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GROWTH IN CITIES: A KWAZULU-NATAL PERSPECTIVE.[1]

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[1] The views expressed in this working paper are the views of the author and might not necessarily reflect the views of the Provincial Treasury.

This paper reports the results of a study that was conducted to test the hypothesis that knowledge spillovers are supportive of city growth. A number of city economic theories and recent theories of economic growth suggest that cities are the engine for knowledge spillovers and that those knowledge spillovers are crucial in generating growth. This study makes use of data on the growth of large industries in 12 KwaZulu-Natal provincial cities between 1996 and 2007. The study finds that regional specialization, monopolistic competition and urban variety encourage employment growth in city-industries. It must however be emphasized that some of the results were mixed, most probably because of the short period of analysis and some question marks about the reliability of the data. Nonetheless, the results suggest that knowledge spillovers might occur within industries rather than between industries. Industries thus move to regions in which they are present rather than to regions which they are not present.

1. INTRODUCTION

In a province such as KwaZulu-Natal, South Africa, or for that matter any of the 9 provinces, rural and urban settlements or regions play an important role in meeting the general needs of their inhabitants. These cities and towns sustain development and growth in their immediate surrounding areas and the province as such and are an integral part of the national spatial economic system. Cities and towns thus do matter because it is where economic activity occurs, i.e., production and consumption and the allocation of resources predominantly takes place in towns and cities. It can also be argued that most innovations and technological progress are made in cities. Towns and cities are thus very relative in the modern economy and therefore the factors that determine the economic growth of a city is as relevant.

Glaeser, et al (1992) states that cities create an opportunity to learn from others and thus improves one's own productivity and without such opportunities there would be little reason for people to pay high rents just to work in a city. They suggest that easy flow of ideas might explain how cities survive despite the high rents. The work by Glaeser et al fits nicely with a number of recent work with regard to the underlying theories of the "city economy".

The majority of theories relevant to the city economy and the work of Glaeser, et al (1992) views externalities and particular externalities associated with knowledge spillovers as the main determinant of growth. It is based on the argument that if geographical proximity facilitates the transmission of ideas then it would be expected that knowledge spillovers to be particularly important in cities. Intellectual breakthroughs in most cases cross hallways and streets much more easily than oceans and continents.

Glaeser, et al (1995) states that growth experiences in the last 30 years of the United States cities varied widely. The population of some grew enormously while the other cities virtually disappeared. They suggest that some dispersion of growth experiences can be explained by geographical factors, such as the movement of population west and south, but questions the economic forces that explain city growth over the last 30 years in a cross-section of the United States cities.

The majority of analysis with regard to the economic forces that explain city growth is based or is a continuation of an extensive regional growth literature that includes the studies of Borts (1960), Kain and Neidercorn (1962) and Mills (1992). Numerous studies, such as Chnitz (1962), Jacobs (1969) and Marshall (1890) focus on human capital as the determinant of city growth. Romer (1986) and Lucas (1988) support the argument that human capital is a significant determinant of growth in that they state that knowledge spillover is the "engine of growth". Bernstein and McCarthy (2005) argue that the

localities that do grow do so due to natural resources, technology, and lifestyles that attract entrepreneurs and effective local governance.

The main aim of this study is to test the hypothesis that knowledge spillover and human capital is a key determinant of city growth. The study will focus on the cities, both rural and urban, in the KwaZulu-Natal provincial economy rather than on the cities of the national economy, because of the author's familiarity of the characteristics and dynamics of the cities in the KwaZulu-Natal provincial economy. However, it would be much more desirable to focus on the cities throughout the national economy, as the number of "large" cities in the provincial economy is much less than the number of "large cities" in the national economy. It must also be stated that the quality of economic data is a cause of concern because of the limited amount of quality economic data on a city level. This limitation is also emphasized by Luus and Krugell (2005) in a similar study.

This paper will predominantly make use of the methodologies employed by Glaeser, et al (1992) and Glaeser, et al (1995).

The paper will be structured as follows: section II will focus on a brief description of the three major theories related to the city economy, section III will focus on the theories of dynamic externalities, section IV describes the data whilst sections V and VI present results for the growth of city-industries and the results of the preliminary econometric analysis. Section VI presents conclusions.

2. ECONOMIC THEORIES RELEVANT TO THE GROWTH OF CITIES

The majority of economic theories related to the benefits of being located in a city cite localisation economies and urbanisation economies as the primary reasons. Localisation economies refer to the benefits a firm receives from being with other firms in the same industry. Urbanisation economies refer to the benefits of overall scale and diversity in cities. The primary theories

relative to the city are briefly discussed below with specific reference to the possible factors that support or reduce city growth.

2.1 Urban Economic Theory

Urban economics is at the core of regional science and has contributed significantly to a better understanding of the urban system, thanks to the works of Von Thünen, Christaller, Alonso, Muth, Isard and many others. The interactive structure of the urban space-economy has generated many externalities which are decisive for continued urban economic growth. In the literature very often a distinction is made between three types of externalities in the city:

- Urbanization and localization economies often referred to as Marshall-Arrow-Romer (MAR) externalities; these externalities are closely associated with specialisation economies.
- Synergy economies that originate from cultural and socio-economic diversity in the city (often referred to as Jacobs externalities); such externalities are based on social learning mechanisms in an urban 'melting pot'.
- Competition economies that are related to the need to do novel things if there are many competing business actors in the same city, often referred to as Porter externalities

The various economies of density in the city do not only have direct economic dimensions (such as efficiency and productivity aspects), but also spatial aspects ('principles') in a broader regional and (inter)national context (Camagni, 1992):

- Agglomeration principle: the high density of production and residential activities in the city – based on physical proximity – creates special

territorial forms of the city (e.g., on the basis of concentric patterns stemming from rent gradients).

- Accessibility principle: the interactions between transport costs and land use form the basis for urban mobility patterns.
- Spatial interaction principle: the intensive and frequent contact potential between urban actors induces various forms for density economies and related spatial implications.
- Urban hierarchy principles: socio-economic heterogeneity in the city creates a socio-economic and territorial division of labour and residential patterns and hence induces socio-economic disparity.
- Competitiveness principle: cities are breeding places of new ideas and call for permanent business innovations which require tailor-made spatial provisions in favour of urban efficiency mechanisms.

