Microeconomic Foundations of Community Economic Development in the New Economy: Three Papers

by

Laura Lamb

A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfilment of the requirements of the degree of

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DOCTOR OF PHILOSOPHY

Abstract

This set of three papers addresses the broad question of what the New Economy (NE) has to offer the community economic development (CED) approach to economic development by first developing some microeconomic foundations for both the areas of community economic development and the New Economy. The first paper focuses on developing microeconomic underpinnings to explain how CED works. With the use of matrix algebra and cost-benefit analysis, formalized microeconomic models are developed to explain and justify the role of subsidies in CED; to present an economic framework for analysing the fiscal impact of CED; to develop an economic model to explain collective action for CED. The second paper presents a theoretical model explaining the clustering behaviour of firms in the New Economy (NE). The model incorporates knowledge creation in clusters as a location specific comparative advantage with negative location specific external economies of scale due to congestion into Krugman's (1991) core-periphery model. Simulation results suggest that clustering is more prevalent in the New Economy. The third paper addresses the broad question of what the NE has to offer CED by assessing the appropriateness of NE activities for CED initiatives, based on the models developed in the first two papers. Analysis reveals that NE clusters are not generally deemed appropriate for CED leading to the consideration of the applicability of the forty acres and a modem concept for CED. With use of the NE model, developed in the second paper, it is shown that firms in certain industries, such as back-office services industries, benefit from locating away from clusters and thus may provide opportunities for CED initiatives in the NE.

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I alone remain responsible for the content of the following, including any errors or omissions which may unwittingly remain.

Paper 1

Microeconomic Foundations for Community Economic Development

Community economic development (CED) has become an important field of study in economics, demonstrated by the growing body of scholarly and applied CED literature. Yet its theoretical foundations remain weak. Without a formal economic theory of its own, CED has drawn on regional economics and development economics for theoretical underpinnings.

This paper develops formalized microeconomic models of selected aspects of CED theory. The models are grounded in existing economic theory which has been successfully applied to CED. The structure of this paper consists of seven sections. Section one is an explanation of the CED approach to local economic development. Section two consists of a literature review of relevant economic theory applicable to CED. Section three consists of a discussion of appropriate methodological techniques and a derivation of a matrix model of CED using input-output analysis and income expenditure equations. Section four is an application of the input-output model to explain the role of subsidies in CED. Section five consists of a model for fiscal impact analysis of CED. Section six explores the question of how communities mobilize to initiate CED by building a model of community collective action for CED. Section seven is a summary and conclusion.

1. Community Economic Development

Over the past several decades, depressed socio-economic conditions in inner city communities and rural and remote northern communities of Canada have posed increasing challenges for economic development agencies. Market-based approaches to economic development have largely failed these communities, evidenced by the growth of inequality in Canada (MacIntyre and Lotz, 2006; Yalnizayan, 1998). The inadequacy of market-based approaches to development signifies that the benefits of economic growth do not "trickle down" to disadvantaged communities. Community economic development (CED) is seen by some to be a viable alternative to market-based approaches.

Community economic development (CED), also known in the literature as community-based development, is an approach emphasizing local self-sufficiency, local decision-making and local ownership as a strategic response that might assist communities in taking up development opportunities and challenges (Loxley, 2000). A CED approach to economic development is a holistic approach in that it goes beyond either individual or collective enterprise (Shragge, 1993). It links economic development with a wider social and economic process.

The concept of community in CED takes on a broad interpretation. A community can be designated according to geographical boundaries, such as an inner city neighbourhood, a rural town, or an aboriginal reserve whereby boundaries are typically determined according to socio-economic factors, such as income and employment. By this definition, a city is viewed as a group of interconnected communities, some

prosperous and some not. The concept of community can also refer to a body of people having similar ethnic backgrounds, beliefs or interests (Loxley, 2007). For instance, the aboriginal community of Winnipeg does not exclusively refer to a geographic area within Winnipeg but to the body of aboriginal people living within Winnipeg. Although the term community encompasses an element of commonality it is essential to note that communities are characterized by social differentiation and heterogeneity. Communities often consist of a variety of social groups with diverse political interests and viewpoints (Loxley, 1985). To facilitate analysis in this dissertation, the spatial definition of community will be applied where boundaries are determined by economic and social characteristics.

The most complete set of CED principles are those underlying the Neechi model of CED, named after Neechi Foods Co-op Ltd, an Aboriginal worker-owned cooperative retail store in Winnipeg. The premise of this approach is to build a strong, inward looking, self-reliant economy which is based on goods and services consumed by people who live or work in the community (Loxley and Lamb, 2005). Since the 1980s the CED approach has gained ground in communities throughout rural and urban Canada (Fontan, 1993).

Community initiatives, under CED, are typically small scale economic activities oriented toward the provision of local needs and demand with moderate levels of export. CED is a microeconomic approach to economic development.

2. Literature Review of Economic Theory Applicable to CED

This literature review surveys existing economic theories, which have been used to explain regional or local economic development, and are believed to contribute to a theory of CED. The objective of the literature review is to synthesize the most appropriate theoretical underpinnings which will become the foundation for a formal economic theory of community economic development, to be developed in sections three through six.

The economic theories reviewed in section 2.1 can be categorized as either theories of economic development or theories of regional development. The theories of economic development include development stages theory, staple theory, big push theory, and convergence theory. The theories of regional development include development stages theory, export base theory, location theory, and attraction models theory. Development stages theory can be viewed as both a theory of economic development and a theory of regional development, as it theorizes the development of nations as well as regions.

Regional economic theory is particularly appropriate for CED inasmuch as regional economics examines the spatial disparities within countries. There does not appear to be a universal definition of regional economics although it has been described as the study of man's economic behaviour in space and the study of what economic activity is where and why (Gore, 1984). Regional growth and development theory is frequently based on economic development theory but adapted to incorporate a spatial

component, as will become evident in this literature review. This section is organized into two subsections. Subsection one is a review of the body of literature covering theories of economic development and regional economic growth and development applicable to CED. Subsection two is a proposed synthesis of economic theories most relevant to CED.

2.1. Theories of Economic and Regional Economic Growth and Development

Post World-War II several development theories were constructed to explain the process of economic development as a progression through a series of predetermined steps or stages through which all countries must proceed. By the 1950s and 1960s, two opposing theories of regional growth had come to dominated the literature, the development stages theory of growth, articulated by Fisher (1933) and later by Clark (1957) and export base theory first articulated by North (1955).

Stages of Growth Model of Development

Development stages theory suggests that a sequential path of development exists through which all societies progress. Societies experience changes in the dominant occupation of the labour force as they progress along the development path. The theory proposes three stages: primary, secondary and tertiary (Fisher, 1933; Clark, 1957).

The initial stage of development is characterized by a degree of self-sufficiency with little trade or investment, where the dominant occupation in this stage is agricultural. Progression along the development path occurs with the emergence of infrastructure such

as transportation enabling trade and regional specialization. As interregional trade increases, cottage industries emerge and eventually societies become dependent on commercial and specialized agriculture rather than subsistence livelihoods. At this stage, increases in population and diminishing returns in agriculture provide conditions favorable for industrialization. In the early stages of industrialization, industry is mostly comprised of extraction and processing of raw materials (agriculture commodities, forest products and mining). As growth rises, regional industrial specialization occurs increasing *per capita* incomes. Finally, a service sector develops and eventually dominates the employment structure of the labour force. Although the development path is sequential, it is not necessarily smooth and steady. The two critical variables in the development sequence are changes in comparative costs and changes in income elasticities of demand (Hewings, 1977).

The stages theory has been criticized for not accurately describing the development of many regions and for not providing insights into the causes of growth and change. North (1955), Thompson (1968), and Tiebout (1956b) all contend that the theory lacks universality, as it fails to explain the development of many regions.

Export Base Theory

North (1955) advanced some propositions that led to a second major theory of regional economic growth, namely export base theory. His formulation of export base theory is shaped, in part, by his criticism of location theory and development stages theory.

Export base theory is rooted in Harold Innis' staple theory, which proposes that the export staple[1] is critical in shaping new economies. Staple theory is elaborated on further in this section. North (1955) argues that Innis' emphasis on the importance of the export staple is relevant to the search for an explanation of differential regional growth. According to North, regional growth is dependent on the export base. North uses the term 'exportable commodities' rather than 'staples' to denote collectively the exportable commodities of a region. North's (1955) analytical propositions on regional economic growth are oriented towards development in America, but are meant to apply to other areas that meet two conditions. The first condition states that the regions must develop within a framework of capitalist institutions and thus respond to profit maximizing opportunities where factors of production are relatively mobile. The second condition states that the regions must grow without constraints by population pressures.

Principles of location theory explain the success of an industry in producing an exportable commodity. Regions with a comparative advantage in costs of production and transportation developed exportable commodities. The demand for the exportable commodity is seen as an exogenous factor, whereas processing and transfer costs are not. Historically, regions have gone to great lengths to reduce their costs as a means of promoting economic growth. Efforts include pushing for government subsidized internal improvements such as canal construction, soliciting for government aid for railroads, and river and harbor improvements. (North, 1955)

External economies accumulate as the region develops, contributing to growth by

[1] The term staples refers to the main commodity produced in the region. It is generally thought of as describing products of extractive value.

improving the region's competitive cost position. Activities which contribute to the export base include the development of specialized marketing organizations, improved credit and transport facilities, a trained labour force, and the development of complementary industries. Improvements in technology for production also contribute to growth. Service adjuncts such as agricultural experiment stations, universities, and other research groups contribute to growth in the region. Efforts to develop external economies and technology focus on increasing competitiveness with other regions and foreign countries. North observes that the benefits gained from external economies and new technologies usually more than compensate for diminishing returns in the staple product. On the other hand, an increasing dependence on the existing staple rather than diversification of the export base may result. (North, 1955)

The role of capital can further reinforce dependency on the export staple. Since new regions typically depend on imported capital to develop their export staple industries, it is the external investors who decide on the investment projects. External investors are typically hesitant to invest in new, unproven activities where risks are greater, thus new investment goes to the proven export staple industries. (North, 1955)

The export base is instrumental in shaping the distinctive quality of the region's economy. The term, 'residentiary' is used to describe industries which develop around the export staple. The residentiary industries are dependent on demand within the region, and ultimately are dependent on the export base. As well, the cyclical sensitivity of the region is ultimately determined by the export staple. It is specifically the income elasticities of export staples that is the major determinant of cyclical sensitivity in the

region. (North, 1955)

Location theorists and geographers have explored the role of exports in shaping nodal centers. Locational advantages such as low transfer and processing costs result in the growth of a nodal center which becomes a trading center. In the nodal centers subsidiary industries develop to service the export industry. Banking, brokerage wholesaling, and other business services concentrate in these centers improving the cost position of the export. At the same time, economies of urban concentration result from fire and police protection, lower utility rates and a specialized labour force, to name a few. As well, the character of the labour force is shaped by the export industries as the skill requirements, the seasonality and the stability of employment, and the conditions of work shape social attitudes of the labour force. (North, 1955)

North believes that growth in a region is largely determined by the success of its exports, either from an improved position of existing exports relative to competing areas or as a result of the development of new exports. North is critical of the role of industrialization in the process of growth.

One of North's major arguments is that industrialization is not necessary for regional growth, contrary to the thesis of the development stages theory that industrialization can be difficult to achieve and has been identified as the main cause of arrested regional development. North states:

> "The contention regions must industrialize in order to continue to grow, as well as the contention that the development of secondary and tertiary industry is somehow difficult to achieve, are both based on some fundamental misconceptions... A state whose export base consists mostly of agricultural products may have a low percentage of its labor force in primary activity and a high percentage in tertiary occupations and yet be

> basically dependent upon agriculture for the high per capita income it enjoys. It is the agricultural export staples that provide the high income that enables the state to support a substantial level of services. In such case both the secondary and the tertiary activities are "residentiary" and can survive only because of the success of the basic agricultural export staples. In short, a percentage shift in such a state from primary to secondary and tertiary employment does not necessarily reflect a shift away from dependence on agriculture to dependence on manufacturing and services" (North, 1955: 341-342).

Being that an appreciable amount of secondary, or residentiary, industry develops directly as a result of high incomes received from the exported commodities, North suggests industrialization may not be as difficult as development stage theorists contend.

Since the growth of the region is determined by the export base, it is the growth, decline and change in the export base that should be the focus of analysis for growth and development (North, 1955). When an export base declines, it is often due to a fall in demand from outside the region. Other reasons include exhaustion of the natural resource, increasing costs of land or labour relative to those of a competing region, and technological changes that change the relative composition of inputs. Developments in transportation are frequently the cause of growth of an export enabling a region to compete with other regions in the production of goods that were previously economically unfeasible. Other important factors for growth of an export include higher incomes and demand in other regions, and technological development. North also notes, "the role of the state and federal government in creating social overhead benefits has created new exports in many regions and the significance of war in promoting industries that may either continue or leave a residue of capital investment for peacetime use has also been

important" (North, 1955: 344). The creation of a new or expansion of an existing export brings new capital investment into a region. Growth is expected to be uneven as spurts of investment are more likely than an even paced steady flow of investment.

A rise (fall) in the demand for products comprised in the export base results in increased (decreased) activity in the region due to indirect effects and the magnitude of the total effects will be greater than the original increase (decrease), as determined by the size of the multiplier. A region with a narrow export base is more prone to disturbances resulting from changes in income levels in other regions than a region with a broad, more diversified export base. Further, income elasticity of demand for the export staples is a more critical determinant of vulnerability to economic fluctuations.

A region's rate of growth is influenced by the source of capital. In a new region, capital primarily comes from outside the region and profits flow out of the region. As an export base becomes more profitable, more of the income will be reinvested in the expansion of the base. Growth in population and income bring about an increase in indigenous savings. The indigenous savings and the reinvested capital are directed into the export industries up to a point beyond which it overflows into other activity. Some of the capital will go into residentiary industries and industries subsidiary to the export and some will likely go into "locationally "footloose" industries, which may start out to serve only the region, but may expand into export industries. At this point we no longer have a new region and it is now much easier to develop new exports. As the region matures, "the staple base will become less distinguishable, since its production will be so varied." (North, 1955: 345).

> "We may expect, therefore, that the difference between regions will become less marked, that secondary industry will tend to be more equalized, and indeed in economic terms that regionalism will tend to disappear" (North, 1955: 345).

Thompson (1968) draws attention to the fact that export base theory, as well as stages theory have an almost exclusive demand orientation. Tiebout (1956a) asserts there is no reason to assume that exports are the only, or even the most important, factor determining regional income. Other factors such as business investment, government expenditures and volume of residential construction may be autonomous variables determining regional income. Tiebout draws on cases where regional growth increased with a reduction in export activity to support his assertions.

The characteristics of export base theory most relevant to CED include the importance of external economies and the role of capital in economic development. The role of external economies for economic development, as well as the need to develop and foster external economies is applicable to CED. The role of capital and the complications created by foreign owned capital, as pointed out above, are also applicable to a theory of CED.

A Staple Theory of Economic Growth

As previously mentioned, staple theory is the inspiration behind North's export base theory of regional growth and development. Staple theory explains economic development as a process of diversification around an export base. The central concept of staple theory is the spread effects of the export sector, in other words the impact of export

activity on the domestic economy and society. The construction of a staple theory involves classifying the spread effects of export activity and their determinants. (Watkins, 1963)

The character of the staple itself is the focus of analysis. The production function defines the degree of factor substitutability and the nature of returns to scale, thus making technology an important determinant. The range of investment opportunities in domestic markets or the extent of diversification around the export base is determined by the demand for factors, the demand for intermediate inputs, the possibility of further processing and the distribution of income.

The staple theory can be stated in the form of a disaggregated multiplier-accelerator mechanism by classifying the income flows resultant from export expansion. The inducement of domestic investment resultant from increased export activity is broken down into three linkage effects: backward linkage, forward linkage and final demand linkage. (A. Hirshman, 1965; Watkins, 1963).

A backward linkage is a measure of the extent that a sector's output depends on inputs purchased from other sectors in the region. The more inputs that are purchased from inside the region, the stronger the backward linkage effects will be. A forward linkage is a measure of the extent that a sector's output is sold as inputs to other sectors of the region. A final demand linkage is a measure of the extent that investment in domestic industries is producing consumer goods for factors in the export sector. The greater the proportion of domestic production sold inside the region, rather than as exports, the larger the final demand linkage effect will be. Thus, linkages have a

multiplier effect whereby aggregate income is increased by more than the initial investment.

Linkages can be determined by supply-side expansion of the export sector. The degree of supply-side expansion depends on the relationship between staple production and the supply of entrepreneurship and complementary inputs, including technology. The effectiveness of entrepreneurship depends on the availability of labour and capital, foreign and domestic. Thus, it is necessary to create conditions to attract labour. Domestic capital, also necessary for supply-side expansion, depends on domestic saving and biases of savers in placing their funds, as some local savers may be biased against domestic investment.

The term leakage is used in association with linkages as it is used as a measure of the income flows leaving a region through sources such as migratory labour, servicing of capital imports, immigrant's remittances abroad, to name a few. In other word, greater leakages are associated with weaker linkages and smaller multiplier effects.

A relevant staple theory must allow for different characteristics of staples and for the impact of the resource base of the new country and the international environment. Initial conditions vary and conditions change over time. "The resource base itself can change through discovery, and success in staple production, at least for some staples, may expedite the process. The likely growth path of a staple economy is where growth is initiated by an increase in demand for a staple export. "In a staple economy, as in any other, sustained growth requires an ability to shift resources at the dictates of the market – what C.P. Kindleberger calls " a capacity to transform" " (Watkins, 1963: 149).

The probability of successful growth and development in the long-run is increased by two distinctive features. One, a favourable man-land ratio translates to a high standard of living facilitating expansion of domestic markets and sustainable factor mobility. Two, an absence of inhibiting traditions with selective carry-over from the 'old world' is most favourable for economic growth as institutions and values must be newly formed. (Watkins, 1963)

One of the major obstacles to economic growth is the occurrence of a 'staple trap'. An economy falls into a staple trap when an over-concentration of resources is devoted to the export sector and there is a reluctance to promote domestic development. Institutions and values consistent with transformation are needed to avoid the staple trap.

"If pitfalls are avoided – if the staple or staples generate strong linkage effects which are adequately exploited – then eventually the economy will grow and diversify to the point where the appelation "staple economy' will no longer suffice" (Watkins, 1963: 151). Per capita incomes will rise, developed secondary markets will serve domestic and possibly foreign markets, staple exports and imports of manufactured goods will fall as a percentage of national income and population growth will result from natural increase rather than from immigration.

Research by Watkins (1977) reveals shortcomings of staple theory. First, the development of a resource base into a staple export does not necessarily lead to an industrial complex. Resource companies do not tend to diversify outside the resource sector and foreign owners tend to take their rents back home. Second, the assumption that all other economic activities are a function of export activities has rarely been the

case (Loxley, 1985). Historically, staple based economies do not diversify and linkages are rarely established at the point of production of the staple. Many of the exports are products with little or no further processing from the raw material.

While exports do not play as large a role in CED as they do in staple theory, the linkage effects are valuable to the development of a theory of CED. Forward, backward and final demand linkages all play a role in the economic development of communities. The concept of maximizing linkages and minimizing leakages is central to CED, as will become evident in sections three to five.

Big Push Theory

P.N. Rosenstein-Rodan's (1943) big push theory is premised on the belief that industrialization is the appropriate path to economic development. Rosenstein-Rodan argues that development requires a series of projects, even if none is big in itself, to create the necessary linkages for effective development. As well, external economies would be possible as labour trained in development strategies would move among the industrial projects, increasing productivity and lowering costs for all.

Complementarity of industries is prescribed as individual firms need suppliers and customers, which may be provided with the creation of numerous industries with a large labour force to furnish demand (Lynn, 2002). "The big push with a balanced pattern of investments provides mutually supporting markets. It has a positive impact on business psychology and allows income earned in one industry to be spent in others. This can be the result of either state planning or incentives to the private sector" (Lynn, 2003: 61).

Further, Rosenstein-Rodin proposes that simultaneous industrialization of many sectors of the economy can be profitable for them all even when no sector can break even industrializing alone (Murphy, Shleifer, and Vishny, 1989).

Nurkse's (1958 as cited in Holland, 1976) literature on the subject of balanced growth supports the application of the big push theory to regional development. "While a single investment project might appear impractical because of the limitations of the pre-existing market, 'a wide range of projects in different industries may succeed because they will all support each other in the sense that the people engaged in each project...will provide an enlarged market for the products of the new enterprises in other industries' " (Holland, 1976: 170).

Unbalanced growth theory also lends support to the big push approach to regional growth and development. Hirschman (1958), an advocate of unbalanced growth, stresses the importance of external economies in the process of growth through inter-sectoral complementarities. "The expansion of industry A leads to economies external to A but appropriable by B, while the consequent expansion of B brings with it economies external to B but subsequently internal to A (or C for that matter) and so on" (Hirschman, 1958: 67).

A key criticism of big push theory is its failure to acknowledge a role for foreign trade which would provide the required outlet for firms to access larger markets. As well, the theory's emphasis on large investments has been criticized as a shortcoming, as the production of many consumer goods and services do not require especially large investments (Lynn, 2003).

While the focus of big push theory is on nations rather than communities, the idea of planned development with the objective of creating linkages through complementarity of industries is very much relevant to a theory of CED.

Location Theory

Location theory was referred to earlier in the discussion of North's export base theory. Regions best suited for industrialisation, according to location theory variables, are predisposed to higher rates of growth and development. Variables affecting the quality or appropriateness of a location include, but are not restricted to, labour costs, energy costs, availability of suppliers, communications, education, training facilities, and quality of local government. (Blakely, 1984)

According to location theory, regions attempt to enhance location beyond its natural attributes to become more attractive to industrial firms. Over time, modern technology and telecommunications have reduced the significance of specific locations for production and distribution of goods. Also, less tangible variables such as quality of life have become more important in location decisions. (Blakely, 1984)

Location theory offers an explanation for why some communities are not predisposed to development. The idea of enhancing location, especially through education and training facilities is relevant to CED theory.

Attraction Models

Industrial attraction models are widely used as economic development models by

communities (Blakely, 1984). The basic assumption behind these models is that a community can alter its market position with industrialists by offering incentives and subsidies. It is assumed that new activities generate tax revenues and increase wealth replacing the initial public and private subsidies.

More recent approaches emphasize attracting entrepreneurial populations, or particular socioeconomic groups, rather than factories to communities. The change in population make-up leads to economic growth as internal demand generates new business enterprises which will also export their products.

This model underlies a recent emphasis on "civic entrepreneurialism", the idea of making communities more attractive for entrepreneurs to succeed. The theoretical basis is that places can display themselves and offer incentives that give them a competitive advantage over other areas with similar resource endowments. However, there is danger of possible cancelling out among communities. (Blakely, 1984)

The characteristic of attraction models most relevant to CED is the role of subsidies and incentives in making a community more attractive for investment. Some aspects of attraction models are not suitable for CED. The inward focus of CED does not support changing the make-up of the population, but rather educating, training, and employing the existing population.

Convergence Theory

C.Y. Thomas's (1974) convergence theory can be described as an economic structuralist dependency theory. In his study of small neocolonial economies, Thomas

(1974) observes underdevelopment to be a consequence of increasing divergence and unresponsiveness of domestic production to meeting the needs of the local people. He contends that foreign ownership and control of domestic resources is a key element of a state of divergence where small neocolonial economies tend to specialize in the production of exports for larger markets.

The divergent nature of dependent economies is considered to be their major structural weakness, a weakness to be remedied by a two stage strategy of convergence. The first stage is that of the convergence of domestic resource use and domestic demand, while the second is that of the convergence of domestic demand and domestic need (Thomas, 1974). The development process involves economic planning of resource use and consumption to meet local needs. Planning involves the organization of the production of goods and services most wanted and most needed by the domestic economy. Planned production is implemented in a way that supports and encourages private entrepreneurship.

A convergence approach is to some extent compatible with a subsistence strategy, as the very nature of subsistence is the convergence of local resources with need. Although, a convergence strategy goes well beyond a subsistence strategy to integrate production for monetary exchange and suggest how this might be organized (Loxley, 1986). A convergence approach shares an important feature with subsistence and care economies, namely the value placed on unpaid labour as a contribution to an efficiently operating society. The care economy refers to work done, usually domestic work, most often by women, which keep the labour force fed and clothed, and contributes to the

future labour force (Bakker and Elson, 1998). A convergence approach recognizes the role of women in the care economy and allows for the possibility of part time employment to accommodate their non-market activities. As well, volunteer labour can play an important role in a convergent strategy.

Convergence allows for the establishment of material relationships between resource use, production, technology, demand, and needs. These relationships provide an economic system with internal autonomy and determine its capacity for sustaining growth and development (Thomas, 1974). At the same time convergence is not autarkic, it allows for engagement in export activity, "where such exports are an extension of domestic demand and domestic needs" (Thomas, 1974: 134). Trade serves a different function under convergence because the economy itself is reoriented to serve different purposes. The economy exports the quantity of production that is not consumed domestically. The strategy underlying export of this residual production is to reduce unit production costs by moderately increasing scale. As well, the transportation costs of production remain low when most of the production is for domestic use rather than export.

Loxley (1981) describes the formation of linkages in convergence strategy:

> "The convergence of local use and demand will be achieved ... through the creation of a series of industries producing "basic goods" - goods which feature prominently in the production of a wide range of consumption and investment goods. They are characterised by extensive forward and backward linkages and by high growth elasticities (increases in per capita value added in a given sector relative to changes in per capita income). It is the dominance of these goods in the production structure of developed capitalist and socialist economies which distinguishes their economies, structurally, from those of dependent underdeveloped economies. The precise constellation of industries, and their phasing will be dictated, of

> course, by the nature of the resource base and the pattern of demand. The essence of the approach is that production is planned, and planned first and foremost to meet local demands and only secondary if at all, as an extension of the domestic market, to meet foreign demands"(Loxley: 164).

Convergence theory is not commonly encountered by that name in the literature (Loxley, 1985). The process of development under economic stucturalist theory closely parallels that under convergence theory. Economic structuralist theory analyses the economic relations between underdeveloped communities and the larger economy. The theory argues that underdevelopment is a structural problem where for historical reasons, the economic activities of communities have focused too much "outward" rather than "inward".

The import domestic expenditure coefficient, a quantitative measure of divergence, relates the value of imports for domestic use to domestic expenditure (Thomas, 1974). The import domestic expenditure coefficient is denoted $\lambda = \frac{Mu}{E}$, where Mu is imports for domestic use and E is domestic expenditures. This measurement provides relevant information on the extent of the gap between the structure of production and the structure of demand which traditional import indices, such as the measurements of import propensity (ratio of imports to GDP) and the import coefficient (ratio of imports to total expenditures), do not divulge. A community whose import domestic expenditure coefficient is close to one is described as a divergent economy, whereas a community whose coefficient is close to zero is described as a convergent economy. Disadvantaged communities typically have import domestic expenditure coefficients close to one meaning that nearly all domestic spending is on goods and services imported into the

community.

Shumacher's (1973) literature on economic development supports convergence theory evidenced in the statement, "production from local resources for local needs is the most rational way of economic life, while dependence on imports....is highly uneconomic and justifiable only in exceptional cases and on a small scale" (Schumacher, 1973: 55-56).

In addition, community-based development literature (Lotz, 1977; Wismer and Pell, 1981, 1983) describes a development process suggestive of convergence and economic structuralist theory. Wismer and Pell (1981) propose CED strategies that match community needs to locally available resources. These strategies propose building community self-reliance by decreasing dependence on outside sources of goods and services, by finding ways to provide them locally. The development process involves "small-scale decentralized, frequently labour-intensive projects which are developed through finding new uses for available resources, both human and material and which serve a variety of locally-identified needs" (Wismer and Pell, 1983: 73).

A convergence approach to development faces challenges on the issues of community ownership and on its political assumptions. It is expected that those who control the economy and those who hold power will fundamentally oppose an approach emphasizing community. A pure convergence strategy is based on ambitious political assumptions. These assumptions include the political system being able to regulate or prohibit trade flows, impose taxes, take property into public sector hands, redistribute income and plan production (Loxley, 1986). Such a political system is very different

from the dominant present day political atmosphere where unfettered free markets and the minimization of the role of the state are held as the formula for development (Loxley and Lamb, 2005).

The main challenge to the convergence approach is the requirement of basic and long term state support which it may be denied if it challenges the private sector or empowers the community to voice its demands and discontents (Shragge, 1993).

In spite of its shortcomings, convergence theory is relevant to CED. Both convergence and CED approaches to development have an inward focus with an emphasis on self-reliance, planned production, and the formation of linkages.

2.2. A Proposed Economic Theory of Community Economic Development

Given that CED is a community-based approach emphasizing local self-sufficiency, local decision making and local ownership, convergence theory is an appropriate starting point for an economic theory of CED. Convergence theory argues that disadvantaged communities are underdeveloped due to a divergence between local resource use and local demand and needs. That is to say divergence, in part, describes a lack of self-sufficiency. Economic development occurs through convergence of a community's resource base and the community's demands and needs according to convergence theory. The development process transpires through economic activity with an inward emphasis. Production decisions are based on the demands and needs of the community first and the demands from outside the community second.

An important component and goal of CED is to work towards meeting the needs

of the community. The significance of addressing community needs in a theory of CED is based on the assumption that the marketplace will not fulfill needs expressed by the community. "The market deals with demand, which in turn is driven by income levels, income distribution, social class and the need for owners of capital to accumulate. If demand coincides with need it will be merely coincidental and will, in any case, refer at best to individual needs and not social need" (Loxley, 2007: 13).

Unlike export-oriented approaches to economic development, export-oriented economic activity plays only a moderate role in CED. While the export of commodities from an economy is necessary for development, it must be balanced with a strong internal component that captures and re-circulates wealth and uses it to sustain more diverse economic activities. "If this element is not present, then the promotion of exports can actually have a negative impact on the development of a community" (Fairbairn, Bold, Fulton, Ketilson and Ish, 1991: 49). Earnings from export-oriented industries are a form of inflows contributing to the level of economic activity in a community. The ability of the economy to maintain or increase its level of economic activity depends on non-negative net inflows (inflows less leakages) (Fairbairn et al, 1991). Leakages arise when economic agents make purchases from outside the community and include such activities as outside investment, consumer purchases, input purchases and profits. Recognizing that no community is an island, CED involves reducing not eliminating leakages. An export-oriented approach also tends to lead to import dependence which also leaves the fulfillment of community needs up to chance (Loxley, 2007).

The formation of linkages among the different production sectors is the

mechanism through which community economic growth and development occurs. Staple theory (Watkins, 1963), convergence theory (Thomas, 1974), the big push theory (Rosentein-Rodin, 1943), as well as theoretical work by Thompson (1965) and Loxley (1985), all emphasize the importance of linkages for economic development. The size of the income multiplier effect is directly related to the number of linkages in an economy. For instance, backward linkages occur if a local restaurant purchases its resources (labour, food, supplies, etc.) from within the community. Forward linkages occur if the restaurant sells some of its baking products to grocery stores for resale in the community. Final demand linkages occur if the restaurant serves the demand and needs of the community. For instance, an expensive high end restaurant in a low income community will not produce final demand linkages. The maximization of linkages and the minimization of leakages enhance the growth and development process. In reference to the local restaurant example, leakages are minimized to the extent that the restaurant is locally owned and the profits stay within the community, that goods and services for operating the restaurant are purchased from within the community, and that the restaurant's products are sold to other businesses and individuals within the community.

