proximity to an interstate highway are all factors that tend to increase the number of strangers in a region. All of these variables were included in a model. Using data from the state of Kentucky, it was concluded that an increase in the number of strangers into an area has a positive effect on a number of different crimes.

Tourism, which necessitates the temporary immigration of numerous strangers, has a positive impact on burglary, larceny, and robbery as tourists are relatively easy (and wealthy) targets. The college/university variable has a positive and significant impact on only the crime of assault. Also, it was concluded that regions in which alcohol distribution is allowed (wet regions) have a higher incidence of each crime than do dry counties. It is quite likely that this could be the result of alcohol impairing the perpetrator's judgment, effectively increasing the benefit/cost ratio of an illegal act. Finally, because having a close proximity to an interstate highway system greatly facilitates escape, it is found that the variable is significant for burglary and robbery.

The findings have several important implications for economic development in the state of Delaware. The four variables included in the Jarrell and Howsen model characterize New Castle

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County and, to a lesser extent, Kent County quite well. New Castle county has traditionally been a popular attraction as tourists from the surrounding states come to see Hagley Museum, Winterthur, and, more recently, Judy Johnson Field and the Riverfront Museum. Also, southern New Castle is home to the University of Delaware, an institution with over 21,000 students representing the U.S. and over 100 foreign nations. Interstate 95, the primary interstate highway system in the eastern United States, has numerous exits between Newark and Wilmington that allow strangers to traverse the entire county. Finally, New Castle County is a Awet≡ county with significant numbers of establishments serving alcohol. In addition, the area is bordered by Pennsylvania, Maryland, and New Jersey, allowing many people simply drive across state boundaries in order to visit these establishments.

Similarly, Kent County has many of the same characteristics that were so foreboding in the Jarrell and Howsen study. The Delaware State Fair and Dover Downs Speedway are attractions which bring spectators from across the country. In addition to potentially greater crime rates, these events also cause tremendous amounts of congestion on Delaware 1 and U.S. 13. Delaware State University, located in Dover, currently has over 3,300 students; furthermore, it is located in close proximity to U.S. 13, which leads to Virginia, Maryland, Pennsylvania, and New Jersey. Finally, Kent County would have be classified as a Awet≡ county.

There is obviously no guarantee that crime rates in Kent and New Castle counties will rise as a result of increased economic activity. Delaware may possess a law enforcement department or judicial system such that it is better prepared to handle the stress that economic prosperity can

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possibly cause. However, the Kentucky study does present some interesting dilemmas and food for thought. In terms of policy, officials who favor economic development should consider the findings that increased illegal activity often accompanies economic growth.

Environmental Degradation

A third significant potential cost of economic growth in Delaware is environmental degradation. In recent years, ever-increasing attention has been given to the state of the environment. Many people remember when the environment was unpolluted and pure (at least, many remember it as such). Environmental tragedies such as the Exxon Valdez oil spill off the coast of Alaska dominate the headlines, even if more mundane sources of pollution (i.e. untreated sewage, carbon dioxide emission, fertilizer run-off) do substantially more damage. A general theory is often mentioned in popular periodicals that directly links economic development and environmental degradation. Problems like those alluded to above are held up as examples of this belief. However, others feel strongly that the relationship between growth and degradation is not inherently problematic; in fact, economic growth can reduce environmental damage. Much research has been performed on the relationship between growth and degradation.

Those who believe that development does not cause environmental degradation have focused their efforts on the relationship between per capita income and various measures of environmental health. This group adheres to the hypothesis that increased pollution is tolerated as an acceptable externality of economic growth. However, when a certain standard of living (measured by per capita income) is attained, constituents begin to focus on surrounding

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environmental amenities. At this point, government policies and individual efforts are aimed at environmental improvement. Emission regulations are passed; clear-cutting is banned; and, river clean-ups are organized. All of these efforts have the desired effect of improving the environment for future generations.

Grossman and Krueger (1995) confronted this relationship. Recognizing that previous research had been criticized on the grounds that very few environmental measures were employed, Grossman and Krueger investigated the relationship between economic activity and a much broader range of indicators. First, urban air quality, a major concern in larger cities such as Los Angeles, but still important in smaller metropolises like Wilmington, was measured by variables accounting for sulfur dioxide and suspended particles. These two pollutants have been well documented as causes of lung disease. Also, the water quality of river basins is assessed using thirteen variables, including oxygen levels, pathogenic contaminants, and heavy metals. As a result, this study was much more comprehensive than others previously performed.