2.2 New Economic Geography Theory

New Economic Geography (NEG), according to Eckey and Kosfel (2004), represents a rediscovery of space in economics. The concept goes back to Krugman and deals with the question of how agglomerations form and under what conditions they are (un)stable. The standard model of New Economic Geography (NEG) presents a synthesis of polarization and neo-classical theories. Within a monopolistic competition framework it aims to explain processes of concentration and de-concentration of manufacturing in a two-sector economy.

The polarization models – whether sectoral or regional – form a counter-thesis to neoclassical location theory, which is based on an inherent tendency of the market economy system towards spatial equilibrium. If reasonable framework conditions are set by politics, economic regions converge. On the other hand, polarization theory presupposes a reinforcing process of increasing concentration and spatial imbalances (Eckey and Kosfel, 2004).

Whereas in neo-classical theory every deviation from equilibrium triggers counter forces, which restore the system to equilibrium, a circular cumulative process arises in polarization theory and this process is based on feedbacks, which distance the system further and further from balance. Assume two regions and call them A and B. Originally they are at the same level of development. Suddenly, region A (region B) is affected by a positive (negative) external shock, in the form, for example, of the set-up (closure) of a company. In the neo-classical model this gap will be quickly closed by adjustment of income and movements of the labour force. In the polarization theory, however, forward and backward linkages lead to increasing deviations from spatial equilibrium. In our example, workers move from B to A. Thus, purchasing power is transferred to A and, because of multiplier effects, contributes to the extension of the services sector. Consequently, advantages of accumulation and urbanization accrue, which make A even more attractive than B and result in increased economic activity in the region and so on. As on a slide, production shifts from B to A. Whether this happens totally depends on the strength of the negative backward linkages present. Among these latter are increasing land prices in A, an overburdened infrastructure and increasing environmental problems (Eckey and Kosfel, 2004).

Krugman (1991) argues that the new economic geography literature also shows that firms might locate near the households when these are already concentrated (Courtney, Lépicier and Schmitt, 2005). In theory, this allows them to both increase the size of their local market and to reduce transport costs. For the same reasons, households tend to locate near firms in order to obtain a wider consumer choice. The size of local final demand on the geographical concentration of production, often called the “Home Market Effect”, could also influence the geographical distribution of firm transactions. Indeed, firms located in an area where the market for its output is large may sell its products more locally. A similar effect could be hypothesised for input markets. Krugman and Venables, (1995) in Courtney, Lépicier and Schmitt (2005) showed a positive relationship between the sizes of the local inputs market, the level of concentration in firms using these inputs. Thus, they

hypothesise that a larger inputs market will favour a local purchasing behaviour.

There are four key terms for the (first-generation) NEG. The first is the general equilibrium modelling of an entire spatial economy which sets apart this approach from that of traditional location theory and economic geography. The second is increasing returns or indivisibilities at the level of individual producer or plant, which is essential for the economy not to degenerate into “backyard capitalism” (in which each household or small group produces most items for itself). Increasing returns in turn lead to the market structure characterized by imperfect competition. The third is transport costs (broadly defined), which makes location matter. Finally, the locational movement of productive factors and consumers is a prerequisite for agglomeration (Fujita and Mori, 2005).

2.3 New Urban Economics (NUE)

The notion of the ‘New Urban Economics’ emerged in the late 1960s as more rigorous approaches were applied to what had largely hitherto been an essentially descriptive approach to analyzing urban economies. The application of mathematical methods to urban problems offered the prospect of both a more thorough understanding of how urban economic systems function and a basis upon which frameworks could be developed for quantitative testing of alternative ideas (Button, 1998).

In the early 1970s, a variety of authors such as Beckmann, Muth, and Mills began developing mathematical models to explain the growth dynamics of simple urban forms. These urban areas are typically characterized by having one single place of employment at the centre surrounded by residential places from where people commute into the central business district (CBD). The assumption of a single transport mode is common. These models have inherent limitations because for their analytical power they rely upon very restrictive assumptions; they tend to limit applicability to the abstraction. Their isolation from reality would seem to be particularly true in the 1990s, when

metropolitan areas were in a state of reformulation. No longer is the CBD the only place one may find gainful employment. No longer are suburbs simply places for residential quality of life and low-order retail (Button, 1998).

The NUE model asserts the following: cities have historically been seen as places to live and work, with the suburbs being merely secondary retail centres and bedroom hamlets.

3 THEORIES OF DYNAMIC EXTERNALITIES

The Glaeser et all (1992) study focuses on three theories, all which deal with technological externalities, whereby innovations and improvements occurring in one firm increase the productivity of the other firms without full compensation. The Marshall-Arrow-Romer (MAR) externality concerns knowledge spillovers between firms and industry. The MAR theory also predicts that local monopoly is better for growth than local competition. Porter (cited in Glaeser, et al, 1992) supports the MAR theory and argues that knowledge spillovers in specialized, geographically concentrated industries stimulate growth. However, Porter insists that local competition, as opposed to local monopoly, fosters the pursuit and rapid adoption of innovation. Jacobs (cited in Glaeser, et al), unlike MAR and Porter, believes that the most important knowledge transfers come from outside the core industry. As a result, variety and diversity of geographical proximate industries rather than geographical specialization promote innovation and growth.

The three theories can be summarized using a simple economic model that guided the empirical work. The model allows the user the measure specialization, local monopoly and city diversity empirically. The model is as follows:

$$\alpha \log\left(\frac{l_{t+1}}{l_t}\right) = -\log\left(\frac{w_{t+1}}{w_t}\right) + \log\left(\frac{A_{\text{national},t+1}}{A_{\text{national},t}}\right) + g(\text{specialization, competition, diversity, initial conditions}) + e_{t+1}.$$

Where L is the labour input at time t, w is wages at time t and where A represents changes in technology at time t measured nominally. The growth rate will be the sum of the growth of national technology in this industry and the growth of local technology. The growth of the national technology is assumed to capture the changes in the price of the product as well as shifts in nationwide technology in the industry and the local technology is assumed to grow at a rate exogenous to the firm but depending on the various technological externalities present in this industry in the city. Glaeser, et al (1992) states further that the model is restrictive in an important respect in that it assumes that knowledge spillovers are constant over time and therefore affect both mature and young industries.