Convergence theory argues for small scale production in the community economic development process. Small scale economic activities are influential in the creation of the inter-industry linkages described above (Thomas, 1974). Self-reliance, a characteristic necessary for community development implies that the community's economy should only rely on limited export activity, thus small scale production is a characteristic of community economic development. In order to achieve economic

growth and development a community must produce for itself first and for foreigners (outside the community) second (Thomas, 1974). As well, Schumacher (1973), argues that small scale production activities are important for economic sustainability, as they are less likely to be harmful to the natural environment than larger-scale ones, "simply because their individual force is small in relation to the recuperative forces of nature" (Schumaker, 1973: 33). Schumacher also makes a case for small scale production in relation to community ownership: "It is moreover obvious that men(sic) organised in small units will take better care of *their* bit of land or other natural resources than anonymous companies or megalomanic governments which pretend to themselves that the whole universe is their legitimate quarry" (Schumaker, 1973: 34).

The inclusion of small scale production as a necessary component in an economic theory of CED may be problematic, as economic theory generally supports the view that economies of scale are crucial in determining the nature and levels of production. Although, there is some evidence that relatively small scale production is not necessarily less efficient than large scale production. Mansfield (1999) states that empirical studies have shown significant economies of scale at low levels of output and that economies of scale tend to diminish as output increases. These findings suggest that the long-run average cost function tends to be horizontal at high levels of output. Although microeconomic theory postulates a U-shaped cost curve, research shows it to be L-shaped (Mansfield, 1999). It may be that community production levels are sufficient to reach the horizontal section of the long-run average cost function, although in practice few CED projects are viable without some degree of subsidization to reduce unit production costs.

Further to the issue of small scale economic activity, inter-industry linkages may be more important than economies of scale in the economic development of a community. Convergence theory suggests that the benefits of creating the linkages will outweigh the losses associated with foregoing large-scale production (Loxley, 1986). This idea of a synergy effect stemming from the additional linkages created among several CED projects in a community draws from Rosenstein- Rodan's big- push approach to economic development (Lynn, 2003). Rosenstein- Rodan's argument is that development requires a series of projects, even if none is big in itself, to create the necessary linkages for effective development. As well, external economies would be possible as labour trained in CED strategies would move among the community projects, increasing productivity and lowering costs for all. Implicit in the big push theory is the idea of planned production for development. Planned production is necessary in the early stages of community development, although it should not be planned in such a way as to inhibit private entrepreneurship and might even support or encourage it. Microeconomic theory on positive externalities complements the big-push component of CED theory.

The microeconomic theory of positive externalities is relevant to a proposed economic theory of CED. In theory, the activity of any economic agent can indirectly affect other economic agents. One type of externality, the production-production externality arises when producers are both source(s) and the recipient(s) of the externality. The classic case of a positive production-production externality is the shopping centre. The small specialty stores benefit from customers attracted by large department stores which are the anchors of most such developments. The existence of positive externalities

is an indication of inefficiency, where resources are underallocated to the source of the externality. With reference to the department store illustration, efficiency would increase if more resources were devoted to anchor department stores which would in turn benefit the many small specialty stores. Internalizing the externality by a third party is one of the remedies for the economic inefficiency. (Eaton and Eaton, 1988)

The internalization of an externality can be applied to CED theory, as it relates to the concept of big push theory. It follows from the explanation above that joint profits from many CED projects may be positive even if some of the CED projects show negative returns. The idea of internalizing a positive externality as a means of increasing economic efficiency strengthens the argument for subsidizing CED projects, or at least subsidizing one larger CED project. If one large and possibly unprofitable CED project can support several other small CED projects, through positive externalities and linkages so that the net profit of all projects is positive, then it is likely worthwhile to subsidize the one large project. There may be a case here for cross-subsidization whereby the smaller projects eventually subsidize the large project.

External economies (North, 1955; Myrdal, 1957; Hirschman, 1958; Perroux (as cited in Holland, 1965; Blakely, 1984; Rosenstein-Rodin (as cited in Murphy et al, 1989)) are a valuable component of development contributing to growth by improving a community's competitive cost position. External economies can be developed through linkages as well as activities such as creating marketing organizations, credit facilities, and training the labour force.

The importance of capital to community development is a common thread

throughout existing theoretical literature on economic development. It is agreed that capital is necessary for community economic development, although the source of capital can influence the development process. Disadvantaged communities have difficulty raising capital within the community, as low incomes and low savings rates are characteristic of these communities. Capital is most likely to come from sources outside the community, although there are development issues related to using external capital for development. Leakages of profits tend to occur when the source of capital is from external sources (North, 1955; Watkins, 1963; Thomas, 1974; Loxley, 1985). When the source of capital is external, profits do not tend to be reinvested in the community (Loxley, 1985) and diversification of the economy is less likely (Watkins, 1963). Although a CED approach to economic development is grounded in the philosophy of self-reliance and community independence, the development implications of external capital suggests a shortage of local capital and the need for public subsidization of CED projects.

In sum, economic development at the community level occurs through the creation of inter-industry linkages through small scale production, production focused on satisfying local demand with a limited export sector, the creation of external economies, the internalization of positive externalities, and with capital from within the community or subsidized by the public sector. The following sections of this paper develop formalized microeconomic models to explain aspects of CED theory. The microeconomic models to be developed in sections four to six are based on methodology drawn from analytical techniques of regional economic development, the topic of section three.

3. Methodology

CED draws on regional economic development literature for analytical techniques. As regional economic development literature has proven very helpful in developing an economic theory of CED, it is also quite appropriate for CED economic impact analysis. The three main analytical techniques used for regional economic development are economic base analysis, income-expenditure analysis and input-output analysis.

There is widespread agreement that input-output analysis is the most valuable of the three techniques for analysing economies characterised by interdependencies between producing sectors. Neither the economic base model nor the income expenditure model is able to handle more than relatively insignificant interdependencies between producing sectors. Linkages and leakages are integral to the process of how CED works, making input-output analysis the superior theoretical method as it is designed to identify linkages between sectors and to derive distinct multipliers for each economic sector of the model. Only the input-output model endogenously determines direct, indirect, and total impacts of a CED project on economic activity.

Since the development of the I-O approach by Wassily Leontief[2], it has become integral to regional economic analysis. A regional I-O model provides a clear still-life picture of the regional economy. It uniquely reveals the ways in which the various sectors of the region's economy are meshed together and are linked to the likely sources of

[2] Wassily Leontief was awarded the Nobel prize in economics in 1973 for developing input-output (I-O) economics.

economic stimuli, namely the "final demands" of household consumption, private capital formation, government purchases, and exports (Davis, 1993).

Input-output analysis is useful for predicting the effects throughout an economy of changes in final demands for the output of any one sector (Davis, 1993). Any increase in quantity purchased from a particular sector by a firm or by a final consumer initiates a chain reaction throughout the economy. "What the input-output model does is to trace through the resulting maze of economic reverberations or interactions to show, when the rounds of spending have come to an end, what the increased output of each sector will be, given the initial increase in one of the final demand categories" (Davis, 1993: 56). Conversely, a decrease in final demand will result in decreased output for the economy sector by sector.

In order to analyse all the rounds of effects in a set of equations the input-output system is represented in matrix form (Richardson, 1972). The matrix equation represents a set of equations with an equation like (3.1) for each sector:

$$\mathbf{X} - A\mathbf{X} = \mathbf{Y} \quad (3.1)$$

where **X** and **Y** are column vectors of gross output and final demand respectively, and A is an n x n matrix of direct input coefficients, a_{ij}. Using the identity matrix **I**, equation (3.1) may be rewritten as

$$(I - A)\,\mathbf{X} = \mathbf{Y} \quad (3.2).$$

If it can be assumed that (I- A) has an inverse then gross output can be expressed as a function of final exogenous demand,

$$\mathbf{X} = (\mathrm{I} - \mathrm{A})^{-1}\,\mathbf{Y} \quad (3.3).$$

Interdependency coefficients are represented by the entries in the inverse matrix, where each coefficient b_{ij} represents the direct and indirect requirements of sector *i* per unit of final demand for the output of sector *j* (Richardson, 1972)[3].

The I-O model is based on a number of simplifying assumptions. The first assumption is constant direct purchase coefficients over the period of analysis. These coefficients represent the proportions in which each sector purchases its inputs from all other sectors. This assumption precludes the effects of changes in technology, proportions and types of inputs.

The second assumption is linearity of the model. A linear model suggests a constant and linear production function, where all inputs are proportional to the output of a particular sector. Linearity precludes the consideration of internal economies of scale, external economies, discontinuities, threshold effects, irreversibilities and other violations of smooth linear functions (Holland, 1976; Davis, 1993). Given earlier comments on the significance of internal economies of scale and external economies to CED, the linearity assumption imposes some restrictions on the analysis in this paper. These restrictions must be considered when interpreting results based on input-output models.

The third assumption is homogenous sectors in the economy. According to this assumption, a given change in demand for sector *i* will always have the same impact on the economy. In reality, sectors are aggregates of heterogeneous activities with different

[3] Equations and explanations for equations 3.9 to 3.11 are referenced to Richardson, 1972.

input patterns.

The fourth assumption pertains to a closed I-O model, as it is assumed that household consumption functions are linear and homogeneous to the first degree. In other words, average propensity to consume is equal to marginal propensity to consume.

The four assumptions lead to a tractable model with a workable number of variables. The restrictive assumptions of the production function do not appear to be too limiting, as evidenced by the fact that input-output models pass the critical test of being able to predict reasonably well. In sum, the advantages of using input-output models for analysing CED outweigh the disadvantages imposed by the simplifying assumptions.

An I-O matrix model of CED is used in this paper as a framework for developing a microeconomic theory of CED. The matrix below represents an open I-O model of CED.

The open I-O model for CED consists of i rows and j columns i,j = 1,...n; n-1 is the number of CED projects in the community. Income equations can be derived by summing across each row yields income equations,

$$X_i = \sum_{j=1}^{n} X_{ij} + H_i + Y_i \quad (3.4).$$

Gross income for CED $_i$ is equal to the sum of income received from selling intermediate goods to other CED initiatives and to community industry plus income received from sales of final goods to households in the community plus income received from sales of final goods to CED initiatives and non-CED industry in the community, local and non-local government, households, and industry outside of the community. Community

industry refers to industry that pre-exists CED in the community.

	CED_1	CED_j	CED_{n-1}	Community Industry	HH	Other final demand	Gross output/ income
CED_1 . . .	X_{11} ...	X_{1j} ...	X_{1n-1}	X_{1n}	H_1	Y_1	X_1
CED_i . . .	X_{i1} ...	X_{ij} ...	X_{in-1}	X_{in}	H_i	Y_i	X_i
CED_{n-1}	X_{n-11}	X_{n-1i}	$X_{-n-1n-1}$	X_{-n-1n}	H_{n-1}	Y_{n-1}	X_{n-1}
Community Industry	X_{n1} ..	X_{ni} ...	X_{nn-1}	X_{nn}	H_n	Y_n	X_n
Wages	W_1 ...	W_j ...	W_{n-1}	W_n			
Other value added	V_1 ...	V_j ...	V_{n-1}	V_n			
Imports	M_1 ...	M_j ...	M_{n-1}	M_n			
Total expenditures	X_1 ...	X_j ...	X_n-1	X_n	H	Y	**X**

Table 1 Open Input-Output Matrix

Summing down each column yields expenditure equations,

$$X_j = \sum_{i=1}^{n} X_{ij} + W_j + V_j + M_j \quad (3.5).$$

Gross expenditures for CED_j is equal to the sum of expenditures on purchases of intermediate goods from other CED initiatives and industry in the community plus expenditures on labour (wages) plus other value added expenditures, including taxes,

profit, rent and interest, less subsidies, plus expenditures on inputs from outside the community (imports).

Direct input requirement coefficients are calculated from the I-O model and illustrated in the matrix table below. The coefficients are calculated as follows: $a_{11} = X_{11}/X_1$, $a_{1j} = X_{1j}/X_j$, $a_{1n-1} = X_{1n-1}/X_{n-1}$, ... The coefficients in the three rows and three columns in the upper left hand section of the table represent the direct requirements of output of any CED_i per unit of output of any other purchasing CED_j, in an n sector model, where n-1 is the number of CED initiatives in the community.

Matrix of direct input requirement coefficients = A

a_{11}	a_{1j}	a_{1n-1}	a_{1n}
a_{i1}	a_{ij}	a_{in-1}	a_{in}
a_{n-11}	a_{n-1j}	a_{n-1n-1}	a_{n-1n}
a_{n1}	a_{nj}	a_{nn-1}	a_{nn}

The direct input requirement coefficients in the fourth row and fourth column represent the exchange of intermediate goods between CED initiatives and community industry. The coefficients in row four represent the direct requirements of output of any community industry, per unit of output of any purchasing CED_j. The coefficients in column four represent the direct requirements of output of CED_i, per unit of output of any purchasing community industry.

The direct input requirement coefficients provide the link between final demand and gross output of CED initiatives and community industry. The relevance of the direct input requirement coefficients relies on the assumption that these input coefficients are linear and homogenous, and remain constant over time. The above stated assumption permits us to state, $X_i - a_{i1}X_{i1} - a_{ij} X_{ij} - a_{in} X_{in} = Y_i + H_i$. Let $Y_i + H_i = \mathbf{Y}$, column vectors of total final demand. $\mathbf{X} - A\mathbf{X} = \mathbf{Y}$, where **X** and **Y** are column vectors of gross CED and community industry output and final demand respectively, and A is an n x n matrix of direct input coefficients, a_{ij} . Re-arranging X - AX = Y yields (I - A) X = Y , where I is an identity matrix.

(I-A) =

$1-a_{11}$	$-a_{1j}$	$-a_{1n-1}$	$-a_{1n}$
$-a_{i1}$	$1-a_{ij}$	$-a_{in-1}$	$-a_{in}$
$-a_{n-11}$	$-a_{n-1j}$	$1-a_{n-1n-1}$	$-a_{n-1n}$
$-a_{n1}$	$-a_{nj}$	$-a_{nn-1}$	$1-a_{nn}$

Rearrange to isolate X on the left hand side, $\mathbf{X} = (I-A)^{-1}\mathbf{Y}$

$(I-A)^{-1} = B$ = Leontief Inverse Matrix

b_{11}	b_{1j}	b_{1n-1}	b_{1n}
b_{i1}	b_{ij}	b_{in-1}	b_{in}
b_{n-11}	b_{n-1j}	b_{n-1n-1}	b_{n-1n}
b_{n1}	b_{nj}	b_{nn-1}	b_{nn}

Each b_{ij} is an interdependency coefficient showing direct and indirect requirements of CED initiatives resulting from a change in final demand.

CED multipliers can be derived from the matrices above. Output or column multipliers measure the total value of CED requirements per unit of final demand for each CED_j. A higher value indicates greater interdependence of CED_j with other CED initiatives and industy within the community. These multipliers can be calculated by summing the column entries of the Leontief Inverse Matrix. For instance, output multipliers for CED j are as follows,

$\sum_{i=1}^{n} b_{ij}$, where j = 1,..,n-1.

In order to calculate type I and type II income multipliers, the I-O model is closed with respect to households, as illustrated below.

	CED_1	CED_j	CED_{n-1}	I	HH	other final demand	Gross output/ income
CED_1	X_{11}	X_{1j}	X_{1n-1}	X_{1n}	X_{1h}	Y_1	X_1
CED_i	X_{i1}	X_{ij}	X_{in-1}	X_{in}	X_{ih}	Y_i	X_i
CED_{n-1}	X_{n11}	X_{n-1j}	X_{n-1n-1}	X_{n-1n}	X_{n-1h}	Y_{n-1}	X_{n-1}
Industry	X_{n1}	X_{nj}	X_{nn-1}	X_{nn}	X_{nh}	Y_n	X_n
HH	X_{h1}	X_{hj}	X_{hn-1}	X_{hn}	X_{hh}		
other value added	V_1	V_j	V_{n-1}	V_n	V_h		
imports	M_1	M_j	M_{n-1}	M_n	M_h		
Total expenditures	X_1	X_j	X_{n-1}	X_n	X_h	Y	**X**

Table 2 Closed Input-Output Matrix

A Type I income multiplier is the ratio of direct and indirect income change to the direct income change resulting from a unit increase in the final demand for any given CED. The direct income change for each CED is given by the household row entry of the original I-O table, the open model, when expressed in direct input requirement form, W_j/X_j. Direct and indirect income change is equal to the sum of the products of column entries in the Leontief inverse matrix and supplying CED initiatives' HH (household) coefficient.

Direct and indirect income change for CED_1 is equal to $(b_{11} \times h_{R1}) + \ldots + (b_{i1} \times h_{Rj}) + \ldots + (b_{n-11} \times h_{Rn-1})$, where $h_{Ri} = W_j / X_{j_n}$, $j = 1 \ldots n-1$ (an entry in the row vector of HH coefficients).

Direct and indirect income change for CED_j is equal to $\sum_{i=1}^{n-1} b_{ij} h_{Ri}$.

The type I multiplier for CED_j is equal to $\frac{\sum_{i=1}^{n-1} b_{ij} h_{Ri}}{h_{Ri}}$.

Type II multipliers take into account induced consumption effects of expansion of final demand as well as direct and indirect income effects. The model must be closed with respect to households in order to calculate the income multipliers. The direct coefficient matrix A* is as follows,

A* =

a_{11}	a_{1j}	a_{1n}	a_{1h}
a_{i1}	a_{ij}	a_{in}	a_{ih}
a_{n1}	a_{ni}	a_{nn}	a_{nh}
a_{h1}	a_{hj}	a_{hn}	a_{hh}

And the corresponding Leontief inverse matrix, B* is as follows,

$(I-A^*)^{-1}$ or $B^* =$

b^*_{11}	b^*_{1j}	b^*_{1n}	b^*_{1h}
b^*_{i1}	b^*_{ij}	b^*_{in}	b^*_{ih}
b^*_{n1}	b^*_{nj}	b^*_{nn}	b^*_{nh}
b^*_{h1}	b^*_{hj}	b^*_{hn}	b^*_{hh}

The coefficients in the B* matrix allow evaluation of the effects of changes in output from any CED. For instance, a $1 increase in final demand for output of CED_1 will require CED_1's output to increase by \$1 x b^*_{11}, CED_i's output to increase by \$1 x b^*_{i1} and CED_{n-1}'s output to increase by \$1 x b^*_{n-11}, community industry to increase by \$1 x b^*_{n1} and household income to increase by \$1 x b^*_{h1}.

The type II multiplier is the sum of the ratio of entries in HH rows of B* matrix to the original direct income changes. Type II multipliers for each CED are as follows:

$CED_1 = b^*_{h1}/h_{R1}$

$CED_j = b^*_{hj}/ h_{Ri}$

$CED_{n-1} = b^*_{hn-1}/h_{Rn-1}$

Type II income multipliers are more meaningful and realistic than type I income multipliers because they consider income changes resulting from changes in consumer spending. They illustrate the chain reaction of inter-CED and industry reactions of income, outputs and resulting consumer spending. The size of the multiplier is directly

related to the extent of interdependence among the CED initiatives and between CED initiatives and community industry. Thus, interdependence among CEDs is an objective of community planners.

4. A Microeconomic Explanation of the Role of Subsidies in CED

Section four consists of two subsections. Subsection 4.1 is an analysis of how subsidization works in CED, explained by deriving and applying cost multipliers from the I-O matrix model. Subsection 4.2 is a matrix justification for subsidization of CED based on principles of cost-benefit analysis.

4.1 Cost Multipliers and Subsidization of CED

CED involves small scale production with typically higher unit production costs than competing larger scale industries. In order to be price competitive a CED might consider one or a combination of the following two strategies. The first strategy involves reducing unit production costs by moderately increasing scale and exporting the residual production (production not consumed by the community). The second strategy involves subsidization by the public sector, again, with the objective of reducing unit production costs.

In regard to the first strategy, the challenge is to determine an optimal level of production while not exceeding an optimal level of exports. The optimal level of production refers to the level at which unit production costs are reduced to those of competing larger scale firms. The optimal level of exports is not specifically defined, but refers to the level at which community needs and demands are prioritized over the

demands of those outside the community (exports). The optimal level of exports may not coincide with the optimal level of production. It may be the case that the level of exports required to reach the optimal level of production is such that CED goals are sacrificed. Further discussion and analysis this strategy will be explored in future research. The discussion in this section focuses on the second strategy of subsidization.

The objective of subsidization is to reduce both total costs and unit costs of CED production so that it is competitive with competing larger scale firms. The small scale characteristic of CED can be problematic if relatively high unit costs result in relatively high and unmarketable product prices. In order to achieve both small scale production and feasible CED projects, measures are required to lower unit costs. With use of the I-O model developed in the preceding section, cost multipliers are calculated and used to explain how subsidization of CED operates to lower unit production costs.

In section three, total expenditure equations were derived from the I-O model, $X_j = \sum_{i=1}^{n} X_{ij} + W_j + V_j + M_j$. Unit production costs for any CED_j is equal to

$(\sum_{i=1}^{n} X_{ij} + W_j + V_j + M_j)/ q_j$, where q_j is equal to the quantity of output produced by CED_j .

As noted in section three, subsidies are illustrated as a negative value in the value-added row vector. A subsidy, S_j, for CED_j reduces total costs, $\sum_{i=1}^{n} X_{ij} + W_j + V_j + M_j$ by an amount greater than S_j due to interdependence among CED initiatives, expressed in a

cost multiplier. A cost multiplier is derived below.

The lower unit production costs for CED_j benefit other agents in the community, namely CED initiatives which have backward and final demand linkages with CED_j. All CED initiatives using CED_j's output as input in their production process realize a reduction in their total and unit production costs. When several CED initiatives are simultaneously operationalized in a community the multiplier effect strengthens the cost reducing effect of subsidization.

Cost multipliers are calculated to illustrate the linkage effects and benefits of subsidization to CED. Matrix A, direct cost requirement coefficients (section 3), provides the link between total costs and gross output of CED initiatives and community industry. The relevance of the direct input requirement coefficients relies on the assumption that these input coefficients are linear and homogenous, and remain constant over time.

The assumption of linearity permits us to state,

$$X_j - a_{i1}X_{i1} - a_{ij}X_{ij} - a_{in-1}X_{in-1} - a_{in}X_{in} = W_j + M_j + V_j.$$

Total costs minus expenditures on community produced intermediate goods equals expenditures on labour, imports and other value-added (profit, rent, interest, taxes less subsidies). Let $W_j + M_j + V_j = C_i$, where C_i, represents column vectors of expenditures on wages, imports and other value-added.

The direct cost requirements must meet two stability conditions since it is used to calculate multipliers. These conditions are as follows: 1) the sum of at least one column in the table must be less than one. 2) the sum of any column must not be more than

one.(Miernyk, 1965). For these to hold, the value of a subsidy, S_j, for any CED_j, must be less than the total of wages, other value added (less subsidy) and imports for CED_j.

The effect of a subsidy is illustrated in the Leontief inverse matrix B, where each b_{ij} is an interdependency coefficient showing direct and indirect changes in total costs due to subsidization. All tables of direct and indirect changes in costs have diagonal entries greater than one because in the general solution of the system of equations the subsidy is increased by one dollar (Richardson, 1972). For instance, for every dollar of subsidy to CED_1, total costs of CED_1 will be reduced by \$1 x b_{11}, CED_j by \$1 x b_{1j}, CED_{1n-1} by \$1 x b_{1n-1} and industry n by \$1 x b_{1n}.

The stability condition for the direct and indirect cost matrix is known as the Hawkins-Simon condition which states that there can be no negative entries in the table (Miernyk, 1965). A negative entry would mean that a subsidy would increase production costs of CED initiatives and community industry.

Cost multipliers are calculated in a similar way to output or column multipliers from a traditional I-O model. They measure the total reduction in costs of community CED initiatives and industry per dollar of subsidy to the CED in question. These multipliers can be calculated by summing the row entries of the Leontief inverse matrix B. The cost multiplier for any CED_j is $\sum_{j=1}^{n} b_{ij}$, where j = 1,...n. The size of the cost multiplier is directly related to the extent of interdependence among the CED initiatives and between CED initiatives and community industry.

The cost multiplier illustrates the benefits of simultaneously subsidizing several

CED initiatives in a community. The unit costs of each CED will be reduced by a greater amount per subsidy dollar when several CED initiatives are simultaneously subsidized, thus increasing the benefits of the subsidization. The unit production cost for each CED_j when n -1 CED initiatives are simultaneously subsidized is $\left(\sum_{i=1}^{n} X_{ij} + W_j + M_j + V_j - \sum_{i=1}^{n} b_{ij} S_i\right) / q_j$, which is less than the unit production cost of any CED_j when it is the only subsidized CED, $(\sum_{i=1}^{n} X_{ij} + W_j + M_j + V_j - b_{ij} S_j) / q_j$. When several CED initiatives are simultaneously subsidized, the total benefit of subsidization, measured by lower unit production costs is greater than when only one CED is subsidized.

The equations above illustrate that less subsidy is required to reduce unit production costs of n –1 simultaneously subsidized CED initiatives to competitive levels than is required to reduce unit production costs of n -1 CED initiatives to competitive levels, each subsidized in isolation.

4.2. Matrix Justification for Subsidization of CED

Based on principles of cost-benefit analysis to justify subsidization, projects that are commercially unviable may be socially viable if the market does not accurately capture the true costs and benefits to society of the project in question. The use of market prices in cost-benefit analysis is conditional upon reasonably full employment of the

economy's labour and capital stock, so that returns to these productive resources are accurate indicators of the true opportunity cost of diverting the resources from alternative productive activities (Davis, 1993). In the case of a disadvantaged community experiencing widespread unemployment, "the true social cost of employing labour is not the wage that would have been paid to hire workers, but rather the loss of output to society of offering these people a job"(Loxley and Lamb, 2006: 50).

In this case, and others where market prices do not reflect the true costs to society, shadow prices are substituted for the prevailing market prices. The opportunity cost of employing previously unemployed labour is zero or negligible, since no production is foregone by their employment. Following this line of reasoning, it is argued that a subsidy is justified by putting wage costs well below their market cost, thus improving the apparent profitability of the project (Loxley and Lamb, 2006). Based on the same principles outlined above, shadow prices may also apply to unemployed capital or land. The following discussion utilizes the concept of shadow pricing and I-O analysis to justify subsidization of CED.

Consider a scenario where two firms are producing similar, competing products. Firm A is a CED initiative producing a product within the community and is represented as CED_A in the I-O matrix below. Firm B produces outside the community and exports some of its product into the said community. Accordingly, the product of firm B is illustrated as an import (MB) in the I-O matrix. Firm B is a producer with significant monopoly power setting competitive prices based on relatively large scale production. Firm A's production is small scale with relatively high unit costs.

Firm B's production would be illustrated in an I-O matrix for the community in which it produces. Total expenditures of firm B are equal to $\Sigma X_B + W_B + V_B + M_B$, where ΣX_B are expenditures on domestic intermediate inputs, W_B is expenditures on wages, V_B is expenditures on the other components of value added, including profit, taxes less subsidies, rent and interest, and M_B is expenditures on imported inputs. Total income of firm B is equal to $\Sigma X_B + H_B + Y_B$, where ΣX_B is income from domestic sales to other firms, H_B is income from final sales to local households, and Y_B is income from final demand from government, investment and export.

Consider firm B's total revenue to be represented by $\Sigma X_B + W_B + V_B + M_B$, a reasonable assumption since $\Sigma X_B + W_B + V_B + M_B = \Sigma X_B + H_B + Y_B$ in the I-O matrix. Further, $(\Sigma X_B + M_B + W_B + V_B)/q_B$ represents average revenue, based on large scale production and competitive product prices. It follows that the target total revenue for firm A, based on competitive product prices, can be represented as $((\Sigma X_B + M_B + W_B + V_B)/q_B)\, q_A$ which will be less than $(\Sigma X_A + M_A + W_A + V_A)$ due to the relatively high unit costs of small scale production.

Note, the sum of W_B and V_B is equal to the total value added, the sum of income payments from firm B, to the final sectors of the economy. Similarly, the sum of V_A and

	(CED_A) Firm A	CED_j	CED_{n-1}	Industry	HH	Other Final demand (I, G, X)	Gross output/ income
CED_A . . .	X_{1A} ...	X_{Aj} ...	X_{An-1}	X_{An}	H_A	Y_A	X_A
CED_i . . .	X_{iA} ...	X_{ij} ...	X_{in-1}	X_{in}	H_i	Y_i	X_i
CED_{n-1}	X_{n-1A} ...	X_{n-1i} ...	X_{n-1n-1}	X_{n-1n}	H_{n-1}	Y_{n-1}	X_{n-1}
Industry	X_{nA} ..	X_{ni} ...	X_{nn-1}	X_{nn}	H_n	Y_n	X_n
Wages	W_A ...	W_j ...	W_{n-1}	W_n			
Other value added (profit, interest, rent, taxes less subsidies)	V_A ...	V_j ...	V_{n-1}	V_n			
Imports	M_A ...	M_j ...	M_{n-1}	M_n			
Imports from firm B	MB_A ...	MB_j ...	MB_{n-1}	MB_n			
Total expenditures	X_A ...	X_j ...	X_n-1	X_n	H	Y	**X**

Table 3 Subsidization Model Input-Output Matrix

W_A is equal to the total value added, the sum of income payments from firm A, with its small scale production, to the final sectors of the economy.

The target profit for firm A is an economic profit of zero which includes a positive rate of return for the factors of production. In order to reach the target rate of profit in V_A plus W_A, a subsidy will be required. The subsidy should not exceed (W_A - W_{Asp}), where the latter is the shadow wage bill. The shadow wage bill is expected to be zero or negligible. If shadow pricing is required for other components of value added, then the subsidy should not exceed

$((W_A + V_A) - (W_{asp} - V_{asp}))$.

5. Fiscal Impact Analysis of CED

Community economic development projects contribute to government revenues by broadening the tax base and by decreasing government transfer payments. The projects increase public expenditures when the project and associated economic development in the community requires additional government services, such as residential development, water supply, waste removal, service roads and subsidies to name a few. The net fiscal impact of a CED project is calculated by taking the difference between changes in tax revenue and changes in government expenditures. It provides an estimate of a project's potential impact on the government budget.

Various methodologies have been used to analyze local fiscal impact using an I-O model. The main contributions to the literature are by J.H. Cumberland (1965) and W. Z. Hirsch (1963, 1968). The strengths of Cumberland's model are the disaggregation of the

tax row and government expenditure column and the adjustment made for population change. Cumberland's model is the simplest but has the drawback of treating the government sector as an exogenous variable. Hirsch outlines two methodologies to deal with local fiscal impact in an I-O model, the two-stage model and the modified balanced regional input-output model. The two-stage model is quite similar to Cumberland's model in that the government sector is an exogenous variable. Hirsch's modified regional input-output model has the advantage of incorporating the local government sector into the I-O model itself (Richardson, 1972). The modified regional input-output model provides the framework for the fiscal impact model of CED in this paper.

In Hirsch's modified regional model, the use of input-output techniques for analyzing local government expenditures implies that local government expenditures are analogous to expenditures of other industries in the matrix. With the understanding that the level of activity of local industry and CED depends considerably on final demand, it follows that a relationship exists between changes in final demand and changes in local government expenditure. "Projection of urban government expenditures within a regional input-output framework assumes that, within limits, benefits from urban government services accrue to specified local sectors. Very few urban government outputs are consumed as pure public goods." (Hirsch, 1968: 264)

Hirsch (1968) argues that the linear homogenous production function implied by the I-O model is reasonable in that local governments tend to be horizontally integrated over a wide range of output. Some of the local government services considered to be horizontally integrated includes education, police and fire protection. Hirsch's argument

for closing the model with respect to households and local government is that in large urban areas the activities of these two sectors are closely related to the general level of economic activity within the area (Hirsch, 1968). Further, he states that it is useful to consider households and urban government sectors as part of the endogenous segment of the economy, based on the assumption of reasonably stable, full employment conditions (Hirsch, 1968).