After analyzing the data, it was concluded that the link between economic development and environmental degradation is not supported. In fact, most variables indicate that economic growth brings an initial stage of degradation followed by a period of environmental improvement. Arrow et al. (1995) also support this inverted-U relationship. Concurrent with the previous theory, it appears that as per capita income increases, the demand for environmental protection equipment increases as well. Furthermore, Grossman and Krueger determine that, in most cases, this turning point is reached at a per capita income of \$8000.

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Other researchers in the field of economics and ecology do not share in the belief that economic growth does not necessarily cause environmental degradation. They argue that growth, or even striving to grow, actually causes environmental damage. Regional growth typically hinges on the use of fossil fuels and other materials; however, these extracted resources represent future pollutants unless used in some type of construction (Ayres, 1995). It is also suggested that, while environmental improvements may be made as income increases, this could be a direct result of relatively richer countries exporting their waste to other poorer nations. Therefore, the health of the environment as a whole is not improved; the location of the degradation is merely altered (Ayres, 1995).

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Urban Sprawl

Urban sprawl is a fourth major potential cost associated with economic growth in Delaware. Urban sprawl, which is the scattering of new developments on isolated tracts that are separated from existing developments by vacant land, can cause significant inefficiency and create problems for local governments. The separation of residential areas leads to increased costs in providing utilities and other public services. Travel distances to economic centers are lengthened, which increases congestion on local highways. New provisions must be made for local schools as well as fire and police protection. Thomas (1990) found that urban sprawl leads to conflicting land uses, pressures on agricultural and open space, higher cost of service provision, transportation congestion, and social disparities.

A great deal of disagreement exists as to the magnitude of the costs associated with urban sprawl. Razin (1998) states that it is an undesirable form of development because of its economic, social, and environmental costs. The Real Estate Research Corporation (RERC) (1974) also concluded that urban sprawl results in significantly higher costs than would be found in carefully planned communities with higher residential densities and contiguous, or continuous, development. While this sentiment seems intuitively appropriate given the inherent characteristics of urban sprawl, some researchers disagree with these findings. Windsor (1979) criticized the RERC study on the grounds that it failed to isolate the effects of density and planning from other sources of variation in development costs. Peiser (1984) concluded that the costs of urban sprawl were lower than expected; he concluded that the cost of sprawl was only 3 percent higher than planned

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residential development. Furthermore, Peiser (1989) found that urban sprawl did not actually lead to inefficiency (as measured by residential density); cross sectional analysis indicates that densities increase over time in almost every distance zone studied.

Despite the apparent disagreement as to the implications of urban sprawl, a number of policies have been suggested in order to cope with the potential problem. First, modest changes in local taxation policies and other sources of local revenue can contribute to the reduction of piecemeal development. However, these measures have generally been found to be insufficient. Therefore, local government reform, consisting of the combination or creation of larger municipalities, has also been considered (Razin, 1998). Such changes are aimed at increasing efficiency, effectiveness, equity, and local democracy. Larger governmental units have been shown to reduce the cost of government in some cases (Dolan, 1990).

The research regarding urban sprawl supports the notion that it can be a cost of economic growth. By definition, it increases the distance between residential developments; as a result, the costs of providing utilities and other public services is increased. The greater distance between residential and economic areas acts to increase congestion also. However, with proper measures, such as local government finance reform and the creation of larger municipalities, the severity of urban sprawl can be mitigated.

Loss of Regional Identity

A fifth major potential cost associated with economic growth in Delaware is the loss of regional identity. Although this cost is less quantifiable than the previous costs discussed, it is

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certainly no less important. Policies that encourage economic growth but force the region to change markedly (from a rural to an urban area, for instance) may not be in Delaware's best interests. Therefore, growth initiatives should not merely be undertaken for the sake of growth; such measures should foster the types of growth that complement the underlying social and economic fabric of a region. After studying the explosive economic growth in New Jersey in the 1980's, Danielson and Wolpert (1991) conclude that "growth should be compatible with community character...Making large amounts of land attractive to developers, for instance, is rarely compatible with maintaining community character."