The model gives three impressions, i.e., 1) rapidly declining city-industries were more regionally concentrated that the rapidly growing ones, 2) industries grew faster in diversified cities than in specialized ones and 3) fast-growing city-industries were more competitive than shrinking city-industries. These general findings turn out to be the general empirical findings as supported by the three theories.

Glaeser, et al (1995) examines the relationship between urban characteristics in 1960 and urban growth (income and population) between 1960 and 1990. They examine population growth experiences of 203 large US cities between 1960 and 1990 as a function of their location, initial population, initial income, past growth, education of the labour force, output composition, unemployment, inequality, racial composition, segregation, size of government and several other factors. Their primary purpose was to understand which cities grew. Glaeser, et al (1995) treated cities as separate

economies that share common pools of labour and capital. Differences in urban growth experiences cannot, therefore, come from savings rates or exogenous labour endowments; rather they differ only in level of productivity and their quality of life.

Glaeser et al (1995) model labour income, quality of life and therefore total utility derived from a particular city as follows:

Labour income of a potential migrant is the marginal product of labour

$\mathbf{W_{i,t} = \sigma A_{i,t} L_{i,t}^{\sigma-1}}$

Where $\mathbf{A_{i,t}}$ represents the level of productivity in city i and time t and $\mathbf{L_{i,t}}$ denotes population of city i at time t.

Quality of life = $\mathbf{Q_{i,t} L_{i,t}^{-\varsigma}}$

Where ς**>0** and is declining in the size of the city. Quality of life is meant to capture a wide range of factors. Total utility of the potential migrant to the city i is :

Utility = $\mathbf{\sigma A_{i,t} Q_{i,t} L_{i,t}^{\sigma-\varsigma-1}}$

Glaeser et al (1995) states that their primary measure of city growth is the growth of its population. They also state that income growth could be an appropriate measure of city growth, however they indicate that income growth also captures declines in quantity of life and is a less perfect measure of general urban success. Their economic determinants of city growth are determined through the use of regression models with the log of population growth rate the primary dependent variable. Some of their findings are as follows:

Income and population growth move together and both types of growth are:

positively related to initial schooling

negatively related to initial unemployment and

negatively related to the share of employment initially in manufacturing.

Government expenditures (except for sanitation) are uncorrelated with urban growth.

Government debt is positively correlated with later growth.

Weather and other regional characteristics have played an important role in migration and hence the growth of cities.

McGregor and Liner (2002) conducted research on the determinants of US municipal economic growth between 1960 and 1990, building on the work by Glaeser et al (1995). They also state that another major objective of the research was the searching of evidence to confirm or refute the per capita income convergence predicted by the neoclassical model of economic growth. They argue that municipalities are completely open economies between which recourses tend to be highly mobile and are usually more specialized economic units than the national. They thus directly imply that there are fundamental differences between the national and local economy and thus each requires its own focus as suggested by this study.

They base their research on a population and income growth equation where

Y = Population or per capita real income growth;

Var 1 = the natural logarithm of 1960 municipal population;

Var 2 = the level of municipal per capita real income in 1960;

Var 3 = the unemployment rate in the municipality in 1960;

Var 4 = Median years of schooling of individuals age 25 and older in 1960;

Var 5 = the per capita level of municipal debt outstanding in 1960;

Var.6 = A dummy variable for municipalities in Southern states (Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia);

Var. 7 = A dummy variable for municipalities in Midwestern states (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin);

Var.8 = A dummy variable for municipalities in Western states (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming);

Var.9 = the percentage of the employed municipal population working in the manufacturing sector in 1960; and

Var.10 = the 1960 percentage of the municipal population that was non-white.

Population growth is measured as the natural logarithm of the ratio of 1990 municipal population to 1960 municipal population. Per capita real income growth is measured as the natural logarithm of the ratio of 1990 municipal per capita real income to 1960 municipal per capita real income. The omitted regional category in our population and income growth equations is the Northeast, which includes municipalities in Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. We include the regional dummy variables to control for differences in U.S. regional economic development between 1960 and 1990 (McGregor and Liner, 2002).

The research found the following:

Growth in population is positively related to the initial level of educational attainment in the municipality and negatively related to the initial municipal unemployment rate.

They however could not find a statistical negative relationship between population growth and the initial share of municipal employment in manufacturing.

They also found through sensitivity analysis that a 10 percent increase in educational attainment would have increased population growth almost 7 percentage points and income growth about 5 percentage points supporting a growing body of evidence about the importance of human capital as determinant of municipal economic growth (McGregor and Liner, 2002).

4 THE DATA

The data set was constructed from the 1996 and 2008 editions of the Regional Explorer, produced by Global Insight Southern Africa (www.globalinsight.co.za) and from the 1996 and 2001 Census data and the 2007 Community Census data, produced by Statistics SA (www.statssa.gov.za). Where possible the abovementioned data has been augmented and supported by a database created and maintained by the author. The year 1996 was chosen because it was the first year with comprehensive data and 2007 was the last year available. It must be stated that 11 years might not be a sufficient enough period and that the reliability of the data in some cases is questionable and that this could pose some question marks related to the reliability of the findings of the study.

The data set contains the information on employment, labour remuneration and gross operating surplus by one-digit industry for every municipality in the province of KwaZulu-Natal. Wages was obtained by dividing labour remuneration by employment. The data is on a municipal level and not on a city level, simple because no such data on a city level is available. However almost all municipalities in the province follow the typical polycentric city model as conceptualized by the New Economic Geography theory and the New Urban Economics theory and therefore it is possible to argue that the municipality is basically an extension of the basic polycentric city. It is thus possible to relate the municipal data to the city level. All data is in nominal terms.