Hirsch's argument for model closure and his assumption of stable, full employment conditions as they apply to a fiscal analysis of CED raises two issues which need to be addressed. First, CED is implemented in small communities rather than large urban areas. The community may be isolated as in the case of a northern Aboriginal reserve, or it may be urban as in the case of an inner-city community. In the case of an isolated community with its own government, as in the case of an Aboriginal reserve, it is reasonable to accept Hirsch's assumption of a close relationship between the general level of economic activity in the community with that of households and the local government. However, in the case of an inner-city community, likely an economically and socially disadvantaged community located in an urban center, a close relationship does not exist between the general level of economic activity in the community with that of households and local government. This shortcoming must be considered when evaluating the net fiscal impact analysis below.

Second, since CED targets economically disadvantaged communities, stable full employment is not a reasonable assumption. The full employment assumption implies that new development, such as a CED initiative, brings an in-migration of people into the

community, requiring additional government expenditures on services. The existence of high rates of unemployment will result in an overestimation of changes in government expenditures, based on government expenditure multipliers calculated using the linear I-O model, as those who were previously unemployed and not in the labour force were being provided with most government services, namely education, fire and police protection.

The following fiscal impact analysis of CED outlines a model for the net fiscal impact of CED based on the main principles of Hirsch's (1968) modified regional I-O model.

The I-O below is closed with respect to households and local government. The relationships between final demand, local CED and industry and local government are assumed to be reasonably stable and predictable.

As in Hirsch's model, outlined above, the local government is represented in two rows, one representing local government service costs and the second representing local government fiscal resources. The values in the second row are calculated by subtracting the costs of local government services from local government tax receipts. It is expected that this row will contain negative values, as local governments typically rely on transfers from the central government (provincial and federal). The sum of both rows is equal to the local tax expenditures of CED initiatives and local industry.

Like Hirsch's model, the first local government column represents sales of local CED initiatives and industry to the local government. The purpose of the second column is to balance entries with transfers from the central government (provincial and federal). Purchases of community produced output by the central government are included in the

	CED_1	CED_j	$CEDn-_1$	Industry	HH	Local G exp.	Transfers from central G			Other final demand (exog. G, I, X)	Gross output/income
							To local G	Social Assistance	EI		
CED_1	X_{11}	X_{1j}	X_{1n-1}	X_{1n}	X_{1n+}	X_{1n+2}	X_{1n+3}			Y_1	X_1
CED_i	X_{i1}	X_{ij}	X_{in-1}	X_{in}	X_{in+}	X_{in+2}	Xi_{n+3}			Y_i	X_i
$CEDn-_1$	X_{n-11}	X_{n-1j}	X_{n-1n-1}	X_{n-1n}	X_{n-1n+1}	X_{n-1n+2}	X_{n-1n+3}			Y_{n-1}	X_{n-1}
Industry	X_{n1}	X_{nj}	X_{n+1n-1}	X_{nn}	X_{nn+1}	X_{nn+2}	X_{nn+3}			Y_n	X_n
HH(wages & salaries)	X_{n+11}	X_{n+1j}	X_{n+1n-1}	X_{n+1n}	X_{n+1n+1}	X_{n+1n+2}	X_{n+1n+3}	S	E	Y_{n+1}	X_{n+1}
Local G service cost	X_{n+21}	X_{n+2j}	X_{n+2n-1}	X_{n+2n}	X_{n+2n+1}	X_{n+2n+2}	X_{n+2n+3}			Y_g	X_g
Local G fiscal resources (local tax receipts – costs = transfers)	X_{n+31}	X_{n+3j}	X_{n+3n-1}	X_{n+3n}	X_{n+3n+1}	X_{n+3n+2}	X_{n+3n+3}				
Taxes to central G	T	T	T	T	T						
EI contributions to central G	E	E	E	E	E						
Other Value Added	V_1	V_J	V_{n-1}	V_n	V_h						
Imports	M_1	M_J	M_{n-1}	M_n	M_h	M_g					
Total Expenditures	X_1	X_J	X_{n-1}	X_n	X_h	X_g		S	E	Y	**X**

Table 4 Input-Output Matrix for Fiscal Analysis

other final demand column.

The exogenous portion of the I-O matrix includes two additional rows and two additional columns. The rows are taxes to the central government and EI contributions to the central government. The columns are social assistance transfers and EI benefits transferred to residents in the community. Direct coefficient and inverse matrices are derived in order to calculate the multipliers necessary for fiscal impact analysis. The direct coefficient matrix A** is as follows,

A** =

a'_{11}	a'_{1j}	a'_{1n-1}	a'_{1n}	a'_{1n+1}	a'_{1n+2}	a'_{1n+3}
a'_{i1}	a'_{ij}	a'_{in-1}	a'_{in}	a'_{in+1}	a'_{in+2}	a'_{in+3}
a'_{n-11}	a'_{n-1i}	a'_{n-1n-1}	a'_{n-1n}	a'_{n-1n+1}	a'_{n-1n+2}	a'_{n-1n+3}
a'_{n1}	a'_{nj}	a'_{nn-1}	a'_{nn}	a'_{nn+1}	a'_{nn+2}	a'_{nn+3}
a'_{n+11}	a'_{n+1j}	a'_{n+1n-1}	a'_{n+1n}	a'_{n+1n+1}	a'_{n+1n+2}	a'_{n+1n+3}
a'_{n+21}	a'_{n+2j}	a'_{n+2n-1}	a'_{n+2n}	a'_{n+2n+1}	a'_{n+2n+2}	a'_{n+2n+3}
a'_{n+31}	a'_{n+3j}	a'_{n+3n-1}	a'_{n+3n}	a'_{n+3n+1}	a'_{n+3n+2}	a'_{n+3n+3}

The corresponding Leontief inverse matrix, $(I-A^{**})^{-1}$ or B** =

b'_{11}	b'_{1j}	b'_{1n-1}	b'_{1n}	b'_{1n+1}	b'_{1n+2}	b'_{1n+3}
b'_{i1}	b'_{ij}	b'_{in-1}	b'_{in}	b'_{in+1}	b'_{in+2}	b'_{in+3}
b'_{n-11}	b'_{n-1i}	b'_{-1nn-1}	b'_{n-1n}	b'_{n-1n+1}	b'_{n-1n+2}	b'_{n-1n+3}
b'_{n1}	b'_{nj}	b'_{nn-1}	b'_{nn}	b'_{nn+1}	b'_{nn+2}	b'_{nn+3}
b'_{n+11}	B'_{n+1j}	b'_{n+1n-1}	b'_{n+1n}	b'_{n+1n+1}	b'_{n+1n+2}	b'_{n+1n+3}
b'_{n+21}	B'_{n+2j}	b'_{n+2n-1}	b'_{n+2n}	b'_{n+2n+1}	b'_{n+2n+2}	b'_{n+2n+3}
b'_{n+31}	B'_{n+3j}	b'_{n+3n-1}	b'_{n+3n}	b'_{n+3n+1}	b'_{n+3n+2}	b'_{n+3n+3}

The output multiplier for any CED_j is equal to $\sum_{i=1}^{n} b'_{ij}$, where j=1,…,n. The type II income multiplier for CED_j is b'_{n+1Ri}, where j=1,…n. These multipliers are used in the fiscal impact model developed in section 5.2.

5.1. Fiscal Impact Model for CED

The net fiscal impact of a CED project is calculated by taking the difference between changes in fiscal revenue and changes in fiscal expenditure due to the impact of CED initiatives. In other words, it provides an estimate of a project's potential impact on the government budget. In subsections 5.2.1.and 5.2.2., the fiscal revenue and fiscal expenditure sides of the model are delineated, and in subsection 5.2.3. fiscal impact model for CED is aggregated.

5.1.1. Fiscal Revenue

According to Hirsch's (1968) regional I-O model for local government decisions, the main sources of government revenue considered in a fiscal impact analysis are personal income tax, sales tax and property tax. This analysis includes Employment Insurance (EI) contributions, as they are relevant to CED analysis. The sum of changes in these four government revenue sources provides an estimate of the change in fiscal revenue associated with CED.

Personal income tax

Personal income tax revenue is collected by non-local government. The household column is endogenous and the taxes to central government row is exogenous in the I-O matrix. The change in personal income tax revenue is directly related to changes in household income measured by the income multiplier (Hirsch, 1968). The type II income multiplier, b'_{n+1Ri}, and the marginal personal income tax rate, t_1 where $0 < t_1 < 1$, are used to estimate the change in personal income tax revenue. For every dollar of final demand that CED_j initiates the change in personal income tax revenue is equal to $(b'_{n+1j}/h_{Ri})\ t_1$.

Sales tax receipts

Sales tax receipts are estimated by using the income multiplier, the marginal propensity to consume local goods, and the sales tax rate (Hirsch, 1968). An assumption of I-O models is that marginal propensity to consume equals average propensity to

consume. The average propensity to consume local goods is given by, $\frac{\sum_{i=1}^{n} X_{in+1}}{X_{n+1}}$, which we interpret as the marginal propensity to consume local goods. The sales tax rate is t_2, where $0 < t_2 < 1$. For every dollar of final demand that CED_j initiates the change in sales tax receipts is equal to $\frac{\sum_{i-1}^{n} X_{in+1}}{X_{n+1}}\left(\frac{b'_{n+1j}}{h_{Ri}}\right)t_2$.

Property tax revenue

Property tax revenue is affected by a complicated maze of interactions which affect the tax base upon which industrial and commercial and residential property taxes are calculated (Hirsch, 1968). Hirsch's methodology (1968) is used to calculate property tax revenue.

i. Industrial and commercial property tax

The change in the industrial and commercial tax base of each sector due to a $1 increase in final demand is the product of the output multiplier and the capital output ratio, c_1, for the sector, $\sum_{i=1}^{n} b'_{ij} c_1$. The change in property tax revenue is calculated by multiplying the preceding equation by the average industrial and commercial property tax rate, t_4. The calculation yields, $\sum_{i-1}^{n} b'_{ij} c_1 t_4$, representing the change in industrial and

commercial property tax revenue for every dollar of final demand that CED_j initiates.

ii. Residential property tax

A sequence of calculations is required to determine the change in the residential property tax of each sector due to a $1 increase in final demand. First, sector employment estimates are calculated using indirect and income induced output from the inverse I-O matrix and sector capital-output ratios, $\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1\right)X}{c2}$, where c_2 is the sector output-employment ratio.

Second, the number of families per sector is estimated using the sector employment estimate with the worker-family ratio, $\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1\right)X}{c_2 c_3}$ where c_3 is the worker-family ratio.

Third, the change in the residential property tax base is estimated using the estimated number of families along with coefficients for family income per sector, c_4, and residential property values per family per sector, c_5, $\left[\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1\right)X}{c_2 c_3}\right]\frac{c_5}{c_4}$. The change in residential property tax, for every dollar of final demand that CED_j initiates is estimated using the change in residential property tax base and the residential property tax rate,

$$\left[\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1\right)X}{c_2 c_3}\right]\frac{c_5}{c_4}t_3$$, where t_3 is the residential property tax rate.

Employment Insurance Contributions

Employment Insurance (EI) contributions are collected by the central government from firms and employees. The change in EI revenue is directly related to changes in employment and household income. The relationship between EI contributions and income is positive up until a maximum contribution is reached at a government set level of income. EI revenues consist of an employee and an employer contribution. As above, sector employment estimates are calculated using indirect and income induced output from the inverse I-O matrix and sector capital-output ratios, $\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1\right)X}{c2}$. The change in EI contributions is estimated by multiplying the sector employment estimate by EI contributions, where the amount of the EI contribution is based on average income in the community. The change in the EI portion of government revenues for every one dollar increase in demand for CEDj is represented by the following equation: $\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1\right)X}{c_2}c_6$, where c_6 is the EI contribution. Note that the coefficients, c_1, c_2, c_3, c_4, c_5 and c_6 and the tax rates t_1, t_2, t_3 and t_4 are all exogenous to the model. For all tax rates, $0 < t_i < 1$, where $i = 1,..,4$.

5.1.2. Fiscal Expenditures

Fiscal expenditures relevant to CED include infrastructure expenditures and EI benefit and social assistance transfers.

Infrastructure expenditures

Government expenditures on infrastructure, schools, etc. associated with new CED projects are estimated using a government expenditure multiplier, a measure of the impact of a change in final demand (Hirsch, 1968). Direct, indirect and induced local government cost changes associated with the implementation of CED projects are obtained by multiplying the coefficients in the sixth row of the Leontief inverse matrix by changes in final demand.

For instance, for every dollar increase in final demand due to the initiation of CED_j government expenditures change by $\sum_{i=1}^{n+3} b'_{n+2,i}$.

EI benefit and social assistance transfers

The rise in employment associated with CED projects reduces government expenditures on EI benefits and social assistance income. Assuming that the newly employed were previously receiving an income from one of the two above mentioned sources, the change in sector-employment estimates are used to calculate the reduction in EI benefits and social assistance transfers associated with economic development due to

CED. The percentage of the newly employed previously receiving EI benefits is denoted as d and the percentage of newly employed previously receiving social assistance is denoted as 1-d. Note that d + (1-d) = 1 and 0<d<1. The average EI benefit is denoted as E and the average social assistance transfer is denoted as S. The reduction in the government EI and social assistance transfers for every one dollar of final demand of output of a new CED initiative, CED_j, is as follows:

$$d \left[\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1 \right) X}{c_2} \right] E + (1-d) \left[\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1 \right) X}{c_2} \right] S.$$

5.1.3. Fiscal Impact Model for CED

The net fiscal impact of CED is calculated by taking the sum of changes in fiscal revenues and subtracting the sum of changes in fiscal expenditures due to the CED initiative. The net fiscal impact for every one dollar of final demand of output of a new CED initiative, CED_j, is as follows:

$$\left[\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1 \right) X}{c_2 c_3} \right] \frac{c_5}{c_4} t_3 + \left(\sum_{i=1}^{n} b'_{ij} c_1 t_4 \right) + \left(\frac{b'_{n+1j}}{h_{Ri}} \right) t_1 + \frac{\sum_{i=1}^{n} X_{in+1}}{X_{n+1}} \left(\frac{b'_{n+1j}}{h_{Ri}} \right) t_2 +$$

$$\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1\right)X}{c_2} c_6 - \left(\sum_{i=1}^{n+3} b'_{n+2i}\right) + d\left[\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1\right)X}{c_2}\right] E + (1\text{-}d)\left[\frac{\left(\sum_{i=1}^{n} b'_{ij} - 1\right)X}{c_2}\right] S.$$

These equations together represent the net fiscal impact of a new CED initiative which is the sum of the positive changes in fiscal revenue from increases in residential property tax revenue, commercial and industrial property tax revenue, personal income tax revenue, sales tax revenue and employment insurance (EI) contributions, minus the sum of fiscal expenditures due to an increase in required government expenditures, excluding subsidies, and a decrease in employment insurance benefits and social assistance transfers.

5.1.4 Net Fiscal Impact as a Justification for Subsidy

The net fiscal impact will therefore depend on whether the change in government revenues are greater or less than the change in government expenditures. This may or may not be positive, but it certainly is expected to be less negative than the cost to government of not investing in CED. Three characteristics unique to CED projects lead to an overstated government expenditure multiplier. First, as mentioned above, consideration must be given to the fact that the government expenditure multiplier will be overstated due to high unemployment conditions. Second, CED projects are small in scale, generally not requiring significant, if any, government expenditure on infrastructure. Third, since CED projects are designed to employ previously unemployed

community residents the community population is not expected to increase, and little if any additional demand is put on horizontally integrated public services such as education and police protection, although, residential development may be required as housing projects are common CED projects.

As previously discussed, CED initiatives require subsidization. Subsidization can be justified to local governments using a net fiscal impact analysis. A local government can justify subsidizing a CED project up to the level of a positive fiscal impact. Although net fiscal results are of interest to the public sector, it can run counter to efficiency and equity (Hirsch, 1968). In other words, there is no reason to believe that the net fiscal balance will be equal to the amount of subsidization derived from the matrix justification for CED using a cost-benefit approach. This is due to the fact that net fiscal balance only represents the effect of CED on the government budget, whereas the cost-benefit approach considers the effects of CED on all sectors of the economy.

5.1.5 Extending Fiscal Impact Analysis for multiple CED projects

The previous derivation of cost multipliers, in section 4, illustrates that when several CED initiatives are simultaneously subsidized, the total benefit of subsidization, measured by lower unit production costs is greater than when one CED is subsidized. It was shown that less subsidy is required to reduce unit production costs of n - 1 simultaneously subsidized CED initiatives to competitive levels than is required to reduce unit production costs of n - 1 CED initiatives to competitive levels, each subsidized in isolation.

As previously discussed, in the case where several CED initiatives are simultaneously subsidized, the interdependence of the CED initiatives will increase the size of both the output and the income multipliers. Through the multipliers, all of the fiscal revenue categories, personal income tax, sales tax receipts, property tax and EI contributions, increase according to the net fiscal impact equation above. On the fiscal expenditure side, the larger output multiplier will increase the reduction in government expenditures on EI benefits and social assistance transfers and the larger government expenditure multiplier will increase the fiscal infrastructure expenditures. As argued earlier, the government expenditure multiplier is expected to be upwardly biased. In sum, the net fiscal impact improves with the implementation of several CED projects.

6. A Model of Community Collective Action for CED

Community economic development requires collective action among community residents. Being an inwardly focused approach to development, mobilization of community residents is essential for successful CED. The ability or inability of a community to collectively act not only determines whether CED is implemented but also determines the degree of success of CED. The objective of this section is to develop a model to explain how collective action comes about within a disadvantaged community.

CED literature emphasizes the importance of community participation in CED. Shragge (1993) holds that local community residents must be empowered through direct participation in order for CED to be a force for economic and social change. Mendell and Evoy (1993) believe that CED must respond to the needs and capacities of the community

as expressed by the community itself.

The degree of community cohesiveness varies widely and affects the degree to which collective action is likely. In spite of sharing a common history, many disadvantaged communities are characterized by transience and a lack of commitment to the neighbourhood. In cases where the lack of social cohesion fails to generate a commitment to a common goal, a community needs to be created (Mendell and Evoy, 1993). The literature cites many examples of community intervention where community organizers, either from within or outside the community, draw communities together for collective action (Fontan et al. 2006; Hanley and Serge, 2006; MacIntyre and Lotz, 2006).

Collective action arises when the efforts of two or more individuals are needed to attain an outcome. The study of collective action deals largely with issues surrounding the interdependency among the participants, as the contributions or efforts of one influence the contributions or efforts of others (Sandler, 1992).

Mancur Olson (1965) altered thinking about collective action and group behaviour with his determination that individual rationality is not sufficient for collective rationality. Collective action literature revolves around the fundamental belief that the pursuit of individual benefits might be in conflict with the benefit of the aggregate group, leading to an inferior outcome (Lichbach, 1996; Sandler, 1992; Olson, 1965).

Section 6.1 presents a formalized microeconomic theory of community collective action for CED based on a rational behavioural approach. This approach has been employed by Lichbach (1996), Mueller (1989), and Becker (1971). The model in this paper most closely resembles that of Mueller's (1989) time allocation model.

6.1 A Formalized Model of Community Collective Action for CED

The model consists of household production functions in which a potential contributor inputs time and receives public and private benefits. The functions are used to calculate marginal costs and benefits of time, critical for determining the optimal level of collective action.

Consider the decision of an individual i, a resident in a disadvantaged community, as to whether to participate in collective action for CED, and if so how much time to devote to collective action. Individual i is dissatisfied with the present state of economic development in the community and anticipates benefits of β should collective action succeed and CED be implemented.

Individual benefits, β associated with CED are numerous and vary in degree of publicness. The public benefits of successful CED include improved public health; improved physical environment; neighborhood stability; human dignity and solidarity among communities and businesses; and empowerment through local decision making. The main private benefits include job training, improved employment opportunities and in some cases better housing and better private health.

The probability of successful collective action is a function of the time i contributes to collective action, t_{ic} and the time other community residents contribute $O_{ic} = \sum_{j \neq i} t_{jc}$. The probability is denoted as $\pi(t_{ic}, O_{ic})$. In addition to gains, β, i may receive personal satisfaction from participating in the collective action movement,

whether it succeeds or not. Personal satisfaction is denoted as $P_i(t_{ic}, O_{ic})$.

Against these benefits must be weighed the costs of participation. By devoting time to collective action, i may forgo income. If w is the market wage, then the opportunity cost of devoting time to collective action is w_{tic}. It is expected that the opportunity cost of devoting time to collective action, w_{tic} will be very low and in many cases zero since disadvantaged communities are characterized by chronically high unemployment.

The expected benefits from participating in collection action towards CED for an individual community resident is then,

$$E_i = \beta\pi(t_{ic}, O_{ic}) + P_i(t_{ic}, O_{ic}) - w_{tic} \qquad (6.1)$$

Maximizing equation (6.1) with respect to t_{ic} yields,

$$\beta\frac{d\pi}{dt_c} + \frac{dP_i}{dt_c} = w \qquad (6.2)$$

Equation (6.2) is the condition i must satisfy when determining her or his optimal level of collective action activity. The marginal expected gain in CED benefits (β) from an extra hour of participation plus the marginal personal enjoyment must equal the forgone wage from not having worked that hour. If the wage rate for an individual is zero, for instance, the optimal level of collective action for CED would be equal to the sum of the number of hours it takes for her or his marginal expected benefits plus marginal personal enjoyment to equal zero.

This model is based on the simplifying assumption that an individual's time is allocated between work and collective action, without acknowledgment of leisure time. The assumption is reasonable considering a direct relationship between wage uncertainty and participation in collective action exists for risk averse people (Austen-Smith, 1981). Wage rates are expected to be extremely uncertain in communities characterized by chronic unemployment. The intuition here is that the individual responds to economic uncertainty by seeking utility gains through the political system, by increasing collective action activity (Austen-Smith, 1981). It may also be that residents of a disadvantaged community with chronic unemployment and uncertain wages are motivated to change the economic state of the community as well as their own personal economic state through collective action.

For most community residents, the benefits from the success of collective action are public good benefits. For a few, β represents benefits of job training and/or employment under a CED initiative on top of public good benefits. For these few, β and $\frac{d\pi}{dt_c}$ will likely be larger than for the average individual. These people are more likely to participate in collection action because they have more to gain.

According to Olson (1965), it is often not in the best interest of a rational individual to participate in collective action. He explains cases in which collective failure occurs due to individuals pursuing self-interest. The pursuit of individual self-interest may imply an outcome for the collective that is sub-optimal, that is to say, collective

failure. In the case where an individual supports a community public good, the free rider effect prevents the individual from participating in the collective action necessary to bring about the public good. The free rider reasons that contributing to the creation of a public park, for instance, is not a rational choice since she or he can use the park once others participate in collective action. The marginal effect of an individual's contribution to collective action is expected to fall with the aggregate contributions of others, O_i, lowering the value of t_{ic}.

Conversely, personal rewards from participating in collective action may rise as others join the movement, characterized by the bandwagon effect (Mueller, 1989). Communities, marked by strong social institutions, hold common ideas and eventually engage in common activities (Lichbach, 1996). Lichbach (1996) argues that a community approach to Olson's collective action problem either works through common idea systems stemming from common knowledge or through common values overcoming pecuniary self-interest. In disadvantaged communities, collective action can be a self-actualizing experience and may have entertainment value, that is to say the costs turn into a benefit. People may be motivated by "other-regardingness" rather than self-interest, where failure to contribute is a social deviance (Lichbach, 1996). The community effect will increase t_{ic}. Thus participation levels could be characterized by increasing or diminishing returns to scale, which might explain the variability of successful collective action among disadvantaged communities.

Another factor which may explain the variability of successful collective action among disadvantaged communities is a scarcity of residents with leadership skills. Those

with leadership skills are most likely to be already employed and either may not have the time or desire to initiate or participate in collective action. According to equation 6.1, the expected benefits from participating in collective action towards CED may not be greater than the expected costs for the employed community residents with leadership skills.

An element of community collective action for CED neglected in the model above is the important role of women as community organizers. The literature (Fontan, 1993; Ninacs, 1993) frequently attributes collective community action to the efforts of women community organizers. The explanation and incorporation of a gender element in a model of collective action towards CED will be addressed in future research.

7. Summary and Conclusion

The CED approach to local economic development has been widely applied in the past 25 years. Despite the growing body of CED literature, a formal economic theory of CED has yet to be developed. This paper is an attempt to strengthen the theoretical foundations of CED by developing microeconomic models to explain aspects of CED.

The literature review, in section one, reveals the critical role of subsidization in CED. Sections three through five apply microeconomic techniques, described in section two, to develop three formalized models explaining how subsidization works in CED. The fourth model uses a time allocation formalization to explain how community collective action works. The principal conclusions of each microeconomic analysis are summarized below.

In the first model, in section three, cost multipliers are derived and used to

illustrate how subsidizing one CED lowers unit production costs not only for that CED, but for other CED initiatives and local industries with backward linkages to the subsidized CED. The cost multiplier analysis further reveals that when several CED initiatives are simultaneously subsidized, the total benefit is greater than when only one is subsidized due to strengthened linkages evident by larger multipliers. Less subsidy is required to reduce unit production costs of several simultaneously subsidized CED initiatives to competitive levels than is required to reduce unit production costs of several CED initiatives, each implemented and subsidized in isolation.

The second model, in section four, is grounded in principles of cost-benefit analysis. The formalization makes use of shadow prices when market prices do not reflect the true economic costs of resource use. Matrix representations of income and expenditure equations are used to justify subsidization of CED up to the value of the difference between value added components at market prices and value added components at shadow prices.

In a third model, in section five, a fiscal impact model is articulated to analyze the net fiscal impact of CED. CED has a positive effect on government revenues through income and property taxes and EI contributions. Government expenditures may rise or fall, as EI benefits and social assistance payments decrease and expenditure on infrastructure and services increase. The net fiscal impact may be positive or negative, but will surely be less negative with CED. When several simultaneously implemented CED initiatives are considered, larger multipliers will improve the net fiscal impact.

The fourth model, in section six, explores the question of how communities

mobilize collectively to initiate CED. The time allocation model consists of household production functions which illustrate the marginal benefits and marginal costs of participating in collective action for CED. Individual community residents are likely to participate when the benefits they receive, in terms of public and private goods, plus the level of personal satisfaction they achieve through the collective action process is greater than the wages they forgo to participate in collective action.

While the models in this paper contribute to the theoretical foundation of CED and to the area of applied microeconomics, there is much more work to be done on these topics. One of the common threads tracing through the models is the idea that linkages among CED initiatives and industries within a community are a key source of economic development and growth. This is a description of clustering, a concept from industrial organization economics. It has been suggested that geographic clustering is a characteristic of the New Economy, the knowledge based economy which began in the mid 1990s. A second paper, in this series of three, will explore the New Economy and the prevalence of clustering.

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Paper 2

Microeconomic Foundations for Clustering Behaviour in the New Economy

The New Economy, also known as the information economy or knowledge-based economy, took hold in North America in the mid 1990s. At present, there is no standardized definition of the New Economy as it has taken on many different meanings. A review of New Economy literature uncovers a few common themes among the range of definitions. The New Economy is typically characterized by the proliferation of information technology throughout the economy that makes the present period appear so different from preceding decades (Kudyba and Diwan, 2002). It is described as a fundamental lasting structural change in the economy resulting from a cumulation of various structural changes during the past two decades (J. Steven Landefeld and Barbara M. Fraumeni, 2001).

Distinctive features of the New Economy include an expanding and influential information & communications technology (ICT) sector, the development of the Internet and its contributions to the economy, increasing globalization, a more skilled labour market, and the increasingly important role of knowledge and ideas. Some macroeconomic conditions ascribed to the New Economy are low unemployment, non-inflationary growth, and greater productivity growth.

While most definitions and explanations of the new economy have a macroeconomic focus, some have a microeconomic orientation. Pascal Petit (2002) describes the New Economy as one in which economic agents can more easily obtain and

implement knowledge to change their strategic capacities. The decision making process of firms in the New Economy is evolving with the increasing role of knowledge. As well, there is a great deal of literature devoted to geographical clustering of firms in the New Economy. This paper investigates the clustering behaviour of firms in the New Economy. As will become evident in section II, the determinants of clustering have evolved in the knowledge-based New Economy. The objective of this paper is to formalize a microeconomic theory of clustering behaviour of firms in the New Economy. This paper is structured into four sections. Section one is a review of New Economy (NE) literature covering both the macroeconomic features and the microeconomic features with a focus on their relation to the behaviour of firms. Section two is a review of clustering literature with an emphasis on clustering in the NE. Section three is a review of methodology applicable to analyzing cluster behaviour. Section four is a presentation of a formalized microeconomic model of clustering behaviour in the New Economy. Section five is a conclusion.

1. The New Economy

The following review of NE literature is divided into two subsections, the first a review of the key macroeconomic conditions in the NE, and the second a review of the key microeconomic conditions and features of the NE.

i. Macroeconomic conditions of the New Economy

The key macroeconomic characteristics in the NE literature are those related to globalization, particularly the increase in productivity and the changing workforce.

Increasing globalization is commonly included among the characteristics of the NE. Stiroh (1999) finds that globalization keeps prices in check as domestic firms are forced to compete with cheap imports and cheap labour from abroad. Non-inflationary growth in the NE is credited to global competition. Landefeld and Fraumeni (2001) report that globalization has brought increased international competition in labour and management practices resulting in reductions in costs and improvements in efficiency and technological innovation over the last several decades. Van Reenen (2001) reports a rise in capital mobility across national borders. Atkinson and Court (2003) state that trade and foreign direct investment are on the rise in the NE.

OECD research on growth in the New Economy (2000) reveals that most countries experiencing higher per capita economic growth in the 1990s, compared to the 1980s, exhibit an acceleration of multi-factor productivity. The growth of per capita income in the 1990s is associated with macroeconomic and structural policies aimed at maximizing the use of labour resources to enhance growth with the available supply of labour and capital resources. The changing composition of the work force is indicative of the NE where higher skills are driving growth. The composition of capital stock is changing with a rising share of ICT equipment. Research by Oliner and Sichel (2000), Van Reenen (2001), Petit (2002), and the Bank of Canada (2002) all support the prominence of productivity growth as a characteristic of the NE. According to Petit (2002), productivity growth appears to be particularly strong in the ICT sector. In addition, information technology (IT) plays a major role in the NE as it allows firms to increase productivity and reduce costs without raising prices (Stiroh, 1999).

Qualitative features of the workforce have changed in the NE. Education and training are more important than ever as the high skilled segment of the workforce drives growth (OECD, 2000; Van Reenen, 2001; Petit, 2002). Furthermore, job creation in the NE depends more heavily on innovative ideas and technology.

ii. Microeconomic conditions of the New Economy

The key microeconomic characteristics in the NE literature focus on the firm. The major microeconomic topics relating to firms are information and knowledge, increasing returns, externalities, and cluster activity.

Globalization has led to greater competition and the opening of new markets creating an international playing field for major multinational firms as well as small niche firms (Bobe, 2002). More intense competition has resulted in greater innovation in the areas of products, processes and organization of firms and industries.

In this discussion the term NE goods and services is used to describe typical production output in the NE. These NE goods and services are information goods, where information is defined broadly by Shapiro and Varian (1999) as anything that can be digitalized and encoded as a stream of bits. Information goods include anything from web pages, data bases, and stock quotes to baseball scores and music.

Knowledge and skills are seen as important assets to NE firms. Firms manage learning and knowledge to a greater degree in the NE. Firms produce more learning and knowledge either through management activity or R&D and innovative activities.