Desirability of Growth Varies by Industry and Location

Regional economic growth cannot be pursued in an indiscriminate fashion. The general goal is focused regional expansion through desirable industries. However, because each industry has its own specific characteristics, its relative attractiveness also varies. Industries vary in terms of environmental degradation, space requirements, and average salary among other things. For instance, according to the Office of Occupational and Labor Market Information (OOLMI), the average salary in the financial, insurance, and real estate (FIRE) sector in Delaware is approximately \$36,000. On the other hand, the average salary in the retail sector is only \$15,000. Therefore, in terms of the economic welfare of Delawareans, the FIRE industry is much more desirable.

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The desirability of growth initiatives also varies by location. Danielson and Wolpert (1991) provided evidence which suggests that a region can experience all the benefits of economic growth while avoiding many of the associated costs. For example, if a firm in the FIRE industry wanted to relocate to Delaware, where should it do so? If the company moved to northern Delaware, the state would benefit from increased per capita income, increased tax base and the like. However, because of the existing congestion in that area, the costs of such a move would be sizable. On the other hand, if the firm moved to southern Delaware, the state would receive all the benefits of the move with minimal costs. Therefore, because of regional variations within the state, the desirability of different growth measures also varies.

What Is “Economic Growth”?

“Economic growth” can be measured in a number of ways. First, growth can be examined in terms of an aggregate measure such as Gross State Product (GSP). Growth can also be measured by the number of jobs created. Using this measure, the change in the number of Delawareans employed determines the state’s growth. These measures of gross output and employment are adequate for measuring aggregate growth. However, increases in personal income are more relevant for determining the economic welfare and average material well being of individual constituents (Malizia, 1990). Therefore, when “economic growth” is discussed, the focus is usually placed on changes in per capita personal income.

A Systematic Evaluation of Growth Proposals

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Once the relevant foundations, costs, and benefits of economic growth have been explored and expounded upon, one faces the task of evaluating future growth proposals. Proposals differ in not only their respective costs and benefits, but also the magnitude of those costs and benefits. An initiative that is welcomed in New Castle County may be wholeheartedly rejected in Sussex County. Policymakers, therefore, need a framework in which to begin to analyze different proposals and their effects. The following matrix serves as just such a tool.

		Industrial Sector									County		
		Agr.	Constr.	Man.	Trans.	Whole.	FIRE	Retail	Service	Gov't	New Castle	Kent	Sussex
Benefits	Job Opportunities												
	Public G&S												
	Property Values												
	Future												
	Consumer Choice												
Costs	Congestion												
	Crime												
	Environment												
	Urban Sprawl												
	Identity												

This matrix allows for the systematic evaluation of different growth proposals. The effects of specific proposals can be compared easily by gauging the magnitude of each benefit and cost. The following example illustrates the usefulness of the matrix. Assume that a hypothetical growth proposal was suggested in which a company in the FIRE industry wanted to relocate to New Castle County. What would be the likely ramifications of such a move?

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		Industrial Sector	County
		Financial, Insurance, Real Estate	New Castle
Benefits	Job Opportunities	+	+
	Public G&S	+	+
	Property Values	+	+
	Future	+	+
	Consumer Choice	+	+
Costs	Congestion	-	-
	Crime		
	Environment		
	Urban Sprawl	-	-
	Identity		

On the other hand, suppose a firm in the manufacturing sector wished to relocate to New Castle County. Because of the differences between the two sectors and their respective costs and benefits, the matrix would appear somewhat differently.

		Industrial Sector	County
		Financial, Insurance, Real Estate	New Castle
Benefits	Job Opportunities	+	+
	Public G&S	+	+
	Property Values	+	+
	Future	+	+
	Consumer Choice	+	+
Costs	Congestion	-	-
	Crime		
	Environment	-	-
	Urban Sprawl	-	-
	Identity		

Conclusion

Delaware has a solid foundation currently in place on which to build future growth initiatives. However, in order to attain economic growth, three main conditions must be met. First, the benefits and potential costs of all growth proposals must be thoroughly understood. Second, the mistakes of failed regional development efforts must be avoided. Finally, local leaders must build upon the foundations currently in place. Provided that these conditions are met, Delaware should expect to achieve a sustained level of economic growth in the next century.