There are 51 municipal regions and 1 metropolitan region in the province, thus there are 52 cities in the province. The cities range from very small to very large in terms of population size, however all cities generate economic activity and therefore are characterized by some sort of business structure. All of these cities achieved either positive or negative economic growth rates since 1996 with some sectors in some cities experiencing more significant growth rates than others, whilst in some cities certain sectors actually

experienced negative growth rates whilst the same sector experienced positive growth rates in other cities.

Table 1 presents a simple description of the data. Panel A of the table describes the six smallest and the six largest cities in terms of population size as of 1996, their employment in 1996 and 2007 and the six largest industries in each of them. The largest city eThekwini or Durban, had employment of over 620 000 and the smallest, St Lucia, had under 1 000 employees. The panel also shows a great variety of top industries across cities, although services related industries features in many of them.

Panel B describes the top city-industries in the population in 1996 and 2007, both in absolute and relative terms. It is evident that total employment in the textile, clothing and leather goods sector has decreased over the period, whereas total employment in the education and other business activities sectors has increased over the period. Total employment in the top city-industries accounted for 30.69 per cent in 1996 compared to 32.87 per cent in 2007.

Panel C describes the most common city industries in the population and the number of appearances of each of them. Education is the most common city industry, appearing in all 12 cities. A few other primary and secondary sector industries appear as well, but the most common industry in the population is tertiary sector related (77 per cent and 83 per cent in 1996 and 2007, respectively).

Panel D lists the 5 fastest-growing and five fastest declining city industries in terms of employment. The panel gives a couple of impressions. First, rapidly growing city-industries were more regionally concentrated than the rapidly declining ones. Second, diversity does not appear to be a significant growth factor, however if we exclude the outliers then it seems that city-industries grew faster in specialized cities than in diversified ones. Third, fast growing city-industries were less competitive, as measured by the gross operating surplus per employee, than declining city-industries. These three impressions

form the basis of the empirical analysis and will be discussed in greater detail below.

Table 1: Description of the Data

A. Cities in 1996

City	Employment 1996	Employment 2007	Six Largest Industries
	Six Largest Cities in 1996		
Durban	623,946	789,926	Textiles, clothing and leather goods, Education, Land and Water transport, Other business activities, Health and social work, Retail trade and repairs of goods
Pietermaritzburg	91,559	106,167	Education, Health and social work, Textiles, clothing and leather goods, Other business activities, Public administration and defence activities, Retail trade and repairs of goods
Newcastle	40,431	52,036	Metal products, machinery and household appliances, Textiles, clothing and leather goods, Education, Health and social work, Public administration and defence activities, Land and Water transport
Port Shepstone	28,764	37,645	Agriculture and hunting, Education, Public administration and defence activities, Health and social work, Hotels and restaurants, Textiles, clothing and leather goods
Ballito	28,185	33,945	Agriculture and hunting, Food, beverages and tobacco products, Education, Wood and wood products, Land and Water transport, Other business activities
Richards Bay	25,932	35,593	Agriculture and hunting, Education, Land and Water transport, Metal products, machinery and household appliances, Wood and wood products, Health and social work
	Six Smallest Cities in 1996		
Tugela Ferry	2,221	2,645	Education, Health and social work, Agriculture and hunting, Public administration and defence activities, Other business activities, Land and Water transport
Ezingoleni	2,141	2,760	Agriculture and hunting, Education, Wood and wood products, Forestry and logging, Retail trade and repairs of goods, Wholesale and commission trade

Melmoth	1,766	1,989	Agriculture and hunting, Forestry and logging, Wood and wood products, Education, Land and Water transport, Health and social work
Mtubatuba	1,509	1,507	Agriculture and hunting, Education, Food, beverages and tobacco products, Public administration and defence activities, Forestry and logging, Land and Water transport
Hluhluwe	1,003	1,065	Agriculture and hunting, Education, Health and social work, Public administration and defence activities, Other service activities, Food, beverages and tobacco products
St Lucia	762	806	Agriculture and hunting, Education, Health and social work, Public administration and defence activities, Other service activities, Food, beverages and tobacco products

B. Included City-Industries

Industry	Total Employment per Sector		Relative Employment per Sector	
	1996	2007	1996	2007
Textiles, clothing and leather goods	75,794	59,650	21.41%	13.07%
Education	58,163	82,437	16.43%	18.06%
Health and social work	48,130	63,065	13.60%	13.82%
Other business activities	44,318	97,301	12.52%	21.32%
Land and Water transport	42,664	38,411	12.05%	8.42%
Retail trade and repairs of goods	33,626	56,905	9.50%	12.47%
Agriculture and hunting	23,948	21,743	6.77%	4.76%
Metal products, machinery and household appliances	9,779	12,819	2.76%	2.81%
Public administration and defence activities	9,092	12,900	2.57%	2.83%
Food, beverages and tobacco products	3,842	4,166	1.09%	0.91%
Wood and wood products	2,860	4,000	0.81%	0.88%
Hotels and restaurants	1,136	2,251	0.32%	0.49%
Forestry and logging	425	497	0.12%	0.11%
Other service activities	90	120	0.03%	0.03%
Wholesale and commission trade	83	162	0.02%	0.04%
Total Employment for the 12 Municipalities	353,950	456,427		
Total Provincial Employment	1,153,296	1,388,675		
Municipal Employment as a % of Total KZN Employment	**30.69%**	**32.87%**		

C. Most Common City-Industries

Economic Sector	**Number of Sectors**
	1996

Education	12
Agriculture and hunting	9
Health and social work	9
Land and Water transport	7
Public administration and defence activities	7
Food, beverages and tobacco products	4
Other business activities	4
Textiles, clothing and leather goods	4
Wood and wood products	4
Forestry and logging	3
Retail trade and repairs of goods	3
Metal products, machinery and household appliances	2
Other service activities	2
Hotels and restaurants	1
Wholesale and commission trade	1