Constant cost functions are a common feature of a NE firm. Fixed costs are high while variable and marginal costs are close to zero. For instance the cost of copying

software, producing a silicon chip, or providing cellular phone service to a new client is negligible compared to the high initial costs of producing the first product. The dominant component of fixed costs are the first copy sunk costs, not recoverable if production ceases (Bobe, 2002; Stenbacka, 2002). Marketing and promotion costs are also a significant component of fixed costs for most NE goods and services. This cost structure leads to enormous economies of scale where unit costs fall as production levels increase. The fixed cost production function leads to rapidly increasing returns (Shapiro and Varian, 1999; Bobe, 2002). For instance, Microsoft's low marginal costs and large scale operation has led it to 92% profit margins (Shapiro and Varian, 1999). Constant cost functions are not new and in fact they have existed in the airline industry for decades. What is new is that constant cost functions are more prevalent in the NE.

Increasing returns are the norm in NE firms. Increasing returns are associated with higher returns, as prices are set differently. Cost-base pricing is replaced with value-based pricing which leads to differential pricing. NE products are priced according to consumer value, not according to production costs (Shapiro and Varian, 1999). An example of differential pricing is charging more for website access of stock market quotes in real-time versus a 20 minute delay (Shapiro and Varian, 1999).

The development of telecommunications networks has led to a reduction in transportation costs of many NE goods. The reduction in transportation costs leads to a global economy where national borders tend to disappear (Bobe, 2002). As well, telecommunication networks enhance distance learning and the transfer of knowledge over distances, evidenced by virtual universities, interactive digital television, and the

Internet.

Network externalities are more important in the NE. While these ideas are not new to economics the new economy gives them far greater weight and regards them as the driving forces of economy-wide growth (Kevin Stiroh, 1999; Stenbacka, 2002). When the value of a product to one user depends on how many other users there are, the product exhibits network externalities (Shapiro and Varian, 1999). Communication technologies such as telephones, e-mail, Internet access, and fax machines all lead to network externalities. Externalities result in strong firms becoming stronger and weak firms becoming weaker, leading to extreme outcomes. For instance, if two firms compete for a market where there is a strong positive spillover, only one may emerge the winner. This effect is illustrated by the 1980s competition for the video recorder market where the network externalities for VHS were stronger than those for Beta. The biggest winners in the information economy are firms that have introduced products that have been propelled by network externalities (Shapiro and Varian, 1999). Markets benefiting from strong network externalities experience demand-side or supply-side economies of scale.

Both demand-side and supply-side economies of scale have been around for a long time, but the combination of the two working together in many IT industries is new (Shapiro and Varian, 1999; Stenbacka, 2002). Demand-side economies of scale are typical in the NE, although the effect is not so strong that the loser necessarily leaves the industry. For example, WordPerfect has lost a large market share to Microsoft Word but it is still a player in the industry. The growth on the demand-side both reduces costs on the supply side and makes the product more attractive to other users thus accelerating the

growth in demand to an even greater degree. The result is a strong feedback, where entire industries are created or destroyed more quickly than in the traditional economy as they combine to make positive feedback in the NE especially strong (Shapiro and Varian, 1999). Network externalities necessitate cooperation among firms. Firms cooperate to establish standards and to create a single network of compatible users. Forming alliances to set standards among firms enhances compatibility and enlarges the network. For example, financial institutions have set standards in ATM networks so that a Bank of Montreal customer, for instance, may use an ATM machine at any one of many other financial institutions. Shapiro and Varian (1999) use the term 'coopetition' to capture the tension between cooperation and competition prevalent in NE industries with strong network externalities.

Technology and technology infrastructure play a larger role for firms in the NE. Technology infrastructure makes it "possible to store, search, retrieve, copy, filter, manipulate, view, transmit, and receive information" (Shapiro and Varian, 1999: 8). Information becomes more valuable when it can be easily accessed through technology infrastructure. The NE is about information and associated technology. The importance of technology and innovation means that firms need to be strategic by focusing on both their competitors and their collaborators. "Forming alliances, cultivating partners, and ensuring compatibility (or lack of compatibility!) are critical business decisions ...the need for collaboration, and the multitude of cooperative arrangements, have never been greater"(Shapiro and Varian, 1999:10). The higher level of communication required among NE firms may be accommodated by firms co-locating in clusters or over distances

with the use of telecommunications and IT.

Bekar and Lipsey (2002) argue that clustering of firms, universities and government research facilities is an important aspect of the NE. A cluster is defined here as a regional grouping of geographically proximate firms, where those firms have strong linkages to local education and research bodies, government laboratories, financial institutions, and other elements of business infrastructure, and to each other (Bekar and Lipsey, 2000). Many argue that while clustering characterizes a wide range of economic activities, it is especially prominent in knowledge-based industries (Globerman, 2002; Bekar and Lispey, 2000). Clusters increase the generation and diffusion of new knowledge both horizontally and vertically. "The emerging network economy leads towards more tightly coupled, more intense, more persistent and more intimate relations among firms and between firms and government organisations" (Bekar and Lipsey, 2002: 63).

At the same time there exists an alternative view of firm behaviour in the NE, the 'forty acres and a modem' (Kotkin 1998: 7) view argues that firms have a tendency not to cluster in the NE. This view conceives of a firm on a farm, a yacht or a mountain top using information technology (IT) to communicate with suppliers, competitors and clients located elsewhere (Kolko, 2002). For these firms, IT makes it possible to locate far from clusters to benefit from cheaper land and a preferred lifestyle. The 'forty acres and a modem' view explains decisions by Citibank and American Express to move back-office functions away from major U.S. banking centres to small towns. Supporters of this view contend the reduction in the cost of sending data electronically enhances the

tendency for firms to locate away from clusters and high density urban areas. This view does not argue the need for collaboration and cooperative arrangements among firms in the NE, it merely suggests that efficient electronic communication renders co-location unnecessary.

According to the 'forty acres and a modem' view, knowledge spillovers become less dependent on geographic proximity as electronic communications improve in quality and become less costly. Firms can share ideas and conduct meetings electronically with new technology allowing for communication among many parties simultaneously. The Web allows documents to be published for many to view. Chatrooms and newsgroups supplement inter-firm communication. As well, the Internet allows firm's employees to browse, "opening the way for spontaneous and serendipitous discoveries... (which) mimics the unplanned and unexpected opportunities for sharing ideas that inevitably arise at dinner parties and street corners in areas where industries concentrate" (Kolko, 2002: 215).

While one view (Bekar and Lipsey, 2000; Globerman, 2002) suggests clustering behaviour is more prevalent in the NE, largely because the generation and dissemination of knowledge is more conducive to firms in clusters, another view (Kolko, 2002) argues clustering may be less prevalent in the NE as IT has made it possible for firms to effectively communicate, and thus create and pass on knowledge, over distances. Are firms more or less likely to cluster in the NE? Clustering behaviour of firms in the NE is the subject of this paper. In the following sections we investigate how a firm's decision to cluster differs in the NE and then formalize the analysis with microeconomic foundations.

A review of clustering literature is the topic to which we now turn.

2. Literature Review of Clustering

The concept of clustering is not new, as the economics of spatial agglomeration can be traced back to Alfred Marshall's reflections on localized industries and the industrial district, published in his *Principles of Economics* in 1890. Most of the 20th century literature merely assumes clustering to be beneficial without explanation. The location pattern of firms is often explained employing a model where the outcome is determined by the net effect of centripetal and centrifugal forces. The main centrifugal or dispersing forces are the costs of congestion, particularly higher land and labour costs. The main centripetal or clustering factors are the benefits of sharing infrastructure and a pool of skilled labour. (Maskell, 2001)

Towards the end of the 20th century an accumulation of interest in clusters provided impetus for several novel research propositions. The explanations for clustering behaviour began to shift to include the benefit of reduced transaction costs. Transaction costs include search and information costs, bargaining costs and decision costs, all of which are reduced when firms co-locate. Maskell (2001) elaborates on the behavioural constraints imposed on co-located firms. Within a cluster, if a firm attempts to "pass defective or substandard goods as first class; or create hold-ups in order to benefit at the expense of others in the local mileu" (Maskell, 2001: 926) it will be immediately noticed. Information about such misbehaviour will quickly spread within the cluster and the firm may become a local outcast and consequently be alienated from the local flow of

knowledge (Maskell, 2001). A climate of trust is enjoyed within a cluster as firms are reluctant to behave in any way that may jeopardize their reputation. The climate of trust helps to reduce malfeasance, encourage volunteering of reliable information, cause agreements to be honoured, and to ease the sharing of tacit knowledge (Maskell, 2001). The literature in this area attributes cluster behaviour to the reduction in costs of identifying, accessing or exchanging products, services and knowledge between firms.

There is a wealth of literature in the area of economics of agglomeration and geographical clustering. In order to address the objective of this paper, the clustering behaviour of firms in the NE, the following literature review firstly narrows in on an investigation of how clusters are established and outlines the determinants of clustering behaviour. Secondly, the literature review addresses the question of whether and how a firm's decision will be affected under economic conditions of the NE.

How Clusters are Established

Regardless of the ever-increasing foundation of empirical cluster research, a lack of consensus persists over how clusters are started (Wolfe and Gertler, 2004). According to Porter (2000), clusters can be seeded in a variety of ways but cannot just start anywhere. The key determinants of cluster viability are at the firm level. History reveals the importance of one or two anchor firms for cluster formation. Two examples are NovAtel (provider of global positioning technologies) in Calgary and Nortel Networks and JDS Uniphase in Ottawa. The anchor firms act as magnets, attracting allies and competitors to the region. Highly skilled labour or a unique skill mix may also be the impetus for a cluster (Wolfe and Gertler, 2004), as in the case of Calgary's wireless

cluster drawing skilled labour from the University of Calgary's department of geomatics engineering with an international reputation for leadership in global positioning systems technology.

Public sector research institutions and institutions of higher learning may, intentionally or inadvertently, play a role in starting a cluster (Wolfe and Gertler, 2004), as in the case of Saskatoon's agricultural biotechnology cluster located in close proximity to both the University of Saskatchewan and the National Research Council's (NRC) Plant Biotechnology Institute.

Generally speaking, there are several ways in which clusters can be created, one not necessarily better than the other. Some may be more susceptible to policy, a topic investigated in the third paper of this thesis.

The determinants of clustering behaviour: at the firm level

The literature covering the determinants of clustering falls into two broad categories, traditional agglomeration economies and the role of knowledge and learning in clusters. Agglomeration economies have been used to explain clustering behaviour in the traditional economy. Although knowledge and learning among co-located firms contributes to clustering behaviour in the traditional economy it appears to play a larger role in NE clusters, for this reason a separate subsection is devoted to the topic.

i. Traditional agglomeration economies

Agglomeration economies traditionally develop as a result of co-located firms having access to a collective set of resources (Wolfe, 2003). Globerman (2002) discusses the widely acknowledged relationship between the size of the market and the degree of

economic specialization of factor inputs within the market. He draws on Adam Smith's insight that specialization is a function of the breadth of a market. It follows that the productivity levels of firms will increase as more specialized inputs are available for the production process. The co-location of firms provides superior and lower cost access to specialized inputs, including components, machinery, and labour. In addition, close proximity to suppliers reduces the need to maintain inventory and delays that can arise with shipments from distances. Close proximity also facilitates communication with suppliers which leads to creating trust conditions and potential for conducting repeated transactions on the basis of tacit and more codified forms of knowledge (Wolfe, 2003).

The production input most discussed in clustering literature is labour. Starting with Marshall in the 20th century, it has been widely believed that firms in clusters can access a local pool of specialized and experienced labour. Globerman (2002) states that a pooled market of workers with specialized skills leads to a more liquid market for specialized skills, as both buyers and sellers of specialized skills will be relatively confident that they can acquire workers and employment at market wage rates in a short period of time. The risk of disequilibrium in the labour market is reduced, making it less costly for potential employers and employees to participate in the labour market. Wolfe (2003) puts forward the idea that the low opportunity cost of gaining access to a ready supply of skilled labour is a key factor driving the growth of clusters and in attracting managerial talent and entrepreneurs into the cluster. Porter (2000) argues that specialized training and educational institutions in a region provide a steady supply of highly qualified labour to the firms within the cluster.

The role of transportation costs as a determinant of clustering behaviour is nebulous. The literature most often associates a reduction in transportation costs with a greater tendency to cluster, reasoning that firms no longer have to locate close to their dispersed customers in order to reduce transport costs (Wolfe, 2003; Globerman, 2002). On the other hand, Pohjola (2002) and Kolko (2002) suggest that clustering becomes less important as the transportation costs fall, reasoning that firms become more motivated to disperse in attempt to dominate segmented markets rather than locate close to suppliers of inputs. Krugman and Venables (1995) find that an initial reduction in transportation costs leads to agglomeration, while a further reduction in transportation costs, below a critical level, leads to spreading in search of lower input costs.

As regions become congested, higher costs for land, labour and other scarce resources tend to reduce clustering. Congestion leads to limited physical space, limited local resources, environmental pollution and other effects which include heavy usage of roads, communication channels and storage facilities (Brakman, Garretsen, Gigengack and Wagenvoort, 1996). Congestion tends to prevent industries from being entirely concentrated in a single location (Kolko, 2002).

ii. The Benefits of Sharing a Local Knowledge Base

In the past few years, a wealth of clustering literature has focused on the role of knowledge and learning in clustering behavour. Wolfe and Gertler (2004) argue that joint production and transmission of new knowledge occurs most effectively among co-located firms, and other economic agents, in a region. The other economic agents include institutions of higher learning, research institutions and the public sector. Specifically

tacit knowledge is most effectively transmitted through interpersonal contacts and the inter-firm movement of skilled workers (Wolfe and Gertler, 2004). Wolfe and Gertler (2004) outline five different types of knowledge spillovers: 1) tacit knowledge, 2) knowledge embodied in employees, 3) knowledge in entrepreneurial skills, 4) knowledge of external market conditions and 5) infrastructural knowledge resources.

On the first type of knowledge spillover, the concept of tacit knowledge has been used to explain competitive advantages of firms within clusters. Within clusters frequent face-to-face interactions between numerous actors ease the exchange of this knowledge through learning-by-doing.

On the second type, knowledge embodied in highly qualified personnel flowing directly from research institutes to private firms in the form of graduates and also moving between firms in the form of mobile labour is one of the most important knowledge flows. Knowledge spillovers commonly occur as workers move among firms and to new firms within the cluster.

The third type of knowledge spillover is that derived from entrepreneurial skills. Workers leaving a firm to start up their own firm take with them knowledge developed through their years of experience. Entrepreneurial skills can be circulated within the cluster, formally, through sharing of knowledge in civic associations and informally, through peer-to-peer mentoring (Wolfe and Gertler, 2004).

On the fourth type, external market conditions about competitiveness is vital knowledge for all firms, though small and medium sized firms have more difficulty

attaining it. Civic associations play an important role of providing this information. And the fifth type of knowledge spillover is the infrastructural knowledge resources found in specialized legal, accounting and financial firms, essential to the success of individual firms in the cluster.

In Maskell's (2001) knowledge based theory of the cluster, he suggests that knowledge creation occurs through the horizontal and vertical spreading of knowledge. The horizontal dimension consists mainly of competitors, while the vertical dimension consists of business partners and collaborators. Features of both dimensions may explain why firms choose to cluster.

The horizontal dimension of the cluster deals with co-located firms undertaking similar activities in a situation where every difference in the strategies chosen can be observed and compared (Maskell, 2001). Co-location affords firms the necessary tools to gain and understand the most subtle and complex information necessary to develop along a horizontal dimension. Firms watch, discuss and compare the different approaches and solutions taken by their competitors in the same geographic location. "If the firms ...were to spread thinly throughout a large city among unrelated businesses, their ability to monitor and subsequently learn from each other's mistakes and successes would be severely restricted" (Maskell, 2001: 929). The social culture, consisting of collective beliefs, values, conventions, and language assist in easing communication among firms. Along the horizontal dimension, firms have the opportunity to imitate the proven successes of others while modifying to allow for some of their own ideas.

"The resulting enhanced knowledge creation following from the ongoing sequence of variation, monitoring, comparison, selection and imitation of identified superior solutions is in essence why N similar firms of size S are not equal to one firm of size N x S doing the same" (Maskell, 2001: 930). The advantages of the cluster over the multinational firm, as described in the preceding quotation, are rooted in the specific forms of knowledge creation only present among competing firms each pursuing profit maximization, and do not apply to the actions within an individual firm.

In addition, Maskell (2001) argues that trust is not required among horizontally co-located firms. The process of monitoring, comparing, and imitating can take place without any close contact or arms-length interaction.

Most relationships within a cluster are of a vertical dimension. Input-output relations are the way in which firms are linked along the vertical dimension of a cluster. Vertically integrated clusters tend to form in one of two ways. First, specialized suppliers and critical customers are attracted to an established cluster. Second, the vertical dimension develops through task partitioning, a spontaneously evolving process by which economic agents freely pursue their own advantage, as articulated by Adam Smith more than 250 years ago (Maskell, 2001). "Some firms will thus gradually move from the horizontal to the vertical dimension of the cluster by concentrating on some particular process, where they believe they possess or might develop certain lucrative capabilities, dissimilar to others" (Maskell, 2001: 931).

Maskell (2001) argues that division of labour is associated with growth of

knowledge along a vertical dimension of a cluster. The deepening of the division of labour is limited by the extent of the market, information asymmetries and the costs of coordination. Due to the way in which knowledge is produced, firms unavoidably possess asymmetrical knowledge about products and market opportunities due to constraints on inter-firm learning. Nevertheless, firms within the cluster maintain advantages over outsiders as heterogeneous knowledge endowments can be more efficiently shared within a cluster, as the costs of co-ordination and problems of asymmetric information are reduced. (Maskell, 2001)

Pinch, Henry, Jenkins and Tallman (2003) apply knowledge-based theories of the firm to develop a model that attempts to explain the competitive advantages of firms within clusters. They examine the likelihood that various types of knowledge formulated by individual firms is either retained internally to gain competitive advantage, or else is disseminated throughout the industry of which the firm is a part (Pinch et al., 2003).

Their work addresses the recent criticism of the well-known dichotomy between tacit and codifiable knowledge. Tacit knowledge has come to be associated with regionalization and codifiable knowledge with global scale, a relationship that has been increasingly questioned in recent years (Pinch et al., 2003). The role of local proximity and fostering of innovation based on tacit knowledge has been questioned. Codifiable knowledge can be communicated in various forms and quickly disseminated through various geographically dispersed regions. This process has been termed "ubiquitification" in the literature (Maskell, 2001).

Pinch et al. (2003) suggest that tacit knowledge rarely works without codified knowledge, thus competitive advantage is a result of how the two are combined Pinch et al (2003) develop a model with the objective of responding to the need to better understand the nature of knowledge and how it is often diffused most effectively at local levels. The model draws on the work of Matusik and Hill (1998), where a distinction is made between component knowledge and architectural knowledge at the firm level[11].

The terms component and architectural knowledge are relative terms representing dimensions along a continuum. They are distinguished by differences in their capacity for dissemination across organizations. Pinch et al (2003) argue "that codified component knowledge is more easily spread than firm-specific architectural knowledge. Nevertheless, over time, agglomerations may develop a cluster-specific form of architectural knowledge that facilitates the rapid dissemination of knowledge throughout the cluster by increasing the learning capacity of proximate firms and thereby conferring cluster-specific competitive advantages" (Pinch, Jenkins, and Tallman, 2003:373).

The shortcomings of this model, as stated by Pinch et al (2003), include the fact that systemic component knowledge and cluster level architectural knowledge are difficult to observe and difficult for practitioners to articulate due to their tacit elements.

Bathelt, Malmberg and Maskell (2002) propose a model that takes into account global connections of firms in clusters while retaining the notion that knowledge is created, stored and utilized locally in a decisive manner. They, like Pinch et al (2003),

[11] The distinction was first developed by Henderson and Clark (1990) to explain technical knowledge.

also attempt to break out of the local tacit knowledge and global codified knowledge dichotomy. They view knowledge creation within clusters as an outcome of 'local buzz', an exclusive quality of a cluster.

Local buzz describes the "information and communication ecology created by face-to-face contacts, co-presence and co-location of people and firms within the same industry and place or region" (Bathelt, Malmberg and Maskell, 2002: 11). Local buzz is similar to Marshall's (1927) notion of 'industrial atmosphere', referring to something in the air limited to the people within a particular region. Owen -Smith and Powell (2002) use the term 'local broadcasting' and Grabher (2002) the term 'noise' to refer to a similar phenomenon where a certain milieu is vibrant and stimulating in the sense that many things are simultaneously occurring creating and spreading information to local agents. (Bathelt et al, 2002).

The buzz includes specific information, continuous updates of new information, intended and unintended learning processes in planned and unintentional meetings. The costs associated with participating in the buzz are low. The information and communication is easily transferred among those located in the cluster and who participate in various social and economic activities. Information is diffused through gossip and news by just 'being there'. Information is exchanged during negotiations with local suppliers, during phone calls at the office, while talking to neighbours over the fence, and so on. The communication of information is supported by the actual movement of employees, embedded with skills, which are not easily learnt, between firms (Bathelt et al, 2002). Structures of social relations created within a cluster stimulate

efficient information transfer, joint problem-solving arrangements and the development of trust and reciprocity (Bathelt et al, 2002). As well, the co-location of firms stimulates development of a particular institutional structure shared by the participants. The participating firms develop similar language, technology attitudes, and interpretive schemes (Bathelt et al, 2002).

Bathelt et al (2002) note that while the clustering literature emphasizes the importance of local networking there is little convincing evidence to show the superiority of local over non-local interaction. Owen-Smith and Powell (2002) first used the term 'pipeline' to refer to the channel in distance interactions of firms. Based on their study of the Boston biotechnology community, they concluded that new knowledge is often acquired through strategic partnerships over distances, nationally and internationally, and thus is not limited to local interaction. The pipeline reaches over short distances to other regions and over long distances internationally.

> Once a potential partner from the outside has been found, it has to be decided how much information should be given to that partner and to which degree the activities of that firm have to be monitored or controlled. The resulting interaction is thus greatly impacted by the degree of trust that exists between the firms. Unlike in the case of local relations between cluster firms, there is not shared trust in this situation from which new partners can benefit (Bathelt et al, 2002: 13).

There are costs involved in building trust. The communication processes in global pipelines entail a high degree of uncertainty, as firms come from different socio-institutional and cultural environments. The advantages offered by global pipelines are associated with "integration of multiple selection environments that open different potentialities and feed local interpretation and usage of knowledge hitherto residing

elsewhere" (Bathelt et al, 2002: 17).

Bathelt et al (2002) describe some limitations to pipeline formation. "In contrast to the type of communication and interaction that often occurs within the cluster, cost-considerations tend to make the knowledge flows and interaction in global pipelines targeted towards a certain, often pre-defined goal" (Bathelt et al, 2002: 17). Essentially the communications are more narrow and focused. Flows of knowledge through pipelines are intentional and participation involves costs. The processes behind the development and maintenance of pipelines are planned in advance.

Bathelt et al (2002) argue that local buzz and pipeline knowledge flows are mutually reinforcing. As more firms in a cluster develop pipelines, more information and news about markets and technologies are spread around the cluster, the dynamics of the buzz increase.

The concept of absorptive capacity is applied to external knowledge, received through pipelines, in a way that increases the firm's innovative capacity. Absorptive capacity refers to the ability of a firm, or organization, to assimilate inflowing information and apply it towards innovation. This theory attempts to explain why firms can gain competitive advantage by being co-located in a cluster with many other firms and organisations which are involved in similar and related types of economic activity. The following four arguments provide a summary of Bathelt et al.'s (2002) theory. First, high quality local buzz leads to a more dynamic cluster, where knowledge flows are plentiful. A high quality local buzz is one in which useful information flows among firms, most likely in an environment where firms have complementary and heterogeneous

knowledge and skills.

Second, a well-developed pipeline system connects the cluster with the rest of the world and provides two benefits to firms. The first is that it develops knowledge-enhancing relations to agents outside the local cluster. The second benefit is to other firms in the cluster who gain new knowledge from outside agents via local buzz. Bathelt et al (2002) argue the quality of local buzz improves as pipelines develop. That is, a firm will learn more from neighbouring firms that are globally connected.

Third, an optimal balance must be reached between a firm's organisational structure that is too inward-looking and one that is too outward looking. Firms have a tendency to become too inward-looking because information is so easily transmitted throughout the co-located firms while new external knowledge sources can be difficult to embrace. On the other hand, a firm can become too outward- looking when external knowledge is easy to comprehend by gate-keepers but not able to be practically useful knowledge due to internal communication gaps.

Fourth, individual firms can effectively manage only a limited number of pipelines at any time. Bathelt et al (2002) postulate that a "large number of related independent firms in a cluster can manage a larger number of pipelines than one single large firm alone. If this is true, this could provide a possible explanation for why spatial clustering gives rise to competitive advantage" (17). Bathelt et al (2002) acknowledge that their theory does not recognize an upper limit to the benefits of spatial clustering. They suggest that buzz congestion could potentially cause a cluster to become over-crowded, reducing the benefits to clustering. Although firms tend to use filters to separate

relevant information from irrelevant information, thus information overload is not usually a problem for local buzz. Strong external linkages could threaten the long term vitality of a cluster by reducing its coherence. In this case the external linkages begin to dominate the local cluster environment so that local firms pay less attention to local buzz. The clusters become hollow and in time die out as firms shift to other locations.

Audetsche and Feldman (1996) examine the extent to which industrial activity clusters and links it to the existence of knowledge externalities. They argue that innovative activity will tend to cluster in industries where new economic knowledge plays an especially important role. They find evidence industries in which knowledge spillovers are more prevalent, where industry R&D, university R&D, and skilled labour are most important, have a greater propensity to cluster than industries where knowledge externalities are less important.

An empirical study by Kolko (2002) isolates the effect of IT on spreading and clustering by controlling for industry skill level and industry growth. His results are mixed. First, they show that IT has the effect of reducing clustering behaviour, although it is reduced by a lesser amount in IT industries than in other industries. He suggests the rise in electronic knowledge spillovers may explain the results. Second, Kolko's (2002) analysis of new firm-birth reveals that IT reduces the need to locate near customers, thus promoting clustering behaviour.

A Synthesis of Firm Behaviour in the New Economy

It is widely accepted that knowledge has heightened in importance as an asset of the firm, and that firms devote more time and resources to the management and creation

of knowledge in the NE. The development of the Internet and telecommunication networks has contributed to the enhancement of knowledge transfer over distances. As well, transportation costs of many NE goods have substantially fallen. Network externalities are especially strong in the NE, necessitating cooperation among firms seeking to establish standards and create a single network of compatible users. The importance of technology and innovation implies that firms must be strategic by focusing on both their competitors and their collaborators. The term 'coopetition' has been used to describe the situation where otherwise competitive firms decide to cooperate to capture network externalities of certain NE industries.

The need for collaboration and cooperative arrangements has never been greater, possibly suggesting a rise in the importance of clustering behaviour of firms in the NE. Clusters of high-technology firms create a critical mass of skilled labour, ready capital and innovative ideas which encourage start-ups and attract firms from elsewhere (Kolko, 2002).

Perhaps it is no coincidence that clustering literature since 2000, shortly after the onset of the NE, has focused on the role of knowledge and learning in clusters. On the basis of the four models of the role of knowledge flows in clustering behaviour, as reviewed in subsection ii above (Wolfe and Gertler, 2004; Bathelt, Malmberg and Maskell, 2003; Maskell, 2001, Pinch, Henry, Jenkins and Tallman, 2003), it is argued that the production and transfer of new knowledge is best achieved by firms co-located with other firms in the same industry and with higher learning and research institutions specializing in their areas of business. Models by Wolfe and Gertler (2004), Bathelt et al

(2003), and Maskell (2001) are quite compatible. Wolfe and Gertler's (2004) classification of knowledge spillovers describes different sources of local buzz. Maskell's (2001) differentiation between horizontal and vertical spreading of knowledge also contributes to a more detailed description of local buzz. While the model proposed by Pinch et al (2003) addresses some valuable points, it does not fit nicely into Bathelt et al's (2002) framework. Pinch et al's (2003) model is a less tractable alternative to that of Bathelt et al (2002). The formalized microeconomic model presented in section IV is grounded in the framework proposed by Bathelt et al (2003).

I use the term "local atmosphere" to describe the creation and transfer of knowledge within a cluster. The term encompasses Bathelt et al's (2002) local buzz, Wolfe and Gertler's (2004) five types of knowledge spillovers, and Maskell's (2001) horizontal and vertical spread of knowledge. Local atmosphere refers to unintended and intended learning processes which occur as an outcome of frequent face-to-face interactions; movement of employees among firms and between universities, research institutions and firms; new firm start-ups by previous employees utilizing years of knowledge developed in a local firm; contact and participation in civic associations; monitoring competitor firms within the cluster; the division of labour occurring in vertical clusters; and casual social activities such as coffee shop talk or conversing with employees of other firms and institutions at a kid's soccer game. All these activities lead to the creation of a social culture, or institutional structure, particular to the cluster, consisting of collective beliefs, values, conventions, language, technology attitudes, and sometimes but not always trust and reciprocity.

The role of knowledge creation and transfer is expected to supersede traditional agglomeration economies in a NE firm's location decision. Firms access knowledge either through global pipelines, local atmosphere or a combination of both. Firm location does not directly affect the knowledge created or transferred through global pipelines, while the co-location of firms does directly affect knowledge created or transferred through local atmosphere. And co-location of firms does directly affect the most powerful source of knowledge, that knowledge created through the combination of global pipelines and local atmosphere. It then follows that firms within a cluster benefit from direct knowledge creation as an outcome of local atmosphere, and indirectly through knowledge creation as an outcome of the combination of global pipelines of other economic agents transferred through local atmosphere. It is the local atmosphere that creates the competitive advantage for firms within the cluster.

The 'forty acres and a modem' view can be understood within the context of the framework outlined above, where isolated firms chooses to depend exclusively on the global pipeline rather than local atmosphere. The 'forty acres and a modem' firms are missing out on the knowledge created from the interaction between local atmosphere and global pipelines.

The framework developed in this section forms the basis for a microeconomic model of clustering behaviour in the New Economy, to be developed in sections three and four which follow.

3. Methodology

For the most part economic literature has neglected spatial issues. Industrial location literature has largely ignored the issue of market structure and obsessed with geometry, with the shape of market areas on an idealized landscape, with little attention paid to the problem of modeling markets (Krugman, 1991). Krugman's (1991) work in the area of industrial geographic concentration has made great strides towards filling the void. The study of production location in space has been called economic geography (Krugman, 1991) or geographical economics (Brakman, Garretsen, and van Marrewijk, 2001). Krugman finds the most striking geographical feature of economic activity to be concentration. He argues that geographic concentration of production is evidence of the general influence of increasing returns. Increasing returns are more difficult to model than constant or diminishing returns, creating a challenge for industrial location theorists. "If increasing returns are purely external to firms, we can still use the tools of competitive analysis; but external economies turn out to be both analytically awkward and empirically elusive. If increasing returns are internal to firms, we are faced with the necessity of modeling imperfect competition" (Krugman, 1991: 6).

In the 1970s, an evolution of industrial organization theory gave rise to a menu of models of imperfect competition. Krugman (1991) maintains that "no one of these models is totally convincing, but they make it possible to write down coherent, rigorous, and often elegant models of economies subject to increasing returns" (7). The revolution in theory has had a transforming effect on international economics and growth theory. A

new view has emerged in international economics where trade is based on increasing returns, rather than an effort to take advantage of exogenous differences in resources or productivity. The idea of sustained growth arising from increasing returns has been reintroduced in growth theory, leading to a renewed interest in the big push theory of economic growth and development (Rosenstein-Rodin, 1943). In addition, increasing returns has been suggested to play a role in business cycles. (Krugman, 1991).

Krugman (1991) contends that the tools developed for modeling increasing returns in the 1970s have allowed economists to deal with the issue of geography in industrial organization. He further argues the line between international economics and regional economics has become blurred. "One need only mention, 1992 in Europe: as Europe becomes a unified market, with free movement of capital and labor, it will make less sense to think of the relations between its component nations in terms of the standard paradigm of international trade. Instead the issues will be those of regional economics"(Krugman, 1991: 8).