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Appendix

Executive Summary and Slides Presented at

Delaware Public Policy Institute Forum on Choices for Delaware:

Life and the Economy in 2000 and Beyond

Presented November 16, 1998 at the University of Delaware

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Kenneth A. Lewis
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There are several prominent examples of successful regional development and many more of failed regional development. Reproducing a "Silicon Valley" in Delaware is unlikely. Factors that have led to the failure of many large-scale regional development efforts include an unprepared labor force, insufficient time to allow for success, failure to recruit key firms and/or industries, inadequate infrastructure, cultural and institutional barriers to growth, and in general an inability to take the "second step" in the growth process. What we can reasonably expect in Delaware is sustained moderate economic growth in the future, provided we understand the costs and benefits associated with

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growth, build on the foundations currently in place, and avoid the mistakes of failed regional development efforts.

What are the foundations of regional economic growth? The professional literature stresses the importance of educated people and of an infrastructure (roads, telecommunications, sewer, water, airports, and ports) that works. Also important is the cultural and institutional environment, including incentives (taxes and enabling legislation), sharing of intellectual property rights, labor laws, “one-stop” shopping, and clearly delineated land use rules. Research indicates that, while incentives have historically been provided through fiscal policy, “new wave” programs have recently moved to the forefront; these policies include support of innovation, industrial modernization, technological advancement, and technology transfer programs. Tax abatements are generally not significant, while right-to-work laws are. While regional amenities are important to economic growth, in firm-location decisions, avoidance of disamenities is more important than attraction to amenities. Finally, the professional literature stresses the cumulative and reinforcing effects of regional growth.

Economic growth policy for Delaware must face the reality that economic development resources are limited. Delaware does not have sufficient resources to promote economic development of all kinds in all places and must be selective with regard to growth policies. Benefits and costs should be the basis for the selection of growth policies.

What are the benefits of growth in Delaware? Providing desirable job opportunities for Delawareans, expanding the tax base to support increased public services, increasing private-property values, ensuring Delaware’s future (growth is cumulative and reinforcing), and

Economic Growth in Delaware: Costs, Benefits, and Realities

expanding consumer choice are at the top of the list. Research indicates that one in five new jobs created goes to local residents, with the other four going to in-migrants.

The potential costs of economic growth in Delaware include congestion, crime, environmental degradation, urban sprawl, loss of local identity, and cross-border effects. Research indicates that congestion can be a particularly high cost and the benefits of the transportation infrastructure can best be realized by using the existing stock more efficiently. Higher incomes lead to higher total crime rates. Economic growth brings an initial stage of environmental degradation, followed by a period of improvement; when a particular standard of living is attained, constituents begin to focus on surrounding environmental amenities. Research also indicates that the costs of urban sprawl can be sizeable. A final cost that is particularly important for Delaware stems from the reality that our growth is fueled by out-of-state workers. The State must provide transportation infrastructure to continue to accommodate these workers. On the other hand these costs are mitigated by the expansion of the local tax base without requisite resident costs such as schools, sewers, etc.

Benefits vary by industry and by location. Average salaries, for example, range from \$36 thousand in the finance sector to \$15 thousand in the retail sector. Average income is approximately \$32 thousand in New Castle County, but only \$21 thousand in Sussex County. Research indicates that the distribution of benefits is wider than the immediate growth area. Costs vary by industry and location as well, particularly environmental sensitivity and the congestion/identity trade off.

What do we mean by economic growth? Growth measures include more jobs, more people, more tax revenue, and more public services. Research indicates that while gross output and

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employment are adequate measures, personal income is more relevant for determining the economic welfare and average material well-being of individuals.

It is important to develop a scheme to systematically evaluate the costs and benefits associated with specific growth proposals. We present a tableau to help accomplish this task and provide three example evaluations. The first example is a hypothetical financial firm desiring to locate in New Castle County, the second is a manufacturing firm in New Castle County, and the third is a manufacturing firm in Kent County. For each case we examine the prospective costs and benefits.

Can we reasonably expect sustained moderate economic growth in Delaware in the future? Yes, provided that we avoid mistakes of others, recognize growth opportunities and be prepared to take the necessary second steps, build on the foundations currently in place, be receptive to the important cultural and institutional determinants of growth, understand the costs and benefits associated with various proposals, be cognizant of the need to handle the cross-border effects and explore “new wave” governmental policies.

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