D. Industry Growth

City- 1996	Industry- 1996	Growth Rate	Diversity	Competition	Concentration
		Six Fastest-Growing City-Industries			
Ballito	Other business activities	16.164	0.033	0.721	0.447
Durban	Other business activities	10.372	0.184	1.086	1.242
Port Shepstone	Hotels and restaurants	8.187	0.098	0.621	2.202
Ezingoleni	Wholesale and commission trade	7.899	0.073	0.586	1.967
Ezingoleni	Retail trade and repairs of goods	7.775	0.086	0.790	1.189
Pietermaritzburg	Other business activities	6.831	0.184	0.671	1.334
		Six Slowest-Growing City-Industries			
Hluhluwe	Food, beverages and tobacco products	-5.155	0.067	0.473	1.041
St Lucia	Food, beverages and tobacco products	-4.777	0.080	0.331	1.175
Mtubatuba	Food, beverages and tobacco products	-4.637	0.113	0.947	1.602
Mtubatuba	Land and Water transport	-4.491	0.068	1.441	0.776
Tugela Ferry	Land and Water transport	-4.391	0.049	0.529	0.665
Pietermaritzburg	Textiles, clothing and leather goods	-2.986	0.201	0.140	0.879

5. RESULTS ON THE GROWTH OF INDUSTRIES ACROSS CITIES

If externalities are important for growth as suggested by the discussed economic theories on cities, then the clearest way to find these effects is by looking at the growth of the same sectors in different cities and checking in which cities these sectors grow faster (Glaeser, et al, 1992). The unit of observation is then an industry in a city, and we look at the growth rates of these industries as a function of our measures of knowledge spillovers. The sample includes 72 observations on the top six 1996 industries in 12 cities (municipal regions). Table 2 describes the variables. The mean of employment growth is 0.07 suggesting that in an average city-industry in the sample employment grew only marginally. The standard deviation of 0.16 indicates the significant dispersion of growth records. The dispersion may reflect the decline of some primary and secondary industries and the growth of services in the provincial economy.

Table 2: Variable Means, Standard Deviations and other Descriptive Statistics

Variable	Mean	Standard Deviation	Median	Min	Max	Kurtosis
Employment in the city-industry in 1996	4,916	11,481	660	35	63,478	11.56
Employment in the city-industry in 2007	6,339	15,255	914	15	84,594	12.12
Log(employment in 2007/employment in 1996) in city-industry	0.07	0.16	0.12	-0.42	0.47	2.00
Log(employment in 2007/employment in 1996) in KZN	0.03	0.06	0.03	-0.17	0.15	1.96
Wage in the city-industry in 1996 per annum (‘000)	232,781	589,482	13,130	300	3,385,067	13.61
Wage in the city-industry in 2007 per annum (‘000)	606,560	1,603,526	54,468	842	8,056,736	10.87
Log(wage in 2007/wage in 1996) in the city-industry	0.38	0.18	0.39	-0.47	0.84	5.51
City-industry's share of city employment relative to KZN industry's share of KZN	1.83	1.47	1.40	0.45	8.65	7.30

employment in 1996						
GOS per employee in the city industries relevant to GOS per employee in the KZN industries 1996	0.94	0.73	0.72	0.14	4.85	14.98
City's other top five industries' share of 1996 total city employment	0.24	0.28	0.16	0.03	1.77	13.26

The theories of city economics and the theories of dynamic externalities suggest that employment growth in an industry in a city may depend on the specialization of that industry in that city, local competition in the city-industry and city diversity.

The measure of specialization of an industry in a city is the fraction of the city's employment that this industry represents in that city, relative to the share of the whole industry in provincial employment (Glaeser, et al, 1992).

Specialization therefore is =

$$\frac{\text{industry employment in city/total employment in the city}}{\text{industry employment in KZN/total employment in KZN}} \qquad (1)$$

The variable measures how specialized a city is in an industry relative to what one would expect if employment in that industry was scattered randomly across the province. The mean of this variable is 1.83 indicating that the top industries in the sample cities are overrepresented relative to what one would expect if they were randomly scattered over the province. The maximum value of this variable is 8.65 for forestry and logging in Mthonjaneni. The prediction according to both MARS and Porter is that high specialization of an industry in a city should speed up growth of that industry in that city (cited in Glaeser, et al, 1992).

The measure of local competition of an industry in a city is the number of firms per worker in this industry in this city relative to the number of firms per worker in this industry in the province. Unfortunately the number of firms in the city-industries and province-industries is not available. Because of the availability of only a limited number of variables the "best" alternative to the number of firms with regard to the measuring of competition is gross operating surplus. Gross operating surplus (GOS) is defined by EuroStat as follows:

> Gross operating surplus is the surplus generated by operating activities after the labour factor input has been recompensed. It can be calculated from the value added at factor cost less the personnel costs. It is the balance available to the unit which allows it to recompense the providers of own funds and debt, to pay taxes and eventually to finance all or a part of its investment.

(Source: EuroStat, http://stats.oecd.org/glossary/detail.asp?ID=1178)

It represents to an extent economic or abnormal profit and thus the level of competition within the particular industry. For the purpose of this article it will be assumed that the larger the GOS the less competitive that particular industry and visa-versa.

Competition therefore is =

$$\frac{\text{GOS in the city-industry/employment in the city-industry}}{\text{GOS in the province-industry/employment in the province-industry}} \qquad (2)$$

The measure of the degree of competition in the city-industry is therefore the GOS per employee relative to the GOS per employee in the province. A value greater than 1 means that this city-industry generates more GOS per employee relative to its size in this city than it does in the province. One interpretation of the value greater than 1 is that the industry in the city is locally less competitive than it is elsewhere in the province. The mean of this variable is 0.94. In a liberal interpretation of Porter a lower value of this measure of competition should be associated with faster growth.

To address Jacobs's theory, according to Glaeser, et al, (1992), we need a measure of a variety of industries in the city outside the industry in question. The measure used is the fraction of the city's employment in the largest five industries other than the industry in question accounted for in 1996. The mean of this ratio is 0.24: suggesting that cities are not well diversified. The lower this ratio, the more diversified the city is and therefore the faster the industry in question should grow, according to Jacobs.