Krugman's (1991) work in this area attempts to illustrate that increasing returns have a pervasive influence on the economy and that increasing returns give a decisive role to history in determining the geography of economies. His work focuses on the localization of particular industries and the differential development of huge regions. This paper deals with the former.

He develops a fully specified, general equilibrium core-periphery model in which the interaction of demand, increasing returns, and transportation costs drive a cumulative process of regional concentration. Krugman's model is grounded in modern trade theory,

of which the crucial features include increasing returns, imperfect competition and path dependency. The core-periphery model, hereinafter referred to as the core model, analyzes the forces of economic agglomeration and spreading by allowing mobile labourers to migrate between regions.

3.1 Krugman's Core-Periphery Model [21]

Consider a country with two regions and two sectors, manufacturing M and food F. The agricultural production of food is homogenous, produced under constant returns to scale and perfect competition. The manufactured production is differentiated, produced according to economies of scale under a monopolistically competitive market structure. Krugman makes use of the Dixit-Stiglitz model[22] of monopolistic competition.

It is assumed that all agents in the economy share the same tastes which are modeled with a Cobb-Douglas function of consumption of agricultural goods, F, and aggregate manufactured goods, M,

$$U = C_M^{\delta} C_F^{(1-\delta)}, \quad 0<\delta<1 \qquad (1)$$

, where δ is the share of expenditures on manufacturers.

The Dixit-Stiglitz approach uses a constant elasticity of substitution (CES)

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[21]The detailed account of Krugman's core model is based on Appendix A of Krugman (1991): 101-113.

[22]The Dixit-Stiglitz model of monopolistic competition makes assumptions concerning symmetry of new varieties and the structural form. The assumption allows one to model firm level production so that it benefits from internal economies of scale in a monopolistically competitive framework. The model is used extensively in geographical economics.

function to construct the aggregate consumption of manufactured goods, of which there is a very large number. The aggregate consumption of manufactured goods as a function of the consumption, c_i of the n varieties is as follows:

$$C_M = \left[\sum_{i=1}^{n} c_i^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \sigma>1 \quad . \quad (2)$$

The large number of manufactured goods in a CES function allows σ to be interpreted as the elasticity of demand for any individual good. Let $\sigma-1/\sigma = \rho$, where ρ is a measure of a consumer's love of variety. If ρ=1, then equation (2) becomes $C_m = \sum c_i$ and variety does not affect utility and we have perfect substitution. For instance, one hundred units of one variety yields the same utility as one unit of one hundred different varieties. For Krugman's analysis, the constraint that ρ<1 is placed to ensure that product varieties are imperfect substitutes. As well, the constraint that ρ>0 is placed to ensure that individual varieties are substitutes and not complements for each other, which will allow price-setting behaviour based on monopoly power. It is assumed that there are two factors of production, agricultural workers and manufacturing workers. Agricultural workers only produce agricultural goods and manufacturing workers only produce manufactured goods. Given the total labour force L, a fraction (1-δ) works in agricultural production and fraction δ works in manufactures. This choice of units leads to equal wages for agricultural workers and manufacturing workers in equilibrium.

In Krugman's core model, the geographical distribution of agricultural workers is fixed at (1-δ)/2 in each location. Manufacturing workers are mobile and locate in the

region offering the highest real income.

Manufacturing production is characterized by internal economies of scale, thus each variety is produced by a single firm because the firm with the largest scale will always outbid a potential competitor. The production of manufactured goods is a function of labour, x = f(L), with the following production function where the coefficients α and β represent the fixed and marginal labour input requirements, respectively.

$$x_{Mi} = \frac{L_{Mi} - \alpha}{\beta} \quad (3).$$

The economies of scale in manufacturing is represented in a linear cost function, where fixed cost in terms of manufacturing labour must be incurred in order to produce any individual variety of manufactures ,

$$\mathcal{L} = L_{Mi} = \alpha + \beta x_{M_i}, \text{ where } \alpha>0 \text{ and } \beta>0. \quad (4)$$

It is assumed that the transport costs of moving manufactured goods between the two regions take Samuelson's "iceberg" form, in which only a fraction of a shipped good arrives. Let T be the parameter representing transportation costs, where T is the number of goods that need to be shipped to ensure that one unit arrives per unit of distance. For instance, if 107 tonnes of canola is shipped from Manitoba to southeast Ontario, while only 100 tonnes arrives intact in southeast Ontario, then T=1.07, as if some portion of the canola has melted away in transit, hence the name iceberg costs. The following terminology, T_{rs} is used to denote the number of goods needed to be shipped from region *r* to ensure that one unit arrives in region *s*. It is assumed that the distance between any two regions is equal to one. Transportation of agricultural goods are assumed to be

costless in order to make certain that the wage rate of agricultural workers and the price of agricultural goods is the same in the two locations.

As mentioned above, considering each of the many potential manufactured goods is subject to economies of scale, it is reasonable that each good be produced by only one firm, where the market structure is one of monopolistic competition with each firm having some monopoly power.

The Dixit-Stiglitz model makes two assumptions about the price-setting behaviour of firms. First, it is assumed that each firm takes the price-setting behaviour of other firms as given, in other words if one firm lowers its price, the other n - 1 firms will not change their prices. Second, it is assumed that each firm ignores the effect of changing its own price on the price index, I, of manufactured goods. These assumptions are reasonable as long as n is large.

Each producer will face an elasticity of demand σ, where the profit-maximizing price is a constant mark-up over marginal cost,

$$p_i = \frac{\sigma}{\sigma - 1} \beta w, \qquad (5)$$

where w is the wage rate of manufacturing workers. As the consumer's love of variety increases, the lower the value of ρ_i. The size of the mark-up depends on the price elasticity of demand. If, for instance, demand is relatively inelastic at σ =2, mark-up is 100%. If demand is relatively more elastic at at σ = 5, the mark-up is 25%. Since elasticity of demand is constant, the mark-up is also constant and not dependent on scale of production.

Note that each manufacturing firm producing x_{Mi} units of output using the production function in equation (3) will earn profits π given by,

$$\pi_{Mi} = p_i x_{Mi} - w(\alpha + \beta x_{Mi}) \quad (6)$$

As in typical monopolistically competitive market structures, profits will be driven to zero with free entry. The zero profit condition is represented by the following equation:

$$(p_i - \beta w)x = \alpha w \quad (7)$$

Zero profits imply that price equals average cost. Thus, the ratio of average cost to marginal cost, one way to measure economies of scale, is equal to $\frac{\sigma}{(\sigma - 1)}$. It follows that equilibrium economies of scale are a function of σ, despite the fact that it is a parameter of tastes rather than of technology. σ can be thought of as an inverse index of the importance of increasing returns.

The scale of production for each firm can be calculated by setting the profit equation (6), to zero and substituting equation (5) for price. The combination of zero profit and pricing conditions imply that the output of a representative manufacturing firm is,

$$x_i = \frac{\alpha(\sigma - 1)}{\beta} \quad (8)$$

The cost function (3) is used to calculate the amount of labour required to produce the level of output, as determined in equation (8) above,

$$L_{Mi} = \alpha\sigma \quad (9)$$

In the manufacturing sector, the total demand for labour is equal to nαL and the total supply of labour is equal to δL. The number of varieties produced in the economy is a function of the size of the manufacturing sector labour force,

$$n = \frac{\delta L}{\alpha + \beta x} = \frac{L_M}{\alpha \sigma} \quad (10).$$

Equation (8) states that the level of output for each firm is fixed in equilibrium, as determined by the production function and price elasticity of demand. Accordingly, the manufacturing sector in aggregate can only grow if more varieties are produced which can only happen if δ, an exogenous variable, increases. Equation (10) explains that a larger demand for manufactured goods affects only the number of varieties, and not the level of output of each variety. Note that the number of varieties equals the number of manufacturing firms, as each firm produces only one variety.

Krugman (1991) uses the model to examine the sustainability of an equilibrium, with one region as the manufacturing core and the other region as the agricultural periphery. For argument sake, suppose region 1 is the manufacturing core and region 2 is the agricultural periphery. Krugman (1991) identifies two agglomerating forces keeping the manufacturing core in existence and one spreading force, pulling the manufacturing core apart. The agglomerating forces are the desire of firms to locate close to a larger market and the desire of workers to have access to goods produced by other workers, which correspond to forward and backward linkages, respectively. The spreading force is the incentive of firms to move out to serve the peripheral agricultural market. Krugman

(1991) derives a criterion that determines whether the agglomeration linkages are strong enough to sustain an established core.

First consider how the incomes of the two regions compare. Half of the farmers live in region 1, receiving a share $\frac{(1-\delta)}{2}$ of total income, plus all the manufacturing workers, receiving a share δ. Supposing total income is equal to one, the income of region 1 is,

$$Y^1 = \frac{1+\delta}{2} . \quad (10)$$

The other half of the farmers live in region 2, receiving a share $\frac{(1-\delta)}{2}$ of total income, thus the income of region 2 is,

$$Y^2 = \frac{1-\delta}{2} . \quad (11)$$

As long as it is unprofitable for any manufacturing firms to enter region 2, the manufacturing will remain concentrated in region 1. Krugman (1991) examines whether it is profitable for an individual firm to "defect" by producing in region 2.

Let n_1 be the number of firms currently producing in region 1. The sales of each of these firms will be,

$$s^1 = \frac{\delta}{n_1} . \quad (12)$$

In order for a firm to produce in region 2, workers would have to be attracted to the region with higher wages, since all manufactured goods, except for the firm's small

contribution, would have to be imported. Keep in mind that only a fraction of a shipped good arrives. Thus, the price of imported manufactured goods in region 2 will be T times as high as that in region 1. The overall price index, the geometric average of manufactured and agricultural goods, will be T^{δ} times as high. Accordingly, the defecting firm would have to match the real wage by offering a nominal wage that is T^{δ} times that paid in region 1.

However, the price charged by a firm is a fixed markup over marginal cost, which is proportional to wages. Thus, the price charged by a new firm in region 2 will exceed that of established firms in region 1 in the ratio,

$$p^2 = p^1 T^{\delta} \text{ or } \frac{p^2}{p^1} = T^{\delta}. \qquad (13)$$

Transportation costs may result in prices to consumers differing from prices charged by firms. The price of a manufactured good produced in region 2 for a consumer in region 1 is higher than the price as reflected in the ratio above (13), by T ; in other words the relative consumer price is Tp_2/p_1. The price of a manufactured good produced in region 1 for a consumer in region 2 incurs shipping costs, the relative price of the region 2 good is p_2/Tp_1.

If a region 2 manufactured good increases in relative price by 1 percent, consumption of that good relative to the consumption of a region 1 good falls by σ percent. However, the higher price reduces expenditure by only σ-1 percent. This result is used to derive the value of the sales of a defecting firm. Considering the incomes of

each region, the sales of a firm in region 2 are represented by the following equation:

$$s^2 = \frac{\delta}{n^1}\left[\frac{1+\delta}{2}\left(\frac{p^2 T}{p^1}\right)^{-(\sigma-1)} + \frac{1-\delta}{2}\left(\frac{p^2}{p^1 T}\right)^{-(\sigma-1)}\right] \quad (14)$$

The sales of the defecting firm relative to those of a typical firm in region 1 can then be derived by dividing equation (14) by equation (12),

$$\frac{s^2}{s^1} = \left(\frac{1+\delta}{2}\right)T^{-(1+\delta)(\sigma-1)} + \left(\frac{1-\delta}{2}\right)T^{(1-\delta)(\sigma-1)} \quad (15)$$

It is important to keep in mind that firms charge a constant markup over marginal costs. The fixed costs incurred by labour also need to be covered by operating profits, and will be higher in region 2 by the ratio T^{δ}. Consequently, firms will only find it profitable to defect if $s^2/s^1 > T^{\delta}$. Krugman (1991) defines a new variable, K, which is equal to $T^{\delta}\, s^2/s^1$,

$$K = \frac{T^{-(\delta\sigma)}}{2}\left[(1+\delta)T^{-(\delta-1)} + (1-\delta)T^{(\delta-1)}\right] \quad (16)$$

If K is greater than one, manufacturing production in region 2 will be profitable. As long as K<1, a core-periphery equilibrium is sustainable. In essence, the sustainability of the equilibrium is dependent on the three parameters, δ, *T*, and σ. The core-periphery pattern, where one region emerges as the manufacturing core and the other becomes the agricultural periphery, depends on some combination of large economies of scale (small σ) , low transportation costs (small *T*) , and a large share of manufacturing in

expenditures (large δ)[23].

Krugman's (1991) model allows for three equilibria, complete concentration of manufacturing in region 1, complete concentration of manufacturing in region 2, and an even split between region 1 and region 2. Multiple equilibria are a consequence of increasing returns to scale. Which equilibrium becomes established is largely the outcome of historically determined initial conditions in each region.

Simulations of the core model indicate that industrial production tends to be concentrated in a few regions (Krugman, 1993). Krugman's core model has prompted the development ofnumerous extensions to analyze topics in the areas of international trade, economic growth, business cycle theory and regional economics. Section IV is an extension of Krugman's model to explain clustering behaviour of firms in the NE, based on theoretical literature reviewed in section two.

4. A Microeconomic Model of Industrial Clustering in the New Economy

The model presented in this section is an application of van Marrewijk's (2005) extension of Krugman's core model. Brakman, Garretsen, van Marrewihjk, and Wagenvoort (1996) extended the core model to incorporate the effect of regional asymmetry and the negative feedback effect of congestion on agglomeration, which was further refined by van Marrewijk (2005). Their model demonstrates that the development of clusters is constrained by congestion as some firms find it more profitable to relocate

[23] A detailed account of the determinants of the core-periphery equilibrium can be found in Krugman (1991) Appendix A: 109-113.

away from the cluster. Their results support the existence of small clusters and may lend some support to the 'forty acres and a modem' argument. Congestion is modeled in the production function as a negative function of the number of firms in the region. Costs associated with congestion have become quite significant in recent decades. For instance, the success of Silicon Valley and the attendant increases in the cost of living and traffic congestion have also fueled the boom in some areas, such as Salt Lake City, Utah, as companies try to locate in places where their employees want to live (Broersma, 1998). The Texas Transportation Institute (2005) estimates the total cost of congestion in 85 U.S. areas to approach $63 billion in 2003, up $1 billion from the previous year. The costs include 3.7 billion hours of delay and 2.3 billion gallons of fuel.

As discussed in section III, firms in the NE rely on the creation and transfer of knowledge to a greater degree than in previous decades. The creation and management of knowledge and information has become an important activity for NE firms. Stemming from section III, existing economic theory suggests that knowledge creation at the firm level is more efficient when a firm is located in a cluster. The model developed here illustrates clustering behaviour in the NE by considering the importance of knowledge creation as a clustering force.

Local atmosphere, the concept explaining knowledge created and transferred among firms in clusters, provides a competitive advantage to participating firms. In this model, one region has a competitive advantage over the other due to the benefits of knowledge created through local atmosphere. The benefit is modeled in lower marginal input requirements for firms located in a cluster. Ricci (1997) modeled comparative

advantage based on technological advantage of one country over another in this same way in an extension of the core model analyzing the structure of international trade.

In sum, this model integrates Krugman's (1991) traditional determinants of clustering which include transportation costs, economies of scale and share of manufacturing in expenditures with Brakman et al's (1996) congestion effect and the NE local atmosphere effect, both of which are captured in the production function.

Consider 2 regions (r =1,2) both producing sector *A* new economy goods, consisting of numerous varieties, and sector *B* a homogeneous agricultural good, which serves as numeráire. The production of NE goods is characterized by increasing returns to scale, footloose[25] production, and imperfect competition. The Dixit-Stiglitz model of monopolistic competition is applied, as it is in the core model[26].

The demand side is modeled with a Cobb-Douglas utility function with the constant elasticity of substitution (CES),

$$U = C_A^{\delta} C_B^{1-\delta}, \quad 0<\delta<1$$

where C_A is the consumption of the sector *A* NE goods, C_B is the consumption of the sector *B* agricultural good, and δ is the share of income spent on sector *A* goods.

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[25]Footloose refers to a firm's ability to change their production location without cost.

[26]The Dixit-Stiglitz model of monopolistic competition makes assumptions concerning symmetry of new varieties and structural form. The assumption allows one to model firm level production so that it benefits from internal economies of scale in a monopolistically competitive framework. The model is used extensively in geographical economics.

$$C_A = \left[\sum_{i=1}^{N} c_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}, \sigma>1 \quad . \quad (1)$$

Let c_i represent the level of consumption of variety i of sector A goods and N be the total number of varieties available. Equation (1) states that the consumption of all varieties is symmetrical, simplifying the analysis. Consumer's demand is derived using a utility optimization problem where equation (1) is maximized subject to the budget constraint,

$$\sum_{i=1}^{N} p_i c_i = \delta Y$$

where p_i is the price of variety i for i= 1,...,N and Y is total income earned in either sector A or sector B, measured in terms of the agricultural good, the numeráire. Any portion of income spent on variety i cannot be simultaneously spent on variety j. The solution to the optimization problem yields[27],

$$c_j = p_j^{-\sigma}\left[I^{\sigma-1}\delta Y\right], \text{ where } I \equiv \left[\sum_{i=1}^{N} p_i^{1-\sigma}\right]^{1/(1-\sigma)} \text{ for } j=1,...,N \qquad (2)$$

$$C_A = \delta Y/I \qquad (3)$$

The large number of sector A manufactured goods in the CES function allows σ to be interpreted as the price elasticity of demand for any individual good. Let $\sigma - 1/\sigma = \rho$, where ρ is a measure of a consumer's love of variety. If ρ=1, then equation (1) becomes $C_A = \sum_i c_i$ and variety does not affect utility and we have perfect substitution. For instance, one hundred units of one variety yields the same utility as one unit of one

[27]See Appendix A for the derivation of equations (2) and (3).

hundred different varieties. Like Krugman, we place the constraint that $\rho<1$ to ensure that product varieties are imperfect substitutes. As well, we place the constraint that $\rho>0$ to ensure that individual varieties are substitutes and not complements for each other, which will allow price-setting behaviour based on monopoly power.

It is assumed that there are two factors of production, sector *A* NE manufacturing workers and sector *B* agricultural workers. Agricultural workers only produce agricultural goods and manufacturing workers only produce sector A manufactured goods. The geographical distribution of agricultural workers is fixed at φ_r in each region. Sector *A* NE manufacturing workers are mobile and locate in the region offering the highest real wage. Sector *B* workers are immobile and the sector *B* agricultural industry is perfectly competitive.

The share of sector *A* workers in the total work force is denoted as γ and the share in region *r* is denoted as λ_r. The total number of sector *A* workers in region *r* is as follows, $L_r = \lambda_r \gamma L$.

The production of sector *B* goods in region *r* is denoted, $Q_{Br} = \phi_r (1-\gamma) L$, where ϕ_r is the share of sector *B* workers in region *r* and *L* is the total labour force in the economy. The production of agricultural goods takes place under constant returns to scale.

The labour necessary to produce quantity *x* of variety *i* in region *r* is,

$$l_{ir} = N_r^{\frac{\tau}{(1-\tau)}} (\alpha + \beta_r x_{i_r}) \quad , 0<\tau<1 \qquad (4)$$

The cost function in equation (4) illustrates that fixed (α) and variable costs (βx_{ir}) depend positively on the number of firms in the region (N_r), and the parameter τ represents

external economies of scale. In the case of congestion, negative location specific external economies of scale arise from congestion, modeled in a value of τ, where $0<\tau< 1$. For reasons previously stated, the inclusion of local atmosphere has a downward effect on variable costs in region 1, the region characterized by co-located sector *A* firms in close proximity to higher learning and research institutions specializing in areas pertinent to sector *A* firms. Sector *A* firms in region 2 are not co-located and are not in close proximity to higher learning and research institutions specializing in areas pertinent to sector A firms. To clarify, a region is geographically large enough so that many firms may exist in the region without being considered co-located. As well, sector A workers do not necessarily live in the same community. The local atmosphere effects are specified through the marginal costs of production in β_r, where $\beta_1 < \beta_2$ due to the cluster effect in region 1. In sum, the two regions are identical in all aspects except for the number of sector A firms and the competitive advantage of clustering for sector A firms in region 1.

Sector *A* production is characterized by internal economies of scale, thus each variety is produced by a single firm since the firm with the largest scale will always outbid a potential competitor. The market structure is one of monopolistic competition with each firm having some monopoly power.

The Dixit-Stiglitz model makes two assumptions about the price-setting behaviour of firms. First, it is assumed that each firm takes the price-setting behaviour of other firms as given, in other words if one firm lowers its price, the other N - 1 firms will not change their prices. Second, it is assumed that each firm ignores the effect of changing its own price on the price index, I, of manufactured goods. These assumptions

are reasonable as long as N is large. Each firm will produce x_{ir} units of output in region r using the production function:

$$x_{ir} = \frac{l_{ir} - N_r^{(\tau/1-\tau)}\alpha}{N_r^{(\tau/1-\tau)}\beta_r} \quad (5).$$

The profit function π_r is given by,

$$\pi_r = p_r x_{ir} - w_r N_r^{\tau/(1-\tau)}(\alpha + \beta_r x_{ir}) \quad (6)$$

where w_r is the nominal wage for sector A workers in region r.

Demand has to be considered as each firm will have to sell x_{ir} units of output it produces. The constant price elasticity of demand σ for a variety holds when the demand for many consumers with the same preference structure is combined. If the demand for a variety has a constant price elasticity of demand, the maximization of profits leads to the simple optimal pricing rule of mark-up pricing where the profit maximizing price is a constant mark-up over marginal cost[28]:

$$p_r = \frac{\sigma}{\sigma - 1}\beta_r w_r N_r^{\tau/(1-\tau)} \quad (7)$$

Note that p_1 will be less than p_2 due to knowledge creation in region 1 through local atmosphere, if the number of firms is equal in both regions. The size of the mark-up is inversely related to the price elasticity of demand, σ.

As in typical monopolistically competitive market structures, profits are driven down to zero with free entry. The zero profit condition conveniently allows for the derivation of demand equations by setting the profit equation (6) is set to zero,

[28] See appendix A for the derivation of the price functions.

substituting in the price equation (7) and re-arranging for x_{ir}:

$$x_{ir} = \frac{\alpha(\sigma - 1)}{\beta_r} \qquad (8)$$

The cost function (4) is used to calculate the amount of sector A labour required to produce the level of sector A output indicated in equation (8):

$$l_r = N_r^{\tau/(1-\tau)} \alpha\sigma \qquad (9)$$

The labour demand equation (9) is used to determine the number of varieties produced in each region by dividing the total number of sector A workers, γL_r, by the number required to produce each variety, l_r:

$$N_r = \frac{\gamma L_r}{l_r} = \frac{\gamma L}{N_r^{\tau/(1-\tau)} \alpha\sigma}; N_r = (\gamma L_r / \alpha\sigma)^{1-\tau} \quad (10).$$

As in the core model (Krugman, 1991) and extensions by Brakman et al (1996), and van Marrewijk (2005) transport costs for sector A take Samuelson's "iceberg" form, in which only a fraction of a shipped good arrives. Let T be the parameter representing transport costs, where T is the number of goods that need to be shipped to ensure that one unit arrives per unit of distance. For instance, if 107 tonnes of canola is shipped from Manitoba to southern Ontario, while only 100 tonnes arrives intact, T=1.07, as if some portion of the canola has melted away in transit, hence the name iceberg costs. We use the following terminology, T_{12} to denote the number of goods needed to be shipped from region 1 to ensure that one unit arrives in region 2. We assume that the distance between any two regions is equal to one. Transporting agricultural goods is assumed to be costless

in order to make certain that the wage rate of agricultural workers and the price of agricultural goods is the same in both regions. The term transport costs represents many types of barriers to trade, such as tariffs, language, and cultural barriers, as well as the cost of transporting the good.

With transport costs in the model, the wage rate of sector *A* workers in region 1 will differ from the wage rate paid to sector *A* workers in region 2. For instance, the wage rate in region 1, w_1 can be put into the price equation (7) to determine the price charged in region 1 by a firm located in region 1. The price this region 1 firm will charge in region 2 will be T_{12} times higher than in region 1 as a result of the transport costs. For instance, the price a firm located in region 1 charges in region 2 is equal to:

$$\beta\left(\frac{\sigma}{1-\sigma}\right)w_1 N_1^{\tau/(1-\tau)} T_{12} \quad (11)$$

This will hold for all sector *A* firms in region 1. A congruent explanation holds true for region 2. Also note that the number of firms located in region 1 is equal to,

$$N_1 = \left(\gamma\lambda_1 L / \alpha\sigma\right)^{1-\tau} \quad (12).$$

In order to solve for a short-run equilibrium, price indices are required. As stated above, the price a firm charges will depend on the location of the firm and the location of the customer. The price index of sector *A* goods will be different in the two regions, $I_1 \neq I_2$. We derive the price index for each region by substituting in the number of sector *A* firms in each region, equation (12), and the price of goods charged in each region (11) into the price index from equation (2):

$$I_r = (B_r)\left(\frac{\sigma}{1-\sigma}\right)\left(\frac{\gamma L}{\alpha\sigma}\right)^{\frac{(1-\sigma\tau)}{(1-\sigma)}}\left[\sum_{r=1}^{2}\lambda_r^{1-\sigma\tau}w_r^{1-\sigma}\,T_{rs}^{1-\sigma}\right]^{1/(1-\sigma)} \qquad (13).$$

For exogenously given distributions of the sector A labour force, λ_r, short-run equilibrium relationships are determined. It is assumed that the sector A labour force is not mobile in the short-run. It is also assumed that the labour market clears so that all sector A and sector B workers are employed. We require the income levels of each region for the short run equilibrium. Since there are no profits for sector A firms because of free entry and exit and no profits for sector B firms because of constant returns to scale and perfect competition, all income earned for consumption expenditures is derived from the wages earned in their respective sectors. Let Y_r denote income generated in region r:

$$Y_r = \phi_r(1-\gamma)L + \lambda_r\gamma L w_r \qquad (14)$$

which defines the income in region r as the sum of income from sector B, the numeráire, and income from sector A. Note that the number of sector B agricultural workers in region r is denoted as $\phi_r(1-\gamma)L$ with each earning a wage rate of 1 and the number of sector A NE manufacturing workers in region r is denoted as $\lambda_r\gamma L$ with each earning nominal wage rate w_r..

The demand in region r for goods and services produced in region r is determined by summing the individual demand of all consumers in region r. It then follows that demand is dependent on the aggregate income Y_r, the price index I_r, and the price charged by a region r producer of locally sold varieties. Similarly, the demand can be derived for products produced in another region, by substituting aggregate income Y_r, price index I_r,

and the price charged by a producer in region r for a good sold in region r. The break-even level of production, x_{ir}, derived above in equation (8),

$$x_{ir} = \frac{\alpha(\sigma-1)}{\beta_r}$$

for a sector A firm is equated to total demand, described above, to determine the price and wage rate. The nominal wage follows from the condition that demand equals supply in all markets:

$$w_r = \rho\beta_r^{-\rho}\left(\frac{\delta}{(\sigma-1)\alpha}\right)^{1/\sigma}\left(\frac{\gamma L}{\alpha\sigma}\right)^{-\tau}\lambda_r^{-\tau}\left[\sum_{r=1}^{2} Y_s I_s^{\sigma-1} T_{sr}^{\,1-\sigma}\right]^{1/\sigma} \qquad (15)^{29}.$$

The nominal wage, w_r, represents the cost of producing in region r. The right-hand side of equation (15) represents the demand for all varieties of sector A goods produced in region r which is a function of the price indices, the other region's income and the cost of transporting goods between the two regions. For a given distribution of the workforce, λ_r, the number of varieties in each region, N_r, can be calculated. Since prices are determined by wages and transportation costs, equations (13), (14) and (15) can be solved simultaneously for income, wages, and prices indices in both regions. Real wage, ω_r, for each region r is determined using equations (13) and (15) as follows,

$$\omega_r = w_r I_r^{-\delta} \qquad (16).$$

The strong non-linear nature of this model makes it impossible to solve

[29] See Appendix A for the derivation of nominal wage.

analytically. Krugman (1991), Brakman et al (1996) and van Marrewijk (2005) all use numerical simulations to investigate outcomes of their models as values of key variables are varied. Simulations of models with congestion costs (Brakman et al, 1996 and van Marrewijk, 2005) illustrate a dampening effect on clustering and explain the viability of small clusters. It is expected that the addition of local atmosphere to the model will strengthen the clustering effect relative to the results of including congestion alone.

The region with the larger number of firms, N_r, will experience congestion resulting in higher fixed and marginal production costs. Production costs in region 1 relative to region 2 will fall due to the competitive advantage of sector A NE firms in region 1 due to local atmosphere, but will rise due to congestion as more firms move to region 1. The net effect on β_1 will depend on the relative size of the congestion effect versus the local atmosphere effect.

4.1 Simulation Results

Simulations are performed to clarify the structure of the model by observing how short run equilibrium values for income, $Y_{r,}$, price index, I_r, nominal wage, $w_{r,}$ change for a range of exogenously set values of λ_1, initial distributions of the sector A labour force. Note that we only need to specify λ_1 since $\lambda_1 + \lambda_2 = 1$. λ_1 is varied between 0 and 1, to perform 59 separate simulations in which the value of λ_1 increases from 0.0169 to 0.9971. The specification of the model does not allow λ_1 to be set equal to either zero or one.

Sector A workers move from the region with lower real wages to the region with higher real wages when the real wages are not equal across both regions. A long-run

equilibrium is reached when real wages are equal in both regions, $\omega_1/\omega_2 = 1$. The real wage ratio (ω_1/ω_2) varies as the initial share of the sector *A* labour force in region 1, λ_1, varies.

First, simulations are performed to analyse the effect of local atmosphere, modeled in the parameter $\beta_{r,}$, on the clustering behaviour of firms. Simulations are executed to observe real wage ratios as values of β_1 are set as follows: $\beta_1=0.79$, $\beta_1=0.78$, $\beta_1=0.77$, $\beta_1=0.76$, while the value of $\beta_2 = 0.80$. The choice of default parameter values for simulations of the new model are the same as those used by Van Marrewijk (2005) in order to objectively evaluate the effect of local atmosphere on clustering[30]. Figure 1 below illustrates the real wage ratios, ω_1/ω_2, as a function of the fraction of sector *A* labour force in region 1, λ_1.

Every point on each of the four graphs in Figure 1 represents a short run equilibrium. A short run equilibrium is a long run equilibrium if $\omega_1/\omega_2 = 1$, as long as there are mobile sector *A* workers in both regions. If $\omega_1/\omega_2>1$, workers in region 2 have an incentive to relocate to region 1. If $\omega_1/\omega_2<1$, workers in region 1 have an incentive to relocate to region 2. When a long run equilibrium implies complete clustering of all sector *A* workers, and thus firms, in one region the real wage ratio will not equal 1 over the range of λ_1's. The short run equilibrium curve must cut the $\omega_1/\omega_2 = 1$ line from above in order for the long run equilibrium to be stable. If the curve cuts from below, the long run equilibrium is unstable. When a small perturbation occurs at an unstable equilibrium, an adjustment process will lead to a different stable long run equilibrium.

[30]Parameter values are listed in Appendix B.

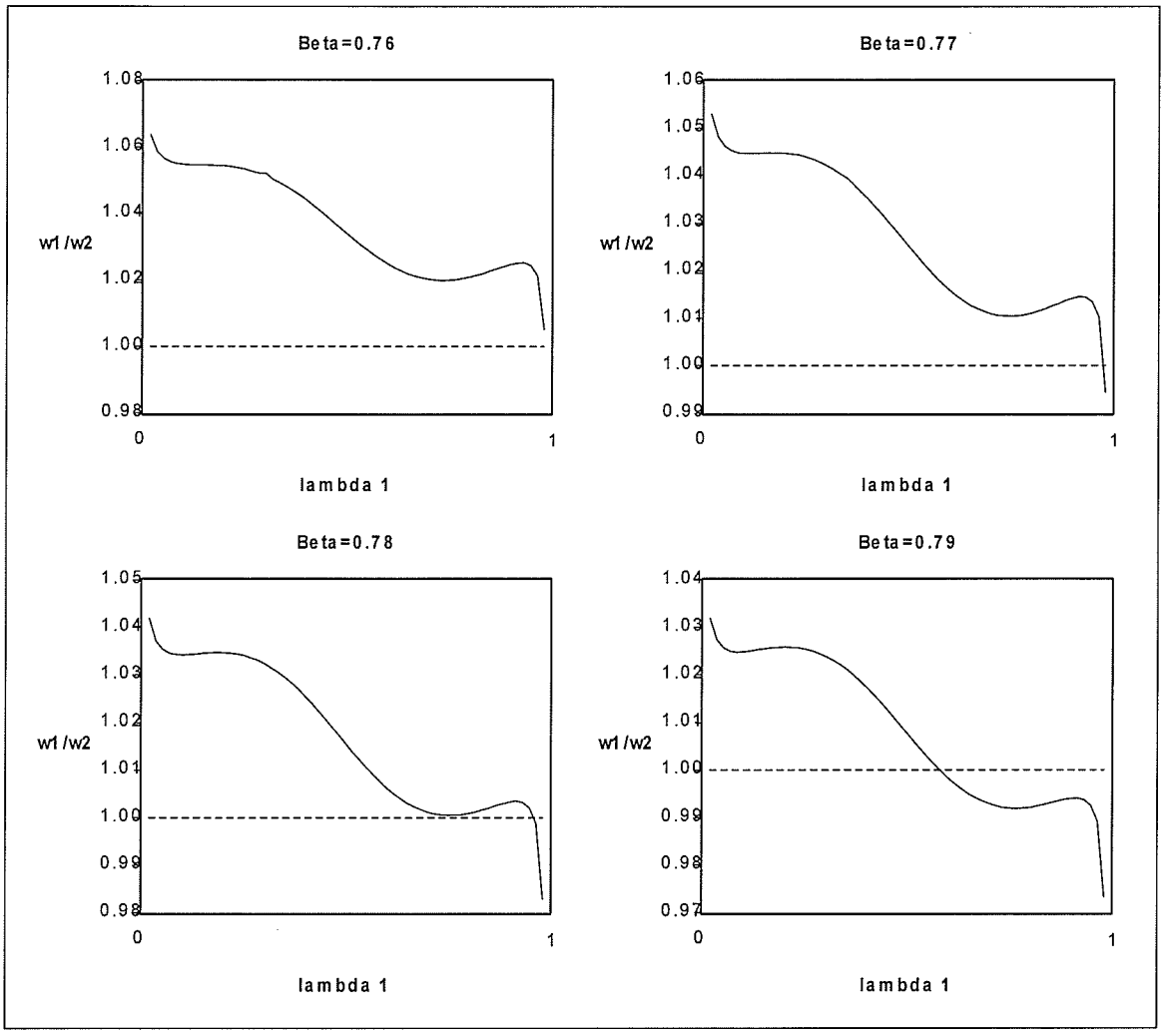

Figure 1 Equilibrium Configurations with Varying Marginal Input Costs in Region 1

The long run equilibriums are unique and stable for all four values of β_1, as illustrated in Figure 1. For β_1=0.79, the long run equilibrium occurs when 58 percent (λ_1=0.58) of the sector *A* labor force in located in region 1. For β_1=0.78 and β_1=0.77, the long run equilibriums are both 98 percent of the sector *A* labour force in region 1. And the long run equilibrium for β_1=0.76 is complete clustering of all sector *A* workers in region 1, as $\omega_1/\omega_2>1$ for all values of λ_1. When the congestion effect is considered

without the local atmosphere effect ($\beta_1 = \beta_2$) in region 1 the long run equilibrium is unique and stable when 50 percent of the sector A labour force is located in region 1.

The simulation results imply that more firms tend to locate in clusters when the cost reducing effect of local atmosphere is incorporated into the model. While congestion costs are positively related to the number of workers in a region, simulation results imply that the cost reducing local atmosphere effect offsets the cost increasing congestion effect. Even when marginal labour costs in region 1 are only 1.25% lower than in region 2 (β_1=0.79, β_2=0.80), the local atmosphere effect increases the clustering behaviour of firms. With reference to equations (13) and (15), the lower marginal labour requirement (β_1) in region 1 reduces the price index and increases nominal wages in region 1, thus increasing real wages in the region with local atmosphere. In sum, Figure 1 supports a tendency towards greater clustering in region 1 when the benefits of local atmosphere are included in the model.

Other parameters may also affect long run equilibria. First, transport costs are considered as they are expected to be relatively low for many NE firms for reasons stated in section III. Transportation costs are varied between T=1.9 and T=1.1 while β_1=0.78 and β_2 = 0.80. Figure 2 illustrates stable long run equilibria for high transport costs, T=1.9 and T =1.7, when 56 percent and 98 percent of the labour force, respectively, is located in region 1. For mid range transport costs, T=1.5 and T=1.3, complete clustering equilibria are unstable. For T=1.5, all sector *A* workers will eventually locate in region 1 if more than 15 percent of the sector *A* labour force is initially in region 1 (λ_1>0.15) and sector *A* workers will locate in region 2 if less than 15 percent of the sector *A* labour force is

initially in region 1 (λ_1<0.15). For T=1.3, all sector *A* workers will eventually locate in region 1 if more than 34 percent of the sector *A* labour force is initially in region 1 (λ_1>0.34) and all sector *A* workers will locate in region 2 if less than 34 percent of the sector *A* labour force is initially in region 1 (λ_1<0.34). For quite low transport costs, T=1.1, the real wage ratio (ω_1/ω_2) is greater than one for all values of λ_1 implying complete clustering in region 1.

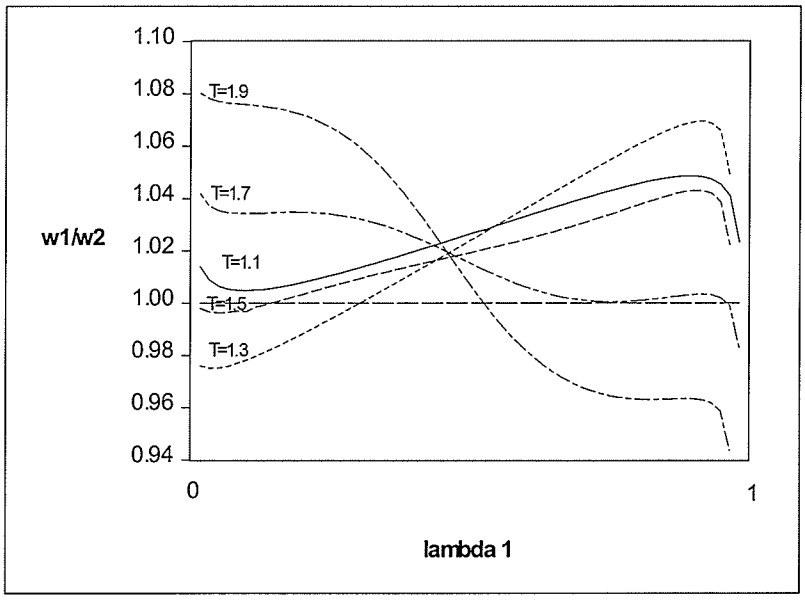

Figure 2 Equilibria with Varying Transport Costs

With high transport costs, the barriers to transport appear to constrain the local atmosphere effects in region 1. Firms tend to cluster less attempting to avoid high transport costs. High transport costs are not likely applicable to many NE goods.

Second, elasticity of substitution, σ, is varied, as illustrated in Figure 2. Small values of elasticity of substitution, $\sigma = 2$ and $\sigma = 3$, imply it is relatively difficult to

substitute one sector *A* good for another. Individual firms have more market power implying a higher markup over marginal costs as well as a larger number of varieties of sector *A* goods. Figure 3 illustrates unstable equilibria for small values of sigma. For σ = 2, all sector *A* workers will eventually locate in region 1 if more than 46 percent of the sector *A* labour force is initially in region 1 (λ_1>0.46) and all sector *A* workers will locate in region 2 if less than 46 percent of the sector *A* labour force is initially in region 1 (λ_1<0.46). For σ = 3, all sector *A* workers will eventually locate in region 1 if more than 44 percent of the sector *A* labour force is initially in region 1 (λ_1>0.44) and all sector *A* workers will locate in region 2 if less than 44 percent of the sector *A* labour force is initially in region 1 (λ_1<0.44). Interestingly, the core model (Brakman, Garretsen and van Marrewijk, 2001), where $\beta_1 = \beta_2$, also demonstrates unstable equilibria with small values of sigma. Similar to the core model the unstable equilibria imply clustering behaviour, although the local atmosphere effect does not appear to play a role in determining which region is the subject of clustering.

Additional simulations with low values of elasticity of substitution, σ = 2, and varying transportation costs and varying marginal labour costs reveal that clustering in region 1 increases with very low transportation costs (T=1.1) and with lower marginal labour costs in region 1 (β_1= 0.76).

For relatively larger values of elasticity of substitution, σ = 6 and σ = 8, where it is not so difficult to substitute one sector A good for another, equilibria are stable. The market power of firms is reduced implying a lower markup over marginal costs and fewer varieties of sector *A* goods. The stable long run equilibrium occurs when 55 percent and

54 percent, respectively, of the sector *A* labour force is located in region 1, a more equal distribution of sector *A* firms in spite of the clustering advantages in region 1. Note that $\sigma = 5$ is the default case where the stable equilibrium occurs when 98 percent of the

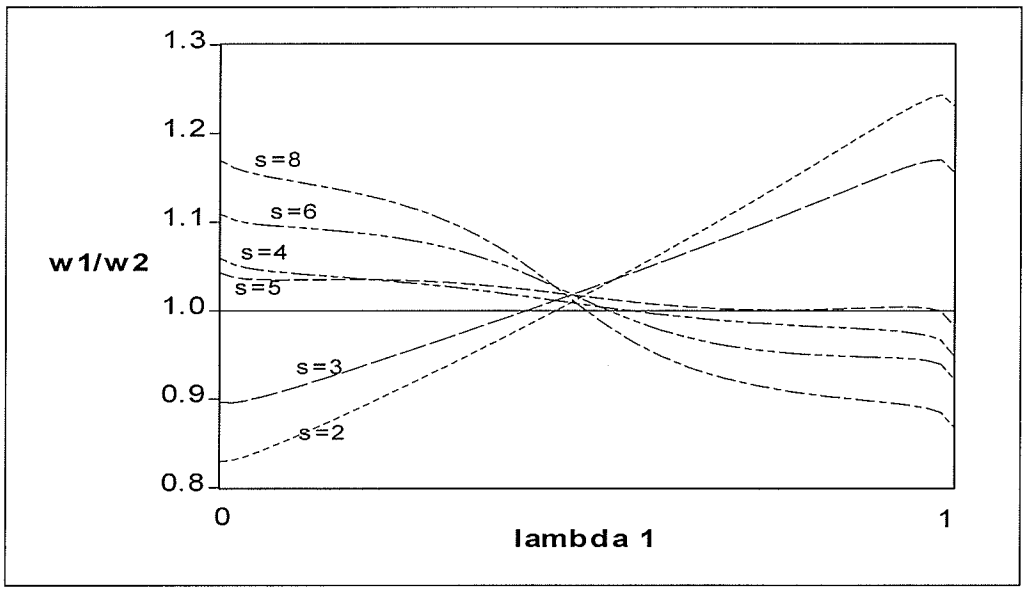

Figure 3 Equilibria with Varying Elasticities of Substitution

sector *A* labour force is located in region 1.

Thirdly, the impact of varying shares of income spent on sector A goods, δ, are illustrated in Figure 4. As the share increases, the sector becomes more important, increasing the tendency for sector *A* NE firms to locate in the cluster in region 1. However, at higher shares of expenditures on sector A goods, δ=5 and δ=6, the equilibria are unstable and allow for complete clustering in region 2 when less than 19 and 41 percent, respectively, of the sector *A* labour force is initially in region 1.

Lastly, Figure 5 illustrates the impact of γ, different shares of the labour force in sector A. Similar to the simulation results of the core model, this parameter has virtually

no impact (Brakman, Garretsen and van Marrewijk, 2001). As the share of the labour force in sector *A* production varies between 20 percent and 60 percent, clustering in region 1 remains relatively constant at 98 percent. Multiple equilibria occur at labour force shares of 30 and 50 percent. When the labour force share is 30 percent, stable equilibria occur when 68 percent and 97 percent of the labour force is located in region 1 and an unstable equilibrium occurs when 89 percent of the labour force is in region 1. Similarly, when the labour force share is 50 percent, stable equilibria occur when 68 percent and 98 percent of the labour force is located in region 1 and an unstable equilibrium occurs when 85 percent of the labour force is in region 1.

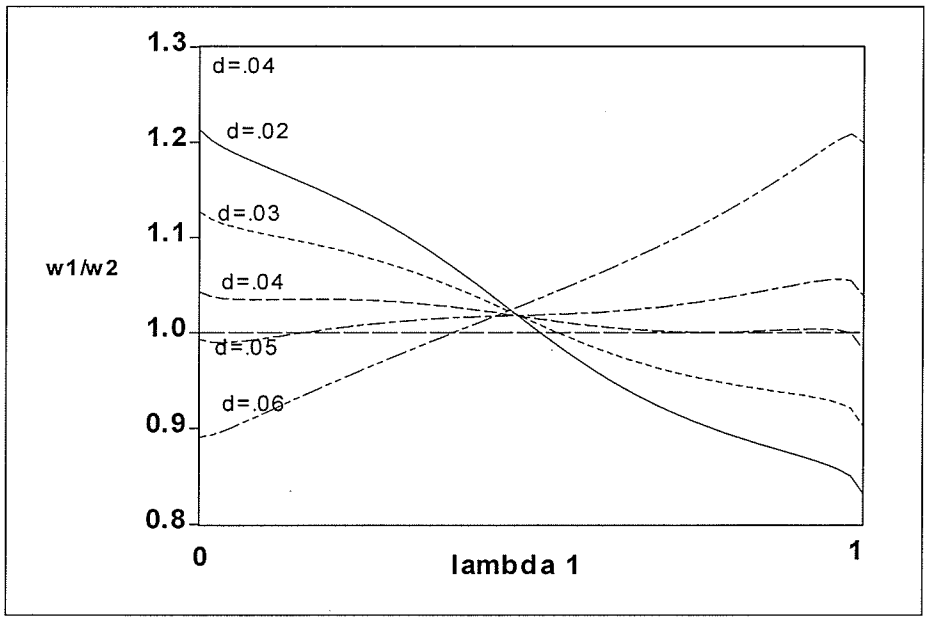

Figure 4 Equilibria with Varying Shares of Income Spent on Sector A NE Goods

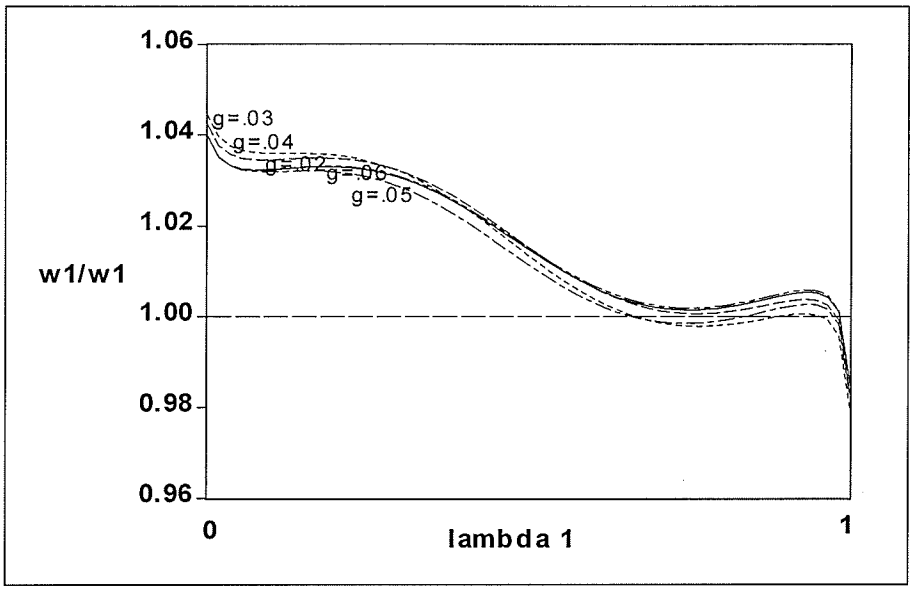

Figure 5 Equilibria with Varying Shares of Labour Force in Sector A

The simulation results, as summarized in table 1 below, lend support to the contention that clustering behaviour is more likely in the NE. To the extent that local atmosphere reduces marginal costs for firms in a cluster, as illustrated in relatively lower values of β_1, clustering behaviour increases as more firms locate in clusters to benefit from the creation and transfer of knowledge which ultimately reduces production costs. The simulation results for varying transportation costs generally support the intuition that firms are more likely to cluster as transportation costs fall because the marginal cost savings associated with locating in a cluster outweighs the small amount of transportation cost savings of locating close to their customers. When transportation costs are high, the transportation cost savings of locating close to customers is more likely to exceed the marginal cost savings of local atmosphere and thereby discourages clustering behaviour.

And further, it is reasonable to suggest that transportation costs are likely to be quite low in many NE industries, such as firms producing digital goods which can be electronically transported at costs close to zero, providing further support for clustering.

Simulation results for varying elasticities of substitution support the perception that firms producing more differentiated goods, indicated by a smaller σ, have more market power and accordingly have greater autonomy in choosing their production location, especially when transportation costs are low. In addition, it may be argued that

Variable	Value	Long Run Equilibrium, λ_1
B_1 Marginal labour cost in region 1 (B_2=0.80)	B_1=0.79 B_1=0.78 B_1=0.77 B_1=0.76	0.58 0.98 0.98 complete clustering
T Transportation costs**	T=1.9 T=1.7 T=1.5 T=1.3 T=1.1	0.56 0.98 0.15* 0.34* complete clustering
σ Elasticity of substitution**	σ=2 σ=3 σ=4 σ=5 σ=6 σ=8	0.46* 0.44* 0.58 0.98 0.54 0.51
δ Shares of income spent on sector A NE goods**	δ=0.2 δ=0.3 δ=0.4 δ=0.5 δ=0.6	0.53 0.56 0.98 0.19* 0.41*
γ Shares of labour force in sector A**	γ=0.2 γ=0.3 γ=0.4 γ=0.5 γ=0.6	0.98 0.68, 0.89*, 0.97 0.98 0.68, 0.85*, 0.98 0.98
*unstable equilibrium **B_1=0.78, B_2=0.80		

Table 1 Simulation Results

firms producing more differentiated goods are continually seeking to further differentiate

their goods and thus may benefit more from local atmosphere than firms producing more standardized goods. NE firms are likely to produce differentiated goods with low transportation costs thus increasing the likelihood of locating in a cluster to benefit from local atmosphere.

A steady rise in clustering associated with increasing shares of income spent on sector *A* goods is evidenced by the simulation results. As the share of income spent on sector *A* NE goods rises, sector A grows, vertical integration follows, and the benefits from clustering are enhanced.

5. Conclusion

The behaviour of firms in the NE is analyzed to determine whether they are more or less likely to cluster. The determinants of clustering appear to be different for firms in the NE with a greater emphasis being placed on the creation and management of knowledge. The model presented in this paper is grounded in Krugman's (1991) general equilibrium framework where the relocation decisions of workers and firms are pivotal.

In Krugman's core model, the clustering forces of economies of scale and the size of the market are constrained by transport costs as a spreading force. Brakman et al's (1996) and Van Marrewijk's (2005) inclusion of congestion costs enriches the core model by demonstrating that negative feedbacks explain the viability of smaller industrial clusters. Their simulations show industrial production to be more evenly spread over regions when congestion is considered. With congestion, it appears that clustering forces are mostly neutralized by spreading forces in the long run. The inclusion of a new

determinant, the creation of knowledge through 'local atmosphere' provides positive feedbacks strengthening the clustering effect in the NE. Simulation results support the view that clustering is more prevalent in the NE. The reduction in production costs due to knowledge creation offsets some of the increase in production costs due to congestion, so that it is more beneficial for firms in the NE to locate in clusters.

Some simulations exhibit total clustering of NE firms in one region which is contrary to most real world observations. It is the contention that clustering is beneficial for many but not all firms in the NE. The decision of some firms not to cluster may be explained by a greater dependence on knowledge created through global pipelines rather than local atmosphere. It may also be that congestion effects outweigh knowledge creation effects for some firms.

In sum, the simulation results provide insight into the location decision of firms in the NE. Knowledge creation and transfer has become an important variable in the decision making process thereby increasing the tendency for firms in the NE to locate in clusters in order to benefit from local atmosphere, the term used to describe the unintended and intended knowledge creation processes which only occur within a cluster.

This research paper contributes to the literature by illustrating the effect of simultaneously incorporating negative location specific external economies of scale with a location specific comparative advantage into Krugman's core-periphery model. In doing so, a microeconomic model of the clustering behaviour of firms in the New Economy has been developed.

The results also provide valuable information for policy makers in the area of

regional and community economic development. It appears that industries in which knowledge creation and transfers are more important benefit most from clustering. This is useful for creating policy for the economic development of less favoured communities and regions. A subsequent research paper will explore the policy implications of the results reported in this paper.

This paper has focused on the location decision of firms with regard to existing clusters without discussing the establishment of clusters in the new economy. Although there is a significant body of literature covering the establishment of clusters, some of the criteria for cluster creation may differ in the NE. As well, the role of global pipeline knowledge is not articulated in the present model as it is merely assumed that all firms have access to it. Both of these issues are topics for future research.

Appendix A

i. Derivation of price index in equation (2) and consumption of sector *A* goods in equation (3)[31]

Equation (1) is maximized subject to the budget constraint, $\sum_{i=1}^{N} p_i c_i = \delta Y$ by defining the Lagrangean Γ, using the multiplier κ:

$$\Gamma = \left[\sum_{i=1}^{N} c_i^{\rho}\right]^{(1/\rho)} + \kappa\left[\delta Y - \sum_{i=1}^{N} p_i c_i\right].$$

Γ is differentiated with respect to c_j and set equal to zero to give first order conditions:

$$\left[\sum_{i=1}^{N} c_i^{\rho}\right]^{(1/\rho)-1} c_j^{\rho-1} = \kappa p_j \quad \text{for j = 1,...,N.}$$

The ratio of the first order conditions with respect to variety 1 yields:

$$\frac{c_j^{\rho-1}}{c_1^{\rho-1}} = \frac{p_j}{p_1} \quad \text{or} \, c_j = p_j^{-\sigma} p_1^{\sigma} c_1 \quad \text{for j = 1,...,N.}$$

These relations are substituted into the budget equation giving:

$$\sum_{j=1}^{N} p_j c_j = \sum_{j=1}^{N} p_j \left[p_j^{-\sigma} p_1^{\sigma} c_1\right] = p_1^{\sigma} c_1 \sum_{j=1}^{N} p_j^{1-\sigma} = p_1^{\sigma} c_1 I^{1-\sigma} = \delta Y$$

rearranged to give equation (2), $c_1 = p_1^{-\sigma} I^{\sigma-1} \delta Y$, which holds true when I is defined as

[31]Derivation is based on Technical Note 2 in "General Geographical Economics Model with Congestion" by Charles van Marrewijk (2005).

it is in equation (2). The demand for other varieties is derived using the same method.

We can substitute the derived demand for all varieties in equation (1), noting that

$-\sigma\rho = 1-\sigma$ and $1/\rho = -\sigma/(1-\sigma)$

$$C_A = \left(\sum_{i=1}^{N} c_i^{\rho}\right)^{1/\rho} = \left(\sum_{i=1}^{N} ((\rho_i^{-\sigma}) I^{\sigma-1} \delta Y)^{\rho}\right)^{1/\rho}$$

$$= \delta Y I^{\sigma-1}\left(\sum_{i=1}^{N} p_i^{-\sigma\rho}\right)^{1/\rho} = \delta Y I^{\sigma-1}\left(\sum_{i=1}^{N} p_i^{1-\sigma}\right)^{-\sigma/(1-\sigma)}$$

Using equation the definition of I in equation (2), $I \equiv \left[\sum_{i=1}^{N} p_j^{1-\sigma}\right]^{1/(1-\sigma)}$, C_A simplifies to: $C_A = \delta Y I^{\sigma-1}\left(\sum_{i=1}^{N} p_i^{1-\sigma}\right)^{-\sigma/(1-\sigma)} = \delta Y I^{\sigma-1} I^{-\sigma} = \delta Y / I$.

ii. Derivation of price functions in equation (7)[32]

The demand x_r for a variety of sector A goods can be written as $x_r = c \times p_r^{-\sigma}$ where c is a constant. This expression is substituted in the profit function to give:

$$\pi_r = c \cdot p_r^{1-\sigma} - w_r N_r^{\tau/(1-\tau)}(\alpha + \beta c \cdot p_r^{-\sigma}).$$

Differentiating with respect to price p and equating to zero yields the first order condition:

[32]Derivation is based on Technical Note 3.3 in "General Geographical Economics Model with Congestion" by Charles van Marrewijk (2005).

$$(1-\sigma)c \cdot p_r^{-\sigma} + \sigma w_r N_r^{\tau/(1-\tau)} \beta c \cdot p_r^{-\sigma-1} = 0 .$$

Cancelling out the term $c \cdot p_r^{-\sigma}$ and rearranging gives the price equation (7).

iii. Derivation of nominal wage in equation (15)[33]

Start with the individual consumer demand of each region, given by equation (2) ,and replace income level Y with Y_r, price index I with I_r, and price of the sector *A* good p_r with $\beta w_s T_{rs} N_s^{\tau/(1-\tau)} / \rho$, the price a producer from region s will charge to consumers in region r. This gives:

$$\delta Y_r \left(\beta w_s T_{rs} N_s^{\tau/(1-\tau)} / \rho\right)^{-\sigma} I_r^{\sigma-1} = \delta(\beta/\rho)^{-\sigma} Y_r w_s^{-\sigma} N_s^{-\sigma\tau/(1-\tau)} T_{rs}^{-\sigma} I_r^{\sigma-1}$$ which is the demand in region *r* for a product from region s.

In order to derive the total demand in both regions for sector *A* goods produced in region s, we sum production demand for both regions:

$$\delta(\beta/\rho)^{-\sigma} \sum_{r=1}^{2} Y_r w_s^{-\sigma} T_{rs}^{1-\sigma} N_s^{-\sigma\tau/(1-\tau)} I_r^{\sigma-1}$$

$$= \delta(\beta/\rho)^{-\sigma} w_s^{-\sigma} N_s^{-\sigma\tau/(1-\tau)} \sum_{r=1}^{2} Y_r T_{rs}^{1-\sigma} I_r^{\sigma-1} .$$

In equilibrium the total demand for sector *A* goods must equal the total supply, given by $(\sigma-1)\alpha/\beta$. We solve for w_r in region r:

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[33] Derivation is based on Technical Note 6 in "General Geographical Economics Model with Congestion" by Charles van Marrewijk (2005).

$$w_r = \rho\beta^{-\rho}\left(\frac{\delta}{(\sigma-1)\alpha}\right)^{1/\sigma} N_r^{-\tau/(1-\tau)}\left[\sum_{r=1}^{2} Y_s T_{rs}^{1-\sigma} I_s^{\sigma-1}\right]^{1/\sigma}$$

and finally we substitute for the number of varieties produced in region *r* to give equation

$$(15):\quad w_r = \rho\beta_r^{-\rho}\left(\frac{\delta}{(\sigma-1)\alpha}\right)^{1/\sigma}\left(\frac{\gamma L}{\alpha\sigma}\right)^{-\tau}\lambda_r^{-\tau}\left[\sum_{r=1}^{2} Y_s I_s^{\sigma-1} T_{sr}^{1-\sigma}\right]^{1/\sigma}.$$

Appendix B: Default simulation values

Unless otherwise specified the parameters for the simulations are as follows:

$\delta = 0.4$	$\alpha = 0.08$	$\varphi_1 = \varphi_2 = 0.5$
$T = 1.7$	$\beta_1 = 0.78$	$L = 1$
$\sigma = 5$	$\beta_2 = 0.80$	$\rho = (\sigma - 1)/\sigma = 0.8$
$\tau = 0.01$	$\gamma = 0.4$	

Appendix C: List of Variables

U = utility
L = total labour force
C_A = consumption of sector *A* new economy manufactured goods
C_B = consumption of sector *B* agricultural goods
c_i = consumption of variety i of sector *A* goods
σ = elasticity of substitution between sector *A* goods
δ = share of income spent of sector *A* goods
γ = share of labour force working in sector A
λ_r = share of sector *A* labour force working in region r
l_{ir} = labour required to produce variety i in region r
N_r = number of varieties of sector *A* firms in region r
x_{ir} = quantity of variety *i* in region *r*
x_r = total production of sector *A* of a representative producer in region r
α_r = fixed labour cost in region r
β_r = marginal labour cost in region r
P_r = price of a variety of sector *A* goods in region *r*
w_r = nominal wage in region r
$P_{ir} = P_i(T_{rs})$

C_{rs} = consumption in region *r* of a variety produced in region s
Y_r = income in region r
τ = congestion parameter
φ_r = fraction of agricultural labour in region r
ω_r = real wage in region r
T_{rs} = transport cost of a shipment form region *r* to region s
L_r = sector *A* labour in region r
I_r= price index of sector *A* goods in region r
c_{rs}= consumption in region *r* of sector *A* goods produced in region s

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Paper 3

What Does the New Economy Have to Offer Community Economic Development?

What does the New Economy offer community economic development? Does the New Economy (NE) enhance or create obstacles to a community-based approach to economic development? Are community economic development (CED) initiatives in NE activities advantageous or even feasible? In this paper, I attempt to answer these questions with support from the discussion and models of CED and the NE developed in papers 1 and 2.

As described in paper 2, the NE is characterized by an expanding and influential information and communication technologies sector (ICT) sector; the development of the Internet and its contribution to the economy; increasing globalization; a more skilled labour market; and an increasingly important role for knowledge and ideas. How might these characteristics affect CED? The combination of the prominent ICT sector and the Internet hold great promise for the development of disadvantaged communities. Online access can provide education and training opportunities as well as a wealth of information whether it be about public sector services or on-line banking. For instance, the NE can provide education and training opportunities for rural and remote communities as the Internet makes on-line electronic learning feasible for those in remote communities. In the U.K., the Manchester Community Information Network initiated 100 local ICT centres which include Electronic Village Halls (EVHs) (Leach and Copitch, 2005). The EVHs are used by local communities to access new online technologies and training. The role of the EVHs was intended to "enable local social and economic regeneration" (Leach

and Copitch, 2005).

The Internet offers lines of communication and access to information and knowledge for isolated firms as knowledge spillovers have become less dependent on geographical proximity (Kolko, 2001). On the other hand, the increasing skill level requirements of the NE sectors pose greater employment challenges to already employment challenged communities. The pivotal role of knowledge and ideas in the NE further emphasizes the need for education and skill development for CED. The overall effect of the NE on CED is not clear as it increases economic and social development possibilities for CED through ICT and the Internet and at the same time creates greater challenges with greater human capital requirements. The challenges call for attention from the public sector, a topic discussed throughout this paper.