The mean values of the three measures thus suggest the following:

The top city-industries are over concentrated in the relevant cities
The top city-industries are less competitive than what is expected
Cities are not well diversified

Table 3 shows the average non-diversity, competition and concentration values for the listed fast and slow growing city-industries. The results of the calculations seem to suggest the following:

Industries grow fast in well diversified cities
Industries grow fast in competitive cities
Industries grow fast in less concentrated cities

Table 3: Variable Means for the Listed Fast and Slow Growing City-Industries

	Log Growth	Diversity	Competition	Specialization/ Concentration
Fast Growing Industries				
Other business activities	0.29	0.11	0.69	0.93
Hotels and restaurants	0.30	0.10	0.62	2.20
Wholesale and commission trade	0.29	0.07	0.59	1.97
Retail trade and repairs of goods	0.22	0.12	0.83	1.23
Public administration and defence activities	0.15	0.11	0.75	1.35
Education	0.15	0.31	1.08	1.58
Other service activities	0.12	0.09	1.49	1.55
Wood and wood products	0.12	0.14	1.68	2.14

Average	**0.21**	**0.13**	**0.97**	**1.62**
Slow Growing Industries				
Metal products, machinery and household appliances	0.12	0.35	2.75	4.05
Health and social work	0.12	0.16	0.99	1.38
Forestry and logging	0.07	0.14	0.91	6.54
Agriculture and hunting	-0.04	0.71	0.52	2.51
Land and Water transport	-0.10	0.10	0.89	0.90
Textiles, clothing and leather goods	-0.10	0.23	0.59	1.03
Food, beverages and tobacco products	-0.27	0.12	0.77	1.78
Average	**-0.03**	**0.26**	**1.06**	**2.60**

Table 4 shows the average non-diversity, competition and concentration values for the listed fast and slow growing cities in the provincial economy. The results of the calculations seem to suggest the following:

Diversity seems to be the same across cities, i.e., diversity does not appear to have a significant impact

Fast growing cities are less competitive than slow growing cities

Less concentrated cities grow faster than more concentrated cities

Table 4: Variable Means for the Listed Fast and Slow Growing Cities

	Log Growth	Diversity	Competition	Specialization/ Concentration
Fast Growing Cities				
Ballito	0.15	0.36	1.05	1.75
Ezingoleni	0.14	0.21	0.75	2.67
Durban	0.12	0.20	1.05	1.12
Pietermaritzburg	0.11	0.20	0.65	1.27
Port Shepstone	0.10	0.25	0.68	1.27
Richards Bay	0.08	0.21	2.37	1.48
Average	**0.12**	**0.24**	**1.09**	**1.60**
Slow Growing Cities				
Newcastle	0.08	0.22	0.98	1.97
St Lucia	0.02	0.22	0.75	1.80
Melmoth	0.05	0.26	0.42	2.98
Hluhluwe	0.01	0.22	0.98	1.71
Tugela Ferry	0.02	0.28	0.71	1.80

Mtubatuba	-0.06	0.24	0.92	2.17
Average	**0.02**	**0.24**	**0.79**	**2.07**

Table 5 supplies the variable values for the six fastest growing and six slowest growing city-industries per the relevant city. The results of the calculations seem to suggest the following:

Fast growing city industries are more diversified, but only marginal

Fast growing city-industries are less competitive than slow growing city-industries

More concentrated city-industries grow faster than less concentrated city-industries

Table 5: Variable Values for the Listed Fast and Slow Growing City-Industries per City

Region - 1996	Sector - 1996	Growth Rate	Diversity	Competition	Concentration
Six Fastest-Growing City-Industries					
Pietermaritzburg	Other business activities	6.83	0.18	0.67	1.33
Ezingoleni	Retail trade and repairs of goods	7.77	0.09	0.79	1.19
Ezingoleni	Wholesale and commission trade	7.90	0.07	0.59	1.97
Port Shepstone	Hotels and restaurants	8.19	0.10	0.62	2.20
Durban	Other business activities	10.37	0.18	1.09	1.24
Ballito	Other business activities	16.16	0.03	0.72	0.45
Average			**0.11**	**0.75**	**1.40**
Six Slowest-Growing City-Industries					
Hluhluwe	Food, beverages and tobacco products	-5.15	0.07	0.47	1.04
St Lucia	Food, beverages and tobacco products	-4.78	0.08	0.33	1.18
Mtubatuba	Food, beverages and tobacco products	-4.64	0.11	0.95	1.60
Mtubatuba	Land and Water transport	-4.49	0.07	1.44	0.78

Tugela Ferry	Land and Water transport	-4.39	0.05	0.53	0.67
Pietermaritzburg	Textiles, clothing and leather goods	-2.99	0.20	0.14	0.88
Average			**0.10**	**0.64**	**1.02**

The results of the different empirical tests (table 2 to 5) seem to suggest the following:

The majority of cities in the province are not well diversified contributing to the weak growth performance of the city-industries located within such cities.

Given the low diversity of the majority of cities in the province it seems obvious that the majority of cities will be over-concentrated in a number of industries. The results relative to the impact of the level of concentration on both industry and city growth seem ambiguous in that some results (table 3 and 4) suggest that less concentration supports growth, whilst some results (table 5) suggest more concentration supports growth. Luus and krugell (2005) also indicated that the results of their concentration analysis were mixed. However, all the results suggest that some concentration is good, because of the relative high values obtained. It therefore seems that concentration does support growth, but that too much concentration actually reduces growth, i.e., there thus seems to be an optimal level of city-industry concentration.

The level of local city-industry competition is also somewhat ambiguous in that tables 3 and 5 suggest that less competition is more supportive of growth than more competition, compared to table 4 that supports the opposite view. However, the medium values of all the fast growing city-industries are less than 1 suggesting that more competition is better than less competition.

It is therefore possible to develop a hypothetical economic structure for a city to optimize industry and city growth in the particular city. The city should

consist of a diversity of industry types, i.e., the city should have a well diversified economic structure, and each industry type should be fairly well represented in that city (optimal level and not maximum level). The occurrence of diversity will support greater competition whereas the occurrence of concentration will support imperfect competition, thus the combination of the two perceived opposing forces will most probably be supporting a monopolistic competitive market structure, to a greater or lesser degree, within the city.

The above hypothetical economic structure is supportive of the new growth or endogenous growth theories and in particular the urban economic theory, as stated, in that the empirical results support the notion that externalities are the engine of growth. It also supports the theories of dynamic externalities as stated by MAR and Porter that argues that industries should specialize geographically in well diversified city economies. A specialized well diversified city economy will support local competition rather than to reduce local competition thus also supporting city and city-industry growth as stated by Jacobs.

6. PRELIMINARY ECONOMETRIC ANALYSIS AND RESULTS

The following tables and figure represent the results of some preliminary econometric analysis. It must be noted that it is beyond the scope of this paper to conduct detailed econometric analysis and estimations. However, the preliminary results do support the argument for further econometric analysis, etc

Figure 1 indicates the behaviour of the listed variables in time series format. The variables concentration, competition and diversity seem to be characterised by some significant outliers. This is supported by all three variables not been characterised by a normal distribution (table 6). It is also noticeable (figure 1) that city employment does not follow a random distribution which is supported by the unit root test (table 6). City employment therefore needs to be converted from an I(0) to an I(1) variable through

differentiation. The first difference of city employment is indeed stationary as indicated by the unit root test (table 6). Therefore, as indicated by the results of the unit root tests (table 6), all of the variables are I(0) except city employment which is I(1).

The significant outliers evident in concentration, competition and diversity suggest that there are a number of cities that are characterised by either very high or very low levels of concentration, competition and non-diversity. Moderate levels of concentration, competition and non-diversity thus seem to the exception to the rule, rather than the rule itself.

Figure 1: Time Series of the Listed Variables

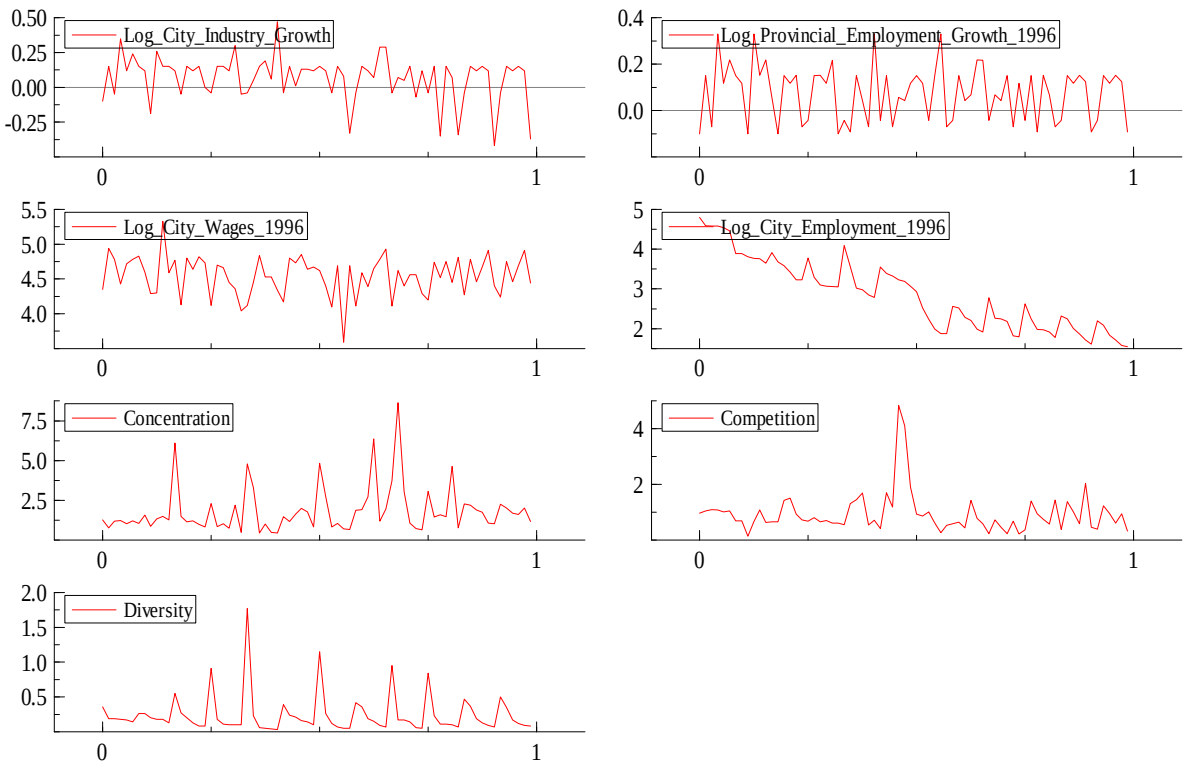

Table 6: Normality and Unit Root test of Listed Variables

Variable	Normality Test	Unit Root Test
Log(employment in 2007/employment in 1996) in city-industry	Normality test: Chi^2(2) = 11.257 [0.0036]**	ADF-Log_City_Industry_Growth = -4.221**

Log(employment in 2007/employment in 1996) in the province	Normality test: Chi^2(2) = 1.7914 [0.4083]	ADF-Log_Provincial_Employment_Growth_1996 = -5.088**
Log Wage in the city-industry in 1996 per annum ('000)	Normality test: Chi^2(2) = 5.0654 [0.0794]	ADF-Log_City_Wages_1996 = -4.256**
Log Employment in the city-industry in 1996	Normality test: Chi^2(2) = 8.8948 [0.0117]*	ADF-Log_City_Employment_1996 = -1.71
Log Employment in the city-industry in 1997 - First Difference	Normality test: Chi^2(2) = 1.3293 [0.5145]	ADF-DLog_City_Wages_1996 = -7.71**
City-industry's share of city employment relative to KZN industry's share on KZN employment in 1996	Normality test: Chi^2(2) = 110.51 [0.0000]**	ADF-Concentration = -3.785**
GOS per employee in the city industries relevant to GOS per employee in the KZN industries 1996	Normality test: Chi^2(2) = 168.67 [0.0000]**	ADF-Competition = -3.635**
City's other top five industries' share of 1996 total city employment	Normality test: Chi^2(2) = 205.54 [0.0000]**	ADF- Diversity = -7.143**

** 99% Level of Significance

* 95% Level of Significance

Table 7 presents the results for employment growth across city industries, with 72 observations. Control variables are included in the regressions as suggested by Glaeser, et al (1992). The control variables are the 1996 log of wages and the log of employment in the city-industry and the provincial employment growth in that industry. The control variables control for labour movements between cities because of city-wage differentials and for employment changes because of demand shifts within the provincial economy.