As discussed in paper 2, clustering has come to be associated with the NE. Note that while not all definitions of industrial clusters encompass the inclusion of education and research institutions, these institutions play a prominent role in NE clusters. In the NE, knowledge and learning play a critical role in cluster formation as firms gain a competitive advantage from knowledge creation resultant from co-location. Most NE industries require relatively high education and skill levels, an additional challenge for participation of disadvantaged communities.

In discussing the appropriateness of NE activities for CED, there are a number of questions to consider. First, can NE clusters, or any clusters for that matter, be created through planning and if so are they suitable for CED? Second, to what extent do NE activities comply with the principles of CED and the microeconomic models developed

for CED in paper 1? Third, how might the NE clustering model in paper 2 behave in a CED application? Fourth, is the forty acre and a modem model appropriate for CED applications? Analyses of these four questions form the content of this paper. In order to address the first question of whether NE clusters can be created through planning, we need to first turn to the literature on the origin and development of clusters.

1. The Origin and Development of a Cluster

The Origin of a Cluster

The question of how clusters are established was briefly addressed in paper 2. In this section, I take a more in-depth look at the origin of clusters in order to evaluate the applicability and appropriateness of new economy (NE) clusters for community economic development (CED).

With the abundance of literature on clustering and the extraordinary incidence of policy directed towards clustering as a means to regional economic development it is somewhat ironic that there is actually little understanding of how clusters are formed. While surveying the existing literature, it becomes evident that there is not one, or even a few, key origins of clusters. There is a great diversity of clusters each possessing unique characteristics and distinctive origins and development paths.

Historical circumstance and chance have been identified by Porter (1998), Brown and McNaughton (2003), Wolfe and Gertler (2004), and Feldman et al (2005) as the origin of many clusters. For instance, research from MIT and Harvard provided historical circumstances for cluster creation in Massachusetts. Holland's central location, extensive

waterways, and skills accumulated through a long maritime history provided historical circumstances for the Dutch transportation cluster (Porter, 1998). Porter (1998) cites the case of Omaha, Nebraska's telemarketing cluster which formed as a result of a decision by the U.S. airforce to locate the Strategic Air Command in Omaha leading to the first installation of fibre-optic telecommunications cables in the U.S thus providing infrastructure suitable for development of a telemarketing industry.

Brown and McNaughton (2003) cite Frederick Terman's desire to live in a warm climate as a serendipitous event leading him to pursue an applied electrical engineering research and business start-up programme at Stanford which is believed to be the origin of Silicon Valley. Wolfe and Gertler (2004) contend that the uniqueness and path-dependent circumstances of many clusters do not make them easy to replicate. Traditional location factors such as a natural or social asset that at some point in time turns out to be an important location factor for a particular type of economic activity as discussed by Malmberg and Maskell (2001), is another way of describing historical circumstances. Malmberg and Maskell (2001) explain, "Some person did, for some reason, get the idea to engage in a certain type of economic activity"(Malmberg and Maskell, 2001: 5). Feldman et al (2005) cite a confluence of exogenous events, the most important of which is federal government downsizing, as igniting entrepreneurial innovation leading to cluster formation in Washington, DC.

Local demand can also inspire the origins of a cluster. Porter (1998) cites the example of Israeli demand for self-sufficiency in food and its scarcity of water as stimulating the creation of an irrigation system cluster. Alberta's mountainous geography

and expanding economy created local demand for more advanced communication systems which led to the establishment of Calgary's wireless cluster.

Some clusters originated through the prior existence of supplier firms or related industries. For instance, southern California's aerospace cluster led to the origin of its golf equipment cluster. Suppliers for castings, advanced materials and engineers for the aerospace industry turned out to be particularly appropriate for the production of golf equipment. (Porter, 1998)

In some cases one or two innovative anchor firms stimulate the formation of a cluster (Brown and McNaughton, 2003; Wolfe, 2003). As the first firms become successful, suppliers, workers, and investors become more readily available lowering the costs of entry for subsequent firms. Two examples of anchor firms which motivated cluster formation are NovAtel in Calgary and Nortel Networks and JDS Uniphase in Ottawa, as discussed in paper 2.

In some cases, clusters have been successfully planned. For instance, Research Triangle Park in North Carolina is a public/private, planned research park created by leaders from business, academia and industry. Early stage planning in 1958 resulted in the formation of the Research Park Foundation, a non-profit organization, which raised financial capital to purchase a non-profit research entity to carry out independent contract research. Public-sector anchors often play a prominent role in cluster initiation (Leibovitz, 2004). The idea of planned clusters and the role of the public sector are discussed more fully later in this section.

A deepening division of labour between firms in a geographic area may result in

the formation of a cluster (Malmberg and Maskell, 2001). This origin would lead to a vertically integrated cluster, where firms are linked through input-output relations and subsequently possess knowledge, experience, and skills useful for doing dissimilar but related activities. The firms cooperate and coordinate as the output of one firm is the input for another firm. However, Malmberg and Maskell (2001) point out that few empirical studies provide evidence of local input-output linkages.

Entrepreneurship has been identified as a crucial factor in the origin of a cluster (Feldman, Francis and Bercovitz, 2005; Harrison, 2004; Cumber and MacKinnon, 2004). Feldman et al (2005) assert that entrepreneurs initiate cluster formation and regional competitive advantage. In effect, entrepreneurs build institutions by collectively shaping local environments which results in furthering the interests of the emerging industry and thus initiating cluster formation.

Feldman et al (2005) developed a model to illustrate the interdependence among entrepreneurs, government policy and the local environment based on empirical observation of New Economy cluster development in Washington, DC. The local environment describes the social and commercial institutions, and physical and human capital. In a healthy entrepreneurial system individual components of the local environment reinforce one another, leading to the promotion of firms, industry and development of a cluster. Feldman et al (2005) expand on these concepts to create a model of New Economy cluster formation occurring through three phases of cumulative stages.

In phase one, a convergence of exogenous events prompts entrepreneurial

innovation. An exogenous shock brings about an entrepreneurial response such as in the Washington, DC case where government downsizing made self-employment a practical option. The entrepreneur influences and is influenced by the local environment. For instance, a reduction in capital gains tax or a government decision to outsource more services to the private sector may lead to entrepreneurial endeavors and subsequently result in the growth of new firms. Entrepreneurial activities lead to the emergence of cluster type characteristics. During this initial phase human capital and research institutions may already exist and venture capital is scarce if it exists at all. The first entrepreneurial businesses acquire knowledge through a learning-by-doing process and relationships form among firms and between firms and institutions. In Washington, entrepreneurs pursued activities requiring low levels of investment and yielding relatively low returns. Most firms started with personal funds rather than venture capital. (Feldman et al, 2005)

In phase two the cluster self-organizes through self-reinforcing feedbacks among entrepreneurs, enterprises, institutions, and resources (Feldman et al, 2005). During this phase entrepreneurial activity increases and networking occurs. Entrepreneurial activity is described as being creative meaning that the firm's needs cannot be predicted beforehand. As firms and their products are created institutional capabilities develop over time (Feldman, 2004).

Entrepreneurial activities in this stage include commercializing technology, envisioning how the technology will be used, gaining information about consumer behaviour with respect to what characteristics consumers will value, and considering

effective approaches to marketing the products. The degree of community collective action and shared goals determine both the direction and success of the cluster. Feldman et al (2005) describe the mutually beneficial and simultaneous evolution of cluster organization and entrepreneurial ventures. In this phase, the initial start-ups from phase one set an example for new start-ups and the cluster becomes sustainable as entrepreneurs attract skilled labour, as services expand to accommodate firms and as public and private networks are created to support entrepreneurial activities. Clusters tend to have their own distinctive characteristics evolving out of entrepreneurial activities taking place in their own unique environments. (Feldman et al, 2005)

In phase three the cluster matures into a well functioning, innovative, and adaptable entrepreneurial system. A synergy between firms leads to new start-ups. As the cluster gains momentum, the risk of failure is reduced. The creation of a secondary industry begins while universities and other training institutions recognize and act on the need to offer specialized programs. Technology partnerships are created to promote growth.

The regional public sector provides funding and creates grant-giving programs to encourage cluster expansion. During this phase mergers and acquisitions reduce the number of firms and successful entrepreneurs start additional firms. These successful entrepreneurs "become serial entrepreneurs with deep roots in the community" (Feldman et al., 2005: 134). In addition, venture capitalists are attracted to the cluster when economic activity has achieved a minimum efficient scale. By the end of the third phase a dynamic system is achieved which may be self-sustaining and self-reinforcing. (Feldman

et al, 2005)

In sum, Feldman et al (2005) see the initial stage of cluster formation as being path dependent with entrepreneurial activity and firm strategy playing a decisive role. Feldman (2004) summarizes the following stylized facts about cluster formation and knowledge-based economic development: a non-linear and unpredictable process; a self-organizing process that cannot be determined at the outset; the set of resources required is determined endogenously along with firm creation.

Harrison et al (2004) view the many forms and unique development of clusters as being a direct function of entrepreneurial dynamics. They identify "entrepreneurial dynamics" as a critical process in the origin and development of the NE clusters in Ottawa. Entrepreneurial knowledge is not just created within the cluster but draws on the individual's unique history of work experience throughout their entire career. They describe the emergence of Ottawa's NE cluster as being a home-grown phenomenon due to the start-up and growth of entrepreneurial firms over a period of 30 years.

Harrison et al (2004) emphasize the role of national and international linkages in cluster development. They demonstrate their proposition by studying the geographies and histories of entrepreneurs in Ottawa's technology cluster. They draw attention to the importance of looking beyond the entrepreneur's last employer because although their last employer may have been local, the entrepreneur may have frequently moved throughout his/her career.

Harrison et al's (2004) study of Ottawa's NE cluster, using qualitative and quantitative methods, reveals that entrepreneurs in Ottawa's cluster come from a wide

range of incubator organizations where the largest source is small firms confirming the "conventional wisdom that small firms are better 'training grounds' for entrepreneurs than large firms" (Harrison et al, 2004: 1054). As well, federal government laboratories are a significant source of entrepreneurs. The significance of incubator organizations becomes apparent in their role as an initiator for individuals to become entrepreneurs. Many individuals who went on to be entrepreneurs identified market opportunities through either their knowledge of technology or knowledge of customers or suppliers gained in the incubator organization. Harrison et al (2004) found that most start-ups located within 30 miles of the organization at which they previously worked, although many of the entrepreneurs were born and raised elsewhere. Most moved to Ottawa more than 10 years prior to their start-up giving them time to develop the strong social and professional networks necessary to establish a new firm.

In-migrants from other parts of Canada and overseas have been an important source of entrepreneurship bringing new ideas, different perspectives and different networks to the Ottawa cluster. Harrison et al (2004) highlight the concept of 'magnet organizations' in attracting talent to a potential cluster. In Ottawa, there are three main groups of magnet organizations, federal government research institutions, the University of Ottawa, and private firms. The Ottawa magnet organizations offered exciting job opportunities given that they were at the forefront of their field. As well, the 'thick' labour markets offered a large range of alternative employment opportunities ideal for lateral moves and attractive to professional dual-career households. Institutions established in the 1940s made Ottawa's cluster development possible in the 1990s.

(Harrison et al, 2004)

In searching for a satisfactory theory of clustering, Malmberg and Maskell (2001) identify critical components of a good theory. A good theory should include the following: an explanation for the existence of a cluster; specification of the process(es) that induce firms to co-locate; an explanation of the unique advantages that only agents in a cluster experience; details of the internal organization of a cluster; a dynamic component so as to explain the possibility of and reasons for the decline of formerly successful clusters (Malmberg and Maskell, 2001).

Malmberg and Maskell (2001) propose an explanation for the origin of a cluster based on the advantages accruing to firms located in the same place and related along horizontal or vertical dimensions, as described in paper 2. They suggest clusters exist because of localization economies and not necessarily because of any internal interaction among firms. Advantages accrue to firms undertaking similar activities which are able to monitor each other constantly, closely, and almost costlessly. Since firms act on incomplete and uncertain information, variation among firms possessing similar bodies of knowledge naturally occurs. As discussed in paper 2, Malmberg and Maskell (2001) maintain that the benefits of knowledge creation and knowledge transfer taking place when many co-located firms undertake similar activities is the most significant benefit.

Malmberg and Maskell (2001) contend that it is very difficult to empirically determine or confirm the mechanisms accounting for the existence of clusters. They identify three main reasons for this difficulty. The first relates to spatial scale. The notions of local and regional have become very elastic as geographic scales of a cluster

may be a local neighbourhood, a small town or an entire nation or a group of nations. The particular cluster characteristic under investigation may play a role in determining an appropriate scale. For instance the role of formal institutions such as the legal system typically involves looking at the national scale. On the other hand, if the focus is on the everyday exchange of information a smaller scale is more appropriate. The second problem is measurability. The degree of agglomeration across groups of firms involves numerous standard industrial classifications making existing data difficult to find. The third difficulty is in capturing and measuring the flow of information and knowledge. For instance, how can the concept of local atmosphere be systematically compared across regions.

The Development of a Cluster

Once established, cluster development may proceed in many different ways and directions. Malmberg and Maskell (2001) discuss the development of internal differentiation. Once a cluster is in existence, the heterogeneous knowledge endowments bring about easier communications among cluster agents resulting in enhanced innovative capabilities. Porter (1998) discusses a self-reinforcing cycle promoting the cluster once it is in existence. The self-reinforcing cycle requires support from local institutions, local competition, cluster agents being able to influence public and private institutions, the migration of skilled labour and entrepreneurs from other regions, the emergence of specialized suppliers, and local institutions to develop specialized training, research and infrastructure. Over time the cluster expands to encompass related industries. Porter (1998) cites research findings confirming that the self-reinforcing cycle may take a

decade or longer to bring about competitive advantage and sustainability of the cluster.

Institutions influence learning processes and thus play a role in the development of clusters (Malmberg and Maskell, 2001; Leibovitz, 2004; Porter, 1998; Steiner, 2002; Xianping, 2004; Colgan and Baker, 2003). Malmberg and Maskell (2001) propose that a cluster's particular set of institutions emerges in response to explicit requirements of the activities of each firm in the cluster. An institutional pattern evolves attracting compatible firms and entrepreneurs to the cluster. The economic structure and the institutions become interdependent as institutions define how things are done and how learning takes place. Accordingly, institutions differ from cluster to cluster. Malmberg and Maskell (2001) suggest that the "mechanisms that reduce cognitive distance within the cluster tend to increase the cognitive distance between clusters" (Malmberg and Maskell, 2001: 14). The institutional fit contributes to the development of successful path-dependent trajectories of clusters but does not explain their existence. Malmberg and Maskell (2001) also note that such institutions are linked to social history and may be slow to adapt to change.

Steiner (2002) sees two relationships between institutions and clusters. First, he views a cluster as an institution capable of internalizing external effects where the unique character of the cluster determines how the external effects are internalized. Second, he views an established institutional environment as a prerequisite for the existence of a cluster. Leibovitz (2004) notes that economic and industrial policy in Scotland has focused on the creation of institutions to support cluster growth, particularly in the biotechnology sector. Xianping (2004) maintains that the function of the government in

cluster development is to create good institutions by clarifying laws and regulations, setting standards and encouraging the development of trade organizations and extending industry linkages.

Colgan and Baker (2003) describe the role of industry organizations in cluster development. Strong industry organizations provide a means of communication, the "opportunity to share resources to address common needs, and an opportunity to showcase industry trends and issues" (Colgan and Baker, 2003: 357). For instance, the Business and Education Partnership of Waterloo Region in Kitchener, Ontario facilitates alliances among business, education and training, labour, government and community organizations (www.bus-edpartnership.org). In Portland, Oregon, the Oregon Association of Nurserymen is a key factor in the success of Portland's Nursery Industry Cluster (Cortright, 2000). The association fosters strong industry wide cooperation in marketing and quality improvement in the nursery industry necessary to establish a viable industry cluster.

The role of external linkages for cluster growth and development is highlighted by Leibovitz (2004) and Cumbers and MacKinnon (2004). Leibovitz (2004) explains how integration and international networks support firms in their effort to penetrate markets, access resources, and to achieve internal economies of scale and scope. Cumbers and MacKinnon (2004) emphasize the value of external connections for sourcing skilled labour, information, entrepreneurs and ideas, especially in peripheral areas that lack urbanization economies.

At the same time, it is acknowledged that strong external linkages may lead to

external control and may create vulnerability to takeovers, acquisitions and mergers, perhaps eventually resulting in capital flight. Breschi and Malerba (2001) observed that "localization and globalization have to be seen as increasingly complementary and mutually reinforcing phenomena, in which transnational communities of practice play the crucial role of recombining specialized components and knowledge produced at different localities" (Breschi and Malerba, 2001: 826). He states that clusters have both local and international dimensions whereby these dimensions interact in the areas of knowledge, technologies, products, individuals, firm, and institutions. The relationship between the two dimensions is essential to understanding the dynamics of a cluster.

Ketels' (2004) research on European clusters reveals two findings regarding the effect of trade barriers on cluster development. One, a reduction in barriers to trade fosters cluster growth. Second, a reduction in barriers to trade tends to reduce the number of clusters in a given field as economic activity becomes concentrated in the strongest areas.

The development of strong social networks is a contributing factor to cluster development (Leibovitz, 2004). In the early stages of a cluster, social networks tend to be weak as firms concentrate on their own survival and are unable to devote resources to informal interaction. In addition, a lack of critical mass can be a constraint to forming social networks. (Leibovitz, 2004)

Porter maintains that competition leads to cluster development. Porter's (2000) model of the 'competitive diamond' illustrates how clusters develop. He developed the

model to explain national competitive advantage and international competitiveness and then subsequently argued that the intensity of firm level interaction within the competitive diamond increases when the firms are located in clusters. Porter (2000) explains that a firm's success depends on a favourable 'competitive diamond' of four sets of factors which include firm strategy, structure and rivalry; factor input conditions; demand conditions; and related and supporting industries. As well, the local environment must encourage investment. Productivity increases as the interaction between the four sets of factors intensifies. Porter sees competitiveness, as modeled in the 'competitive diamond' as the driving force in cluster development.

A Canadian ICT cluster study (2004) identifies the capture of positive externalities as an accelerating factor in cluster development. For instance, positive externalities occur when a firm cannot capture all of the economic benefits from its innovation process. Some of the positive externalities are captured when experienced employees, with knowledge gained through their term of employment, leave to start-up their own firms. For instance, the employee may have realized a potential new product that their previous employer did not have time to pursue or may have realized an opportunity to supply their previous employer with a specialized input.

The minimization of leakages and the maximization of linkages are ways in which cluster development can be accelerated (Industry Canada, 2004). The local sourcing of products and services and local supplier development programs lead to minimizing leakages in a cluster. Examples include local sourcing of product inputs such as labour, material, and capital. A concerted effort on the part of firms to minimize leakages creates

an incentive for new firms to locate in the cluster.

Linkages among firms, institutions, and other agents in the cluster tend to stimulate the innovation and growth processes of a cluster. Linkages may be formal or informal and may include product development partnerships, market development partnerships, research and development alliances, educational and training linkages, innovation linkages and industry-university linkages,to name a few.

Other elements contributing to the development of clusters once they exist include the creation of a local culture, supporting infrastructures, establishment of the location as a brand of the industry, and the attraction of additional resources which include labour, capital and entrepreneurs (Malmberg and Maskell, 2001). Leibovitz (2004) maintains that cluster development and growth benefit from an urban location offering a large and diverse labour market.

The public sector, as briefly discussed above, has played a significant role in the origin and development of some clusters. The literature on this subject is fairly broad, necessitating that it be dealt with in a following separate section of this paper.

The Role of the Public Sector in the Origin and Development of NE Clusters

The public sector plays a variety of roles in the creation and development of NE clusters. The public sector provides anchor institutions, infrastructure, finance, regulations, human capital development, and leadership which have contributed to the creation and development of many NE clusters. This section outlines the role of the public sector in the origin and development of NE clusters according to literature on case studies, consultant reports, and public policy critiques.

An Industry Canada (2004) report on ICT clusters in Canada concludes that all levels of government have important leadership roles in NE cluster development. The Industry Canada report (2004) finds leadership and support to be inconsistent across Canadian ICT clusters. While association leadership is sustained, it is often fragmented by industry or geography within the cluster. They observe some cases of municipal leadership and find that provincial leadership changes with the government of the day. The federal government offers broader support with a long term vision although it is not generally directed towards developing existing capabilities. In addition, industry leadership sometimes plays a role in cluster development. The Industry Canada (2004) study of Canadian ICT clusters report recommends that effective leadership needs to come from within the cluster and be supported by provincial government. They recommend that the role of the federal government is to sustain cluster-based leadership with long- term funding commitments.

The Industry Canada study (2004) recommends the public sector support one or more anchor projects aimed at cluster development in the NE sector. Public sector anchors, particularly universities and research institutes often play a vital role in NE cluster development. For instance, the University of Ottawa drew talented labour to the region fuelling Ottawa's technology cluster (Harrison, 2004) and the University of Calgary produced talented labour for the development of Calgary's wireless cluster (Langford, Wood, and Ross, 2004). And Silicon Valley's success has been largely attributed to the efforts of Frederick Terman, the Dean of Engineering at Stanford University, who developed close industry-university partnerships.

Government laboratories and universities in Scotland played a significant role in providing the science and skill base necessary for biotechnology cluster growth (Leibovitz, 2004). Public sector anchors in Scotland, such as universities and government laboratories were found to influence initial location in the region, as well as influence the types of expertise and innovative properties of firms.

Leibovitz (2004) looks at what he calls the substantive and reputational effects of public sector anchors. The substantive effects include the generation of scientific research, the training of research staff, new technology, new ideas, and scientific expertise. The reputational effects include prestige associated with the presence of the major institutions and the placement of the region on the map which may be important to potential investors, suppliers, customers and entrepreneurs. (Leibovitz, 2004)

Leibovitz notes that while public sector anchors play a crucial role in cluster development, their existence is not necessarily sufficient for successful cluster development. In support of Leibovitz's cautionary view of the role of public sector anchors Xiangping (2004) finds that the presence of public anchors is not enough to promote cluster development as in the case of the Zhongguancun area of China where a shortage of funds, high land prices and imperfect market conditions hinder cluster development in an area rich in scientifically and technologically- trained labour from public sector research institutions.

Porter (1998) focuses on the role of the public sector in providing infrastructural support for cluster development. Investments made by the public sector in physical infrastructure and public and quasi-public goods have a significant impact on linked

businesses according to Porter (1998). A NE cluster study for Industry Canada (2004) suggests the public sector make provisions for secure electronic commerce and telecommunications infrastructure.

Educational programs can serve a cluster by enhancing productivity by means of ensuring a trained and educated labourforce (Industry Canada, 2004; Porter, 1998). The appropriate mix of skills is a common constraint to firm growth. An Industry Canada NE cluster study (2004) reports that skills are particularly scarce in the areas of management, marketing and commercialization. The Industry Canada (2004) report recommends the public sector work with universities to increase the supply of appropriately skilled labour. The report suggests a need for public polices pertinent to human resource development including those calling for availability of accurate and timely labour market information; human resources development including guiding institutions for future competency requirements and speed of implementation of new curriculum, addressing the needs of skilled workers and ensuring broad access to education and training opportunities for continuous learning.

Promotion of entrepreneurship has been identified as an important policy goal for cluster creation (Feldman et al, 2005; OECD, 2000). Feldman et al (2005) suggest the role of the public sector be to transform latent entrepreneurs into active entrepreneurs. Feldman et al (2004, 2005) suggest that opportunity is critical for entrepreneurial activity and incentives may lead to the development of opportunities even if the regional conditions do not match those of successful clusters. "The local environment, in terms of the types and quality of resources and the networks and institutions that provide support

and further business interests, ultimately affects the sustainability of the startups, although not necessarily their initial establishment" (Feldman et al, 2005: 131). They suggest policy makers look at identifying factors that may inhibit potential entrepreneurs from starting companies. For instance, Germany recognized that its bankruptcy laws created a barrier to the formation of new companies and subsequently modified them.

Feldman et al (2005) discuss the importance of regional public sector financing and grant-giving programs for the development of clusters in stage three of cluster development for additional start-ups once the original firms are established. In the 1990s, Virginia technology entrepreneurs lobbied for infrastructure development for the cluster region to promote a broader socially responsible social agenda rather than their own firms (Feldman et al, 2005). Their success resulted in infrastructure development, training programs and tax incentives to support the technology-based economic development.

Feldman and Francis (2004) find no evidence to support the idea that industrial incentives influence firm location. The incentive strategy is based on neoclassical microeconomics which contends that small differences in input prices will impact firms' decisions. The reasoning is that firms typically prefer locations offering lower factor prices, and therefore, government policy to reduce costs will influence location decisions. Feldman and Francis (2004) find that NE firms have different priorities, namely access to skilled labour and proximity to sources of knowledge and expertise. They note that the competitive advantage of many NE firms is not in producing with the lowest input costs, but being the first to market a new product or a higher quality product. They do not

believe that an incentive program can be identified a priori because clusters develop endogenously by means of their ability to leverage local-specific assets to induce new investment and create new value (Feldman and Francis, 2004:128).

Feldman and Francis (2004) criticize public investment for tending to focus on business plans rather than the entrepreneur, thereby locking entrepreneurs into situations that limit their adaptability. Flexibility and adaptability must be recognized by policy makers. On the other hand, venture capitalists say they bet on the person and not on the technology.

An Industry Canada ICT cluster study (2004) suggests the public sector make available substantive and sustained financing which have proven to be constraints to NE cluster growth. Policy suggestions include providing incentives to venture capital investors to make long-term investment commitments to firms; increasing the mobility of capital through labour sponsored funds; and by increasing the size of capital pools for investing in NE firms, perhaps through changes in pension fund rules. Specific incentives for early market development include tax credits and the encouragement of procurement of locally developed products and the promotion of such products in the export markets (ICT Cluster Study, 2004).

The public sector plays a regulatory role in the development of NE clusters by setting rules to protect intellectual property, enforcing antitrust laws, and ensuring international agreements are adhered to (Industry Canada, 2004; Porter, 1998).

A study of European clusters finds few private sector initiatives but sees potential for private-public cooperation. "Case evidence suggests that effective cooperation

between the public and private sector is more likely when the regional government institutions have strong independent decision power" (Ketels, 2004: 4). The OECD (2000) advises all levels of governments to foster linkages by providing frameworks for public-private partnerships and inter-firm partnerships. They suggest that clustering policy be indirect and concerned with supporting skills development, making resources available, and removing constraints to firm interaction..

Challenges to Public Policy Promotion of NE Clustering

Whether or not public policy can lead to the creation of a NE cluster, or any cluster for that matter, is a subject of debate. Many see cluster creation as a non-linear and unpredictable process that cannot be planned (Feldman, 2004; Ketels, 2004; Steiner, 2002). At the same time there exist mature developed clusters that appear to have resulted from public sector planning.

Feldman (2004) sees clusters self-organizing in a way that cannot be predicted at the onset. Accordingly, the resources necessary for cluster development are unknown and only become apparent as firms are created. Cortright and Mayer (2001) contend that it is difficult to generate a NE cluster where none previously existed seeing as there is no universal recipe. They find successful NE cluster development to be an indigenous process building on the distinct knowledge base of existing firms and workers and qualities of each individual region.

In addition, the dynamic nature of cluster creation makes them extremely difficult to plan. Much of current government policy aims to replicate Silicon Valley by focusing on recreating a static picture of an advanced stage of Silicon Valley's development,

without considering the dynamics of the actual development process. (Feldman et al, 2005). If planning is possible, it would "require the temporal development of unique and not easily replicated assets and capabilities" (Feldman et al, 2005: 130).

Feldman and Francis (2004) cite examples of planned clusters, where none existed previously, such as Research Triangle Park in North Carolina, Science Park in Taiwan and Bi-Regional clusters in Germany. They contend the few successful cases of planned clusters do not provide a universal recipe that is easily adaptable to other regions (Feldman and Francis, 2004; Cortright and Mayer, 2001). Attempts at planned clusters often do not develop into mature, innovative, and profitable clusters. For instance, New Jersey's attempt to create a Silicon Valley along the turnpike developed into a limited research conglomerate. There does not appear to be a general set of conditions applying to clusters as each cluster is characterized by unique factors.

Bathelt et al (2002) question cluster development policy initiatives directed towards creating local buzz by developing mechanisms to promote potential for interactive learning and knowledge creation across firms and related organizations within a region. As discussed in paper 2, local buzz is believed to be a critical source of competitive advantage for firms in NE clusters. Local buzz, although dependent on particular local institutional preconditions, is largely self-created as a result of economic agents physically located in close proximity to one another. However, Bathelt et al (2002) acknowledge that the development of global pipeline knowledge is enhanced with institutional and infrastructural support.

The length of time it takes for a cluster to be created is a challenge for public

policy. For instance, the creation of Silicon Valley's high-technology cluster has roots that extend back to the early twentieth century (Feldman et al, 2005). Feldman and Francis (2004) report that Research Triangle Park is a result of close to 70 years of patient government investment. And in the case of the U.S. Capital region, it took over 30 years for entrepreneurs to reinvest in the region and create conditions to attract appropriate resources to the cluster. In addition, an Industry Canada (2004) study reports that it can take more than 30 years for a cluster to reach maturity. However, the report maintains that growth can be accelerated through government support, as in the case of Hsinchu, Taiwan.

There appears to be a consensus in the literature that governments do play a decisive role in the development of clusters but should not attempt to create NE clusters from scratch (Industry Canada, 2004; Ketels, 2004; Francis and Feldman, 2004; Breschi and Malerba, 2001; Cortright and Mayer, 2001; Porter, 1998).

An Industry Canada NE Cluster study (2004) recommends government policy implement programs with fairly broad applicability in order to avoid the trap of attempting to pick technology winners in a fast moving environment where technological obsolescence occurs at a rapid pace. It is recommended that government policy take a long-term cluster sustainability approach implementing incentives for diversity to weather times of economic uncertainly.

A European Commission study (Kelels, 2004) concludes that cluster development initiatives should aim to activate clusters not create them. In other words, they should focus on assisting an existing base of companies and institutions to jointly upgrade their

cluster rather than investing huge sums in an attempt to create a cluster from scratch. Ketels (2004) reports little evidence of successful cluster initiatives intended to create new clusters.

Breeschi and Malerba (2001) observe a remarkable convergence of opinion, as expressed in current literature, in drawing attention to the ineffectiveness of public policies attempting to direct the formation of new clusters through top-down interventions, such as science parks. It is becoming a consensus that government policies can be most effective by accommodating the formation of new firms, investment in education and the provision of infrastructural support. Cortright and Mayer (2001) contend that development efforts should focus on extending existing strengths or emerging local competence as there is no one single cause that triggers the development of NE clusters.

Porter (1998) suggests that the public sector should work with the private sector to reinforce and build on emerging and existing clusters rather than attempt to create new ones. He states that most clusters form independently of government action and sometimes in spite of it. Initiatives should embrace the pursuit of competitive advantage and specialization rather than imitate successful clusters in other locations. Finding areas of specialization and building on local sources of uniqueness is suggested rather than head-on competition with well-established rival locations.

Feldman and Francis (2004) recommend that policy focus on creating a hospitable environment for firms to originate and grow and not to target specific industries or technologies. They also note that new ways of measuring economic development success

are needed: "New metrics need to be developed to consider the synergies that government investment creates in a region and the additional activities that would not have been undertaken in its absence" (Feldman and Francis, 2004: 136).

Breschi and Malerba (2001) conclude that policies must be accommodating in the creation of support infrastructure i.e. education, institutions, etc. rather than a well-structured, articulated and complete set of policy interventions aimed at directly affecting the dynamics of a cluster.

Applicability of Planned Cluster Development to Community Economic Development

The fact that successful planned NE clusters such as Research Triangle Park (North Carolina) and Science Park (Hsinchu) exist is evidence that clusters can be planned despite the consensus in the literature that the cluster creation process is non-linear, unpredictable with no universal recipe. However, the non-linearity and unpredictability of the process places huge challenges to the planning process and increases the probability of failure. With gestation periods possibly ranging from 30 to 70 years, it may not be realistic to suppose public policy, while enduring periodic changes in governments, has the tenacity to achieve the creation of clusters. Both the creation of Research Triangle Park and Science Park involved long-term public sector financial support. The literature on both CED and NE clustering criticize the public sector for failing to provide substantive and sustained financing necessary for successful development. Much of the current public sector financial support for cluster creation and CED initiatives are said to be short-term and sporadic.

For the most part, the public sector has found its role in cluster development to be a provider of services which includes, but is not limited to, physical infrastructure, investment in education and training, various forms of financial incentives, and anchor firms/institutions much in line with public sector support proposed for CED. The role of the public sector in cluster development parallels that of its role in CED as outlined in paper 1.

Community development, like cluster development, is a process that builds on the distinct knowledge base and unique characteristics of the region and its people thereby excluding the use of a generic development plan. The literature on CED and NE cluster development both advocate a bottom-up rather than top-down approach to development. As explained in paper 1, CED is a community-based, inward focused approach to economic development where development strategies are to be created from within the community rather than imposed from outside the community. This approach to community development is somewhat congruent with NE cluster development where leadership needs to come from within the cluster. In both cases the role of the public sector is seen as one of providing leadership and support to the development strategy rather than imposing development plans from outside the community or cluster.

Both CED and NE literature advocate that the public sector provide and/or support anchors in order to assist in the development of disadvantaged communities and NE clusters, respectively. In the case of the disadvantaged community the anchors are likely to be training centres, housing projects, or small community based business instead of research institutions and universities as in the case of NE clusters.

The provision of infrastructure is an important role for the public sector in CED and NE cluster development. Public investment in physical infrastructure and public and quasi-public goods has a significant impact on the development of disadvantaged communities and clusters both. Telecommunications infrastructure, for instance, is essential for both communities and clusters.

Public sector financial support, whether it be in the form of subsidies, tax incentives, grant-giving programs or the like, is vital to the successful development of both disadvantaged communities and clusters. Public policy in both development areas has endured criticism for not providing sufficient and sustained financing necessary for effective development.

Providing and assisting in the development of human capital is a common role for the public sector in both CED and NE cluster development. The appropriate mix of skills is cited as a constraint to firm and thus cluster growth, just as it is to CED. With CED the issue is not so much providing appropriate skills but unemployable skills with secondary education often being the first goal. Human capital development towards NE clusters involves higher level skills than for CED. As well, the availability of labour market information is important to both CED and NE cluster development, another role for the public sector.

The similarities of the prescribed role of the public sector in NE cluster development and CED support the idea that cluster development policy is applicable to CED, although planned NE clusters as a CED strategy may not be realistic due to the conviction that planned clusters are likely to be unsuccessful.

2. The Compatibility of the NE Cluster Model with Community Economic Development

Leaving aside for the time being the issue of whether or not NE clusters can be planned, consider the appropriateness of NE clusters as a development strategy for CED. In other words, to what extent would a development strategy involving the creation of NE clusters in a disadvantaged community be suitable? In this section three facets of compatibility are assessed. First, the compatibility of the NE cluster model with the principles of CED is assessed. Based on the proposed economic theory of CED in section 2.2 of paper 1, NE clustering is evaluated in terms of its compatibility with CED. Second, the compatibility of NE clusters with I-O analysis is analysed to determine if the impact of NE cluster activities can be evaluated in an I-O framework for CED. Third, the compatibility of CED with the NE clustering model is assessed.

The Compatibility of the NE Clustering Model with the Principles of CED

The main theoretical economic components of CED include local self-sufficiency, local decision making, and local ownership; linkages among enterprises; small scale production; planned production; positive externalities; external economies; and locally owned capital. In this section, NE clustering is evaluated in terms of its compatibility with each of these principles of CED theory.

Self-sufficiency, local decision making and local ownership

Cluster development is not typically viewed as a means to self-sufficiency.

However, a vertically integrated cluster can be viewed as being self-sufficient to some degree as firms choose to locate in the cluster to meet local demand for intermediate products for further processing and local final demand for capital goods and government purchases. Viewed in this light there is some level of self-sufficiency in terms of production inputs in vertically integrated clusters but not horizontally integrated clusters. Further, most NE final goods are produced for outside markets, both national and international. The input-output relations and production linkages among firms and institutions in vertically integrated clusters are elaborated upon later in this section.

On local ownership, although it is not always strong in a cluster there is a tendency for local ownership to exist when new firms start-up as part of the cluster development process, either as employees leave existing firms to start up new firms, or as students or researchers from local institutions start up new firms. The local demand for more specialized inputs is often the impetus for the new firm start-ups. These start-ups are often locally owned and become a part of a vertically integrated production process. As well, some horizontal clusters become vertically integrated over time as opportunities become available for producing specialized intermediate goods. In sum, new start-ups are most likely to be locally owned. A larger number of locally owned firms lead to a larger portion of value-added expenditures, specifically profit, staying in the community. Locally owned NE firms in clusters are more likely to make decisions locally than non-locally owned firms. Specifically, new start ups ensuing from cluster-grown entrepreneurs are likely to partake in a higher degree of local decision making compared to a branch office or plant of a multinational firm.

The importance of linkages

The economic theory of CED, as explained in paper 1, places a good deal of emphasis on the role of production linkages in the development process. The maximization of forward, backward and final demand linkages and the minimization of leakages create higher valued output and larger income multipliers leading to successful economic development.

The microeconomic model developed in paper 2 shows that NE firms locate in a cluster largely to benefit from the creation and transfer of knowledge within the cluster as described by the concept local atmosphere. Information and knowledge is a vital asset of NE firms and its production and transfer occurs most efficiently among co-located firms. As well the co-location of firms with institutions of research and higher learning enhances the knowledge creation process. In order for NE firms to benefit from local atmosphere some type of intentional or unintentional communication between the firms must exist which may be enhanced by production linkages.

Local atmosphere, as defined in paper 2, encompasses five types of knowledge spillovers (Wolfe and Gertler, 2004), the horizontal and vertical spreading of knowledge (Maskell, 2001) and local buzz (Bathelt et al). Each of the components is analyzed with respect to its compatibility with the concept of linkages.

The five types of knowledge spillovers, as explained in paper 2, are tacit knowledge, skilled workers, entrepreneurial skills, external market conditions and infrastructural knowledge resources. Tacit knowledge refers to the knowledge created through frequent face to face interactions and learning by doing. The geographic

proximity of firms to each other and to institutions of learning and research create more opportunities for the creation and transfer of tacit knowledge. When linkages exist among firms and between firms and institutions the opportunity to create and transfer tacit knowledge increases. However, tacit knowledge is also created and transferred among rival firms who are not linked through forward or backward production linkages. Thus linkages are useful but not necessary for the spillover of tacit knowledge.

Skilled workers move among firms and between firms and learning and research institutions illustrating the value of forward and backward linkages. Forward linkages occur as workers move from learning and research institutions to firms bringing with them their experience, information and knowledge. For instance a significant portion of the graduates from the University of Calgary's Geomatics Engineering Department become employed by private sector firms in Calgary's wireless cluster (Langford, Wood and Ross, 2003). Forward linkages also occur as workers move from one firm to another bringing their specific set of skills, experience, information and knowledge. In Saskatoon's agricultural biotechnology cluster, close to 40 percent of all employees have some educational or work experience with the local University of Saskatchewan (Ryan and Phillips, 2003). Backward linkages occur when a firm locates in a cluster to benefit from the information and knowledge possessed by the local skilled workers. In Calgary's wireless cluster, new firms are attracted to the cluster to benefit from the specialized labour from the University's Geomatics Engineering Department.

Entrepreneurial skills are developed with the accumulation of information and knowledge from years of industry experience. Forward linkages are formed as workers

with entrepreneurial skills leave a firm or institution to start-up a new firm. In Ottawa's technology cluster, Microsystems International, a division of Bell Northern Research, provided some of the most talented technology and business entrepreneurs in the region who became instrumental in creating many new firms. For instance, Michael Cowpland created Mitel, Corel and ZIM technologies. Terry Matthews created Mitel with Cowpland and then created Newbridge Networks and March Networks. The success of these entrepreneurs and others, along with their knowledge and experience led to further successful start-ups by other entrepreneurs. (Chamberlin and de la Mothe, 2003)

Knowledge about external market conditions and competitiveness is often spread through civic associations such as a chamber of commerce or a more industry specific association. Backward linkages are created as firms participate in such associations to benefit from knowledge spillovers. For instance, Ottawa Photonics Cluster (OPC) is an industry specific association and has been referred to as the voice of Ottawa's photonics community. By providing opportunities for networking, guest speaker presentations, and trade missions, OPC is committed to helping its members attract investment, employees and business opportunities locally and internationally (Chamberlin and de la Mothe, 2003). Learning and research institutions occasionally offer public lectures and information sessions providing firms with an opportunity to gain knowledge. For instance, Smartpark is a University of Manitoba initiative that brings the University's research community together with research and technology firms and organizations. Smartpark hosts "Smartpark INTERACTIVE", a series of networking and information events for researchers, business and government.

Firms gain infrastructural knowledge as backward linkages are formed between firms and specialized legal, accounting and financial firms. These firms specialize in the type of law, accounting and financial practices pertinent to the specific industry.

The concept of horizontal spreading of knowledge, as described in paper 2, is not compatible with the concept of creating and transferring knowledge through production linkages. Horizontal spreading involves the transfer of knowledge among competing firms where no input-out relationships exist. However, as previously discussed, horizontally integrated clusters often evolve to incorporate vertical integration through forward and backward production linkages. The vertical spread of knowledge is most compatible with production linkages, as both involve input-output relationships among firms.

Local atmosphere can be created through face-to-face contact and is enhanced by linkages in a cluster. It is the direct result of co-located firms and intended and unintended learning processes, and planned and unplanned meetings. Linkages increase the likelihood of contact and thus enhance knowledge spillovers. Generally, linkages reduce the costs of co-ordination and problems of asymmetric information in the transfer of information and knowledge among agents in a cluster.

The quality of local atmosphere varies and may in part be determined by the strength of linkages. Since production linkages increase the likelihood of contact among firms, the quality of local atmosphere is expected to improve as linkages strengthen.

Global pipelines, as discussed in paper 2, describe how knowledge is created and transferred over distances. As stated earlier, local atmosphere and global pipelines are

mutually reinforcing as knowledge gained through pipelines can spread to agents within a cluster through local atmosphere. It then follows that production linkages within a cluster enhance the spreading of global pipeline knowledge among agents in a cluster.

To the degree that knowledge is created and spread within a cluster due to production linkages, there is support for small scale production. It has been suggested that the value of local atmosphere exchanges between a large number of small firms is greater than those in one large firm (Malmberg and Maskell, 2001).

Small scale production

Some NE clustering literature supports small scale firms in clusters. The OECD (2000) reports that small and medium sized firms have advantages over large firms in clusters. Small and medium sized firms can often be more flexible and responsive to customer needs than large integrated firms. They can pool resources, share costs of training and diffusion of technology and create new possibilities for efficiency. Clustering eases exchange of labour and diffusion of technology and creates new possibilities for efficiency gains. "Small firms working in clusters can attain the advantages of large firms while retaining the benefits of specialization and flexibility"(OECD, 2000: 6).

Ketels (2004) finds that small and medium-sized firms dominate European clusters and have been successful in competing in global markets. At the same time multinational firms are frequently present in the clusters. Sonobe, Hu, and Otsuka (2002) report that industrial clusters in developing countries tend to be formed by small and medium sized enterprises.

Feldman and Francis (2004) report that small scale projects frequently yield an equivalent or larger impact than large scale economic development projects which is ironic given that public investment is typically directed towards to the large scale projects. The rationale being that the high visibility of large scale projects skews public investment since local media is more interested in covering stories about large scale projects than about small projects or individual firms.

Bathelt et al (2002) propose that a large number of related independent firms in a cluster have an advantage over one large firm in effectively managing a large number of pipelines. This follows from their argument that there are limits to the number of pipelines that any one firm can simultaneously manage thus supporting the proposition that a cluster of many smaller firms is likely to be more competitive and successful than a cluster of few larger firms.

On the other hand, Industry Canada's NE cluster study (2004) reports that the global ICT sector is dominated by a small number of large firms and many smaller niche players. Large Canadian NE firms are increasingly becoming foreign multinational enterprises.

Planned Production

According to CED theory, planned production is necessary for, at least, the early stages of development. It is important to note here that CED theory prescribes the decision-making process of planned production to be a bottom-up process directly involving community residents. However, in reality CED initiatives are typically

dependent upon outside development agencies, often public sector funded. Public sector involvement is also common for cluster development. Since Silicon Valley, every level of government has attempted to encourage clustering with planned production. Subsidy is common practice as many public sectors have used incentives in an attempt to re-create historically successful clusters. As discussed in the previous section, the literature on both cluster development and CED call for a bottom-up rather than a top-down approach to the planning and development process of clusters and disadvantaged communities. There are a wide range of opinions on the type and degree of planning required for successful cluster development including the opinion that clusters cannot be planned, as was covered in section 1 of this paper.

Positive Externalities

As explained in paper 1, in the case where the activity of any economic agent positively affects other economic agents, positive externalities exist and are indicative of inefficiencies. From paper 1, the idea of internalizing a positive externality as a means of increasing economic inefficiency strengthens the argument for subsidizing CED projects, or at least one larger CED project. This line of thought is congruent with some of the strategies for developing NE clusters, specifically those involving the role of anchor firms as discussed above. For instance, an anchor firm can provide experienced and skilled workers who eventually leave the anchor to start their own firms thereby contributing to the development of a cluster. The positive externalities stemming from the anchor provide rationalization for subsidization of the anchor as a way of correcting for the inefficiencies of externalities.

External Economies

The noteworthy role of external economies for CED, as explained in paper 1, is to improve the community's competitive position by providing facilities such as those for training, marketing and credit. This same rationale can be applied to the development of NE clusters which also require similar facilities or institutions. In the NE cluster literature the role of research institutions and institutions of higher learning is essential for providing the skill level needed for NE firms. In NE clusters, external economies occur when firms benefit from the supply of skilled labour and innovative ideas flowing from the public sector institutions.

Locally Owned Capital

The necessity of capital for both the development of disadvantaged communities and NE clusters is prominent in the literature on both topics. The source of capital is a more critical topic in CED literature than in NE clustering literature. While internal capital is often a scarce commodity in disadvantaged communities[1], importing capital comes with development challenges as discussed in paper 1, an issue not discussed in the NE clustering literature. This issue is directly tied to the subject of local ownership in view of the fact that profits tend to leave the community when the source of capital is external (Loxley, 1986). The literature on NE clusters discusses the tendency of firms to seek external capital, particularly venture capital, without concern about the source (Industry Canada, 2004).

[1] While scarcity of internal capital is a common challenge for economic development of disadvantaged communities, some communities have formed Tribal Councils or similar organizations, such as Tribal Council Group in Winnipeg which funds larger projects.

The Compatibility of NE Clusters with Input-Output Analysis

Input-output (I-O) analysis is the most appropriate methodology for analyzing small regions and communities characterized by interdependencies between producing sectors. As explained in section 3 of paper 1, it is designed to identify linkages between sectors and derive multipliers for each sector of the economy. The microeconomics of CED, as developed in section 3 of paper 1, makes use of an input-output matrix to illustrate the significance of linkages between CED projects. Output and income multipliers calculated with information in the I-O matrix provide a measure of the impact of a CED project on a community's economy.

The microeconomic model developed in section 4 of paper 2 illustrates that NE firms locate in a cluster largely to benefit from the creation and transfer of knowledge within the cluster as described by the concept local atmosphere. As well, the co-location of firms with institutions of research and higher learning enhances the knowledge creation process. In order for NE firms to benefit from local atmosphere, some type of intentional or unintentional contact among firms or between firms and research and higher learning institutions must exist. The vehicle for the communication can be viewed as a linkage, although not necessarily a production linkage.

Conceptually it appears that I-O analysis may be appropriate for analyzing clusters of NE firms because of the interdependencies created by information and knowledge transfer among the firms and other economic agents within a cluster. However, upon closer examination, there are three main reasons that preclude it from being an appropriate method to analyze the interdependency of NE firms in clusters.

First, the linearity assumption of the I-O model is a constraint. As stated in section 3 of paper 1, the linearity assumption rules out consideration of economies of scale and external economies, two important components of the microeconomic theory of firms in NE clusters. For instance, non-linear modeling is required to illustrate and explain the effects of congestion and increasing returns. Congestion costs are a negative external economy of scale increasing with the number of firms in the cluster, and NE firms typically experience increasing returns to scale where unit production costs fall as the level of output rises. Neither of these effects can be modeled in a linear I-O matrix.

Second, although NE firms in clusters are interdependent, they are not necessarily interdependent through production linkages as is a requirement of the I-O model. The sources of interdependence for NE firms in clusters are best understood by analyzing the components of local atmosphere. As outlined above the main components of local atmosphere include the five knowledge spillovers, the horizontal and vertical spreading of knowledge, and local buzz. The source of interdependence may be production linkages in the case of vertically integrated clusters but is not in the case of horizontally integrated clusters. The horizontal spread of knowledge among competing firms presents a challenge for the I-O model since knowledge creation often occurs without communication between two competing firms. As described in paper 2, knowledge is created as a result of an ongoing process of watching, discussing and comparing different approaches and solutions taken by competitors within a cluster. These firms are interdependent in the sense that many of their decisions depend on information and knowledge gained by monitoring each others' activities. As described above, knowledge

spillovers of tacit knowledge may or may not occur through production linkages. The transfer of knowledge through skilled workers may be modelled in the case where learning institutions are viewed as producing skilled labour which is used as an input to the production process of a firm, but not when workers move from firm to firm, or research institution to firm. No production linkages are required for the creation and transfer of knowledge through entrepreneurial skills, external market conditions or infrastructural knowledge resources.

Third, the I-O model does not lend itself to modeling local atmosphere in a method compatible with the NE clustering model of paper 2. The benefit of local atmosphere, according to the microeconomic model in paper 2, is experienced in lower marginal input costs. Using expenditure equations from the I-O model, firms within a cluster incur lower marginal costs and thus lower average costs since marginal costs equal average costs with the assumption of linearity. It then follows that the total cost function is linear. Equation (4), below, from the NE clustering model represents a non-linear cost function, where costs are measured in terms of the labour necessary to produce quantity x of variety i in region r,

$$l_{ir} = N_r^{\frac{\tau}{(1-\tau)}}(\alpha + \beta_r x_{ir}), 0 < \tau < 1.$$

It will be recalled that N_r = the number of varieties of the sector A NE firms in region r, α = fixed labour costs, β= marginal labour costs, and τ = the congestion parameter representing external diseconomies of scale.

The microeconomic foundations presented in the NE clustering model do not specify how

local atmosphere specifically lowers marginal costs. The local atmosphere effect may reduce wages, the cost of imports, the cost of domestically produced intermediate goods, or other components of value added. The information and knowledge gained by firms within a cluster can lower marginal costs through a variety of sources. The marginal cost benefits of local atmosphere could be found in any of the typical expenditure rows of an I-O matrix, $X_j = \sum_{i=1}^{n} X_{ij} + W_j + V_j + M_j$. It will be recalled that X_j represents gross expenditures for CED_j, which is equal to the sum of expenditures on purchases of intermediate goods from other CED initiatives ($\sum_{i=1}^{n} X_{ij}$) and industry in the community plus expenditures on labour (W_j) plus other value added expenditures (V_j), including taxes, profit, rent and interest, less subsidies, plus expenditures on inputs from outside the community (Mj=imports). The I-O model equations are typically used to illustrate linear or constant decreases in costs[2].

For instance, consider the knowledge embodied in labour flowing from a research institution to a private firm. How does this knowledge translate to lower marginal input costs? It could occur in a variety of ways. The worker could bring knowledge about a new cost saving technology which would reduce the cost of inputs required for production, thus reducing marginal costs. The worker could bring knowledge about the development of new products which would reduce the amount of resources devoted to research and development, thus reducing marginal costs. Another example is the

[2] Methods have been developed to adjust fixed coefficients to account for structural changes due to technological advance, changes in relative prices of inputs, and changes in a model's organization and classification of data (see Blitzer, Clark and Taylor, 1975, Miernyk, 1969).

knowledge embodied in infrastructural knowledge resources found in specialized legal or accounting firms which may reduce taxes or increase subsidies to a firm, thus reducing marginal costs.

As explained in paper 1, the value of the I-O model for CED is not only in its ability to present a picture of the interrelationships between various sectors of the economy, but in its ability to demonstrate impact analysis where the model allows the prediction of effects throughout an economy of changes in final demands for the output of any one sector. As explained in paper 1, each purchase from a particular CED by another CED or a final consumer initiates a chain reaction throughout the economy. The I-O model traces through the resulting maze of economic reverberations to show, when the rounds of spending have come to an end, the value of increased output of each CED, given the initial increase in one of the final demand categories. The creation and transfer of knowledge does not necessarily occur as a result of an increase in final demand for a firm's product. An I-O framework precludes illustrating how knowledge can be transferred between firms with no production linkages to each other.

The Compatibility of CED with the NE Clustering Model

This section evaluates the compatibility of NE clusters in disadvantaged communities for CED with the NE clustering model developed in paper 2.

It appears that a major constraint to using the NE clustering model for clusters in CED is the issue of scale. Some critical components of the NE model rest on the assumption that the variable N, representing the number of varieties of NE goods and

thus the number of firms, is relatively large. A large number of firms or CED initiatives are not likely to be the case since skilled labour and other necessary resources including capital and entrepreneurship are scarce and will not support a large number of NE firms. As well, many of the rural and isolated disadvantaged communities do not have the population to support the labour requirements of many firms.

In the NE clustering model, a large N in the CES function conveniently allows σ to be interpreted as the elasticity of demand for any individual good,

$$C_A = \left[\sum_{i=1}^{n} c_i^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$ (equation 1, paper 2)

It will be recalled that C_A = the consumption of the sector *A* NE goods, c_i = the consumption of variety I of sector A NE goods and N= number of varieties of sector A NE goods, σ = elasticity of substitution between sector A goods.

As well, the two assumptions of the Dixit-Stiglitz model concerning the price-setting behaviour of firms are based on a large N. First, it is assumed that each firm takes the price-setting behaviour of other firms as given, and second, it is assumed that each firm ignores the effect of changing its own price on the price index, I, of manufactured goods. Both of these assumptions are only reasonable with the assumption of a large N.

Economies of scale and increasing returns are critical to the microeconomic theory of NE clusters, as discussed in paper 2. Krugman's (1991) core-periphery model, upon which the NE model in paper 2 is developed, utilizes increasing returns to demonstrate how clusters are formed. Krugman (1991) contends that geographic concentration of production is evidence of the significant influence of increasing returns.

The production of NE goods is characterized by internal economies of scale, thus each variety is produced by a single firm because the firm with the largest scale will always outbid a potential competitor. In Krugman's (1991) model economies of scale is measured by the ratio of average costs to marginal costs, where average costs are equal to the total labour requirement divided by output,

$$\frac{\alpha\sigma}{\frac{\alpha(\sigma-1)\beta}{\beta}}$$

and marginal labour costs are equal to β. The measure of economies of scale reduces to $\frac{\sigma}{\sigma-1}$. Thus, in equilibrium the economies of scale depend only on sigma. A smaller sigma represents relatively low elasticity of substitution and low price elasticity of demand corresponding to more varieties being produced and allowing greater potential for economies of scale than if sigma was large. The simulation results indicate NE firms producing goods with a small sigma are more likely to cluster. Since NE goods are often quite differentiated, it is expected that sigma is relatively small and the importance of economies of scale is great which does not comply with small scale objectives of CED.

The congestion component of the NE model results in smaller clusters due to higher costs associated with congestion. Note that while congestion keeps clusters from growing very large, as demonstrated by the simulations in paper 2, it does not necessarily imply small scale as prescribed in CED theory. The scale of each firm tends to be relatively large since each firm, producing a differentiated product, is the sole producer of the product. Large scale production is not compatible with CED.

Is New Economy Clustering an Appropriate Development Strategy for CED?

This question is addressed based upon conclusions drawn from the analyses of the three facets of compatibility analysed in the previous section.

In regard to the study of compatibilities in the previous section, NE clusters are somewhat, but not wholly, compatible with the major principles of CED. Neither self-sufficiency, local decision-making, nor local-ownership is a characteristic typically associated with NE clusters although they are sometimes present. Production linkages are common in vertically integrated, but not horizontally integrated, NE clusters and they are expected to supplement local atmosphere. Production linkages enhance all the five types of knowledge spillovers.

The OCED (2000), Feldman and Francis (2004) and Bathelt et al (2002) all discuss small scale advantages in NE clusters even though small scale is not necessarily a requirement of a NE cluster. Likewise, planned production is not necessary for successful NE cluster creation although there have been cases of successfully planned NE clusters. At the same time, there have been numerous failed attempts at NE cluster creation as well as cases of clusters that have developed without planning.

Positive externalities play a significant role in NE clusters, as they do in CED, through anchor firms which provide positive spillovers to other agents in the cluster. As well, external economies are important for NE clusters particularly the role of public institutions such as research institutions and universities in supplying an appropriately skilled labour force. Lastly, there is no emphasis on locally owned capital for NE cluster

development. By and large, with the exception of a few features, NE clustering is not compatible with the principles of CED.

On the second facet of compatibility, input-output (I-O) analysis is not an appropriate tool for analysing NE clusters for three main reasons. First, the linearity constraint of I-O analysis does not allow the modeling of increasing returns which is the foundation of the NE clustering model. Second, production linkages are not adequate for illustrating the non-production linkages of NE firms in clusters. Third, local atmosphere is modeled in a non-linear cost function in the NE cluster model which is not compatible with linear cost functions of the I-O model. As well, the NE cluster model does not specifically explain how local atmosphere lowers marginal cost making it that much more challenging to illustrate in an I-O matrix.

The third facet of compatibility explores the consistency of CED with the NE clustering model. The small scale characteristic of CED is a challenge for the NE clustering model. The large variety of goods assumption, represented by N, in the NE clustering model is the major constraint to analysing CED within the model. Overall, the three compatibility analyses led to the conclusion that NE clustering is not an appropriate development strategy for CED.

In addition there are several characteristics of NE clusters which make them incompatible with a CED strategy. First, NE firms are characterized by a highly skilled workforce, much higher than the workforce available in disadvantaged communities, even with training. In fact, it is often the skilled workforce that attracts firms to the cluster. Second, the public sector institutions in NE clusters, namely institutions of

research and higher learning are not often located and connected with economic activity in disadvantaged communities. Though there are some important connections between researchers and disadvantaged communities evidenced by the existence of the Manitoba Research Alliance even though somewhat geographically removed. Third, the capital requirements for NE activity are typically higher than for many other economic activities due to the information technology infrastructure required. Fourth, NE clusters typically export most of their goods and services to regions outside the cluster with little if any concern for producing to meet local needs of the community.

If NE clusters are not appropriate for CED, then what, if anything, does the NE have to offer CED? Perhaps the answer lies in the forty acres and a modem concept from paper 2. Section 3 considers the applicability of the forty acres and a modem concept for CED.

3. Applicability of the Forty Acres and a Modem Concept for CED

While much of the literature cited in paper 2 suggests that clustering activity has become more prominent in the New Economy, an alternative body of literature suggests that telecommunications infrastructure and technology offered by the New Economy has enabled firms to successfully conduct economic activity away from metropolitan hubs. In other words, a firm with a modem in a geographically remote area can be competitive. The forty acres and a modem concept is applicable to specific economic activities, particularly back-office operations.

Back-office operations, or services, describes the off-side delivery of a range of

non-core service functions, including administrative tasks, customer service and technical support (Conrad, 2000). There are basically three types of back-office services: routine, discretionary and specialized (International Trade Centre, 2000). Routine services require only basic skills and include activities such as data capture and processing, routine queries, order taking and customer call centre work. Discretionary services require some technical training and problem-solving and include activities such as data verification and repair, claims processing, and remote secretarial services. Specialized services require specific expertise and managerial authority and include accounting, payroll processing, electronic publishing, and medical records management. Information and communications technology has made it possible for many back-office operations to be provided in locations far from home offices. With appropriate information technology (IT) support, any non-face-to-face service can be provided back-office.

The global market for business services is about $3 trillion (US) or nearly 10% of global GDP and the export of business services is approximately $734 billion (US) (International Trade Centre, 2000). Outsourcing is the term used to describe the contracting of business functions outside the firm. Outsourcing may occur within or outside national borders. Outsourcing outside the country is viewed as importing business services.

There is nothing new about outsourcing as it has been going on for years. Manufacturers have outsourced parts manufacturing to smaller firms for many years. In the New Economy, the demand for outsourcing has increased because information and communications technology (ICT) has made it possible for many more aspects of

production to be outsourced, namely services. The ability to outsource services offshore is specifically what the NE brings to the concept of outsourcing, often to low cost countries with lower labour standards such as China and India. In essence, services can be provided from anywhere on the globe if the telecommunications infrastructure is available. Firms outsource to reduce costs, improve employee productivity and to focus on core business functions. On a macroeconomic level, outsourcing leads to lower inflation and improved productivity. (Canadian Chamber of Commerce, 2005)

Offshore back-office operations is growing at a rate of 15% to 20% annually (Conrad, 2000). India and China have dominated the export of back-office operations with India taking an early lead in the call centre industry and China becoming well known for data entry. The International Trade Centre (2000) suggests developing countries can benefit from current trends of outsourcing business operations by making back-office operations a part of their export development strategy. Back-office operations are provided to international firms, public-sector agencies and non-profit organizations. There is potential to explore new prospects for economic development in the area of back-office operations.

For instance, General Electric offshores financial services in India employeeing 12,000 workers. In addition, they have global processing centres in China and Mexcio working around the clock in inbound and outbound call centres, accounting services among other back-office operations. Barbados and Jamaica in the Carribbean have developed successful back-office industries while the Dominican Republic has more recently entered the industry.

Telecommunications infrastructure has proven to be a barrier for Eastern Europe, Africa, the Middle East and Latin America to enter the back-office operations industry. However, there are some call centres and software processing in Albania and Hungary. The city of NewYork outsources parking ticket processing to Ghana, Africa (Conrad, 2000). While back-office operations are typically thought to be offshored to low income developing and transitional countries, high income countries are also participating in the industry.

> "While the movement to back-office operations involved going offshore in order to lower labour costs, most countries now have at least one firm providing back-office operations. As demand growth shifts to high-valued customer service functions, developing countries are facing increasing competition from developed countries, which are able to offset high wage structures with specialized skills and significantly lower telecommunication costs" (Conrad, 2000)

Primary call centres in the European Union have been growing at a rate of 40% per year (Conrad, 2000). Germany, Belgium, Denmark, Northern Ireland, Norway and Scotland are all participating in growing call centre business and Australia has been named the call centre capital for the Asia-Pacific region.

Some of the concerns about offshore operations to low income and transitional economies include security of information, the viability of the service providers, quality of service, accents, and reliability of infrastructure. Politically, offshore back-office operations has been controversial, particularly from a labour standpoint as domestic workers stand to lose jobs as more back-office working is allocated offshore (Wharton, 2002).

Cultural and societal differences are a concern for some types of back-office work. There have been concerns that workers from low income countries may not understand enough about Western culture to trouble-shoot. Wharton (2002) suggests that there may be limits to how much a firm wants to move back-office operations offshore. There are also concerns about becoming dependent on one outsourcer in terms of giving up knowledge. A high level of dependence may result in a costly switch down the road (Wharton, 2