The control variables provincial employment growth and employment in the city-industry are statistically significant and tend to have the expected signs. High initial employment in an industry in a city leads to higher growth on that industry's employment. Employment in an industry in a city grows faster when employment in that industry in the whole province grows faster and the coefficient of greater than 1 suggests that factors shifting employment in the provincial industries seem to be more influential in the large cities than in the smaller cities. However, city-wages does not seem to be a statistical significant variable with regard to city-industry growth.

The results on the externalities reveal several interesting findings. Equation 2 in table 7 reveals that industries that are more heavily concentrated in the city than they are in the province as a whole grow faster. The effect is only statistical significant at 90% and qualitatively quite small. The result is in support of the prediction of the MAR model that suggests that geographical specialization supports growth.

In equation 3 in table 7 the coefficient on the competition variable is positive, but is also only statistically significant at 90% and qualitatively quite small. More GOS per employee in a city-industry relative to the provincial average leads to higher growth of those city-industries, which is not consistent with Porter's and Jacobs's hypothesis. However this is supportive of the MAR model that suggests that monopolies that internalize externalities are good for growth.

Equation 4 in table 7 shows that industries in cities in which other large industries are relatively small grow slower, although it must be noted that the finding is not statistically significant. This supports the previous finding that diversity or non-diversity does not appear to be a significant factor with regard to city growth. However the negative sign does not support the importance of knowledge spillovers stressed by Jacobs from outside the industry, but rather the importance of knowledge spillovers from within the industry.

Equation 5 in table 7 uses all three measures of externalities simultaneously. The results, except for city-wages and diversity, remain statistically significant. They confirm the finding that industry overrepresentation supports growth. They also confirm the view that less competition is more supportive of growth than more competition, because of the ability to generate positive returns to scale. Diversity is supported by equation 5 compared to non-diversity in equation 4, suggesting that both external and internal knowledge spillovers are supportive of growth. The overall results are favourable to MAR and Porter but mixed on Jacobs.

Table 7: City-Industry Employment Growth between 1996 and 2007

	Log(employment in 2007/employment in 1996) in city-industry				
Equation	1	2	3	4	5
Log(employment in 2007/employment in 1996) in the province	1.1005 (12.00)**	1.1169 (12.20**	1.0985 (12.10)**	1.1082 (11.70)**	1.1108 (12.00)**
Log Wage in the city-industry in 1996 per annum ('000)	0.0106 (0.4)	0.0081 (0.3)	0.0025 (0.1)	0.0115 (0.4)	-0.0012 (-0.04)
Log Employment in the city-industry in 1996	0.0348 (2.82)**	0.0356 (2.92)**	0.0322 (2.61)**	0.0335 (2.60)**	0.0341 (2.60)**
City-industry's share of city employment relative to KZN industry's share on KZN employment in 1996		0.0113 (1.59)^			0.0128 (1.55)^
GOS per employee in the city industries relevant to GOS per employee in the KZN industries 1996			0.0212 (1.43)^		0.0215 (1.45)^
City's other top five industries' share of 1996 total city employment				0.0146 (0.36)	-0.0116 (-0.25)
R^2	0.71	0.72	0.72	0.71	0.73
F	55.03 [0.000]**	42.84 [0.000]**	42.44 [0.000]**	40.77 [0.000]**	29.1 [0.000]**
DW	1.58	1.58	1.61	1.57	1.63

** 99% Level of Significance

^ 90% Level of Significance

The regression model, equation 5, as per table 7 suggests that there exists a co-integration relationship, i.e., there is some long-run equilibrium relationship linking the dependent variable and independent variables so that the relationship is stationary. Testing the residuals of the model for a unit root (table 8) suggests that the residuals do not contain a unit root and thus are stationary supporting the argument of a co-integrating relationship. The results of the correlation, partial autocorrelation and portmanteau tests also suggest that the residuals are indeed stationary.

It therefore becomes possible to argue that there exists a long-run relationship between the growth of cities and concentration, competition and diversity,

although the nature and dynamics of such a long-run relationship is still unknown. Much work still needs to be done on such a long-run relationship, which is outside the scope of this paper.

Table 8: Normality, Unit Root test of Model 5 Residuals

Model Residuals	Normality test:	Chi^2(2) =	10.148	ADF-Residuals = -3.52*

* 95% Level of Significance

Table 9: Correlogram (ACF) and Portmanteau statistic of Model 5 Residuals

Residuals : Sample correlogram (ACF) from lag 1 to 8:					
0.14339	0.034803	0.060138	0.035255	0.051637	0.20252
-0.014022	-0.047400				
Partial autocorrelation function (PACF):					
0.14339	0.014542	0.054262	0.019240	0.042789	0.19043
-0.075238	-0.049210				
Portmanteau statistic for 8 lags and 71 observations: 5.51046					

7. CONCLUSIONS

The results presented in this paper allow some tentative conclusions. The empirical and preliminary econometric results suggest that at the city-industry levels, specialization, but only at an optimal level, supports employment growth, that less competition rather than more competition is good and that diversity within the structure of the city economy is desirable.

The findings suggest that inter-industry knowledge spillovers are more significant for growth than spillovers across industries. The MAR and Porter models seem to be the most consistent with the findings of the study.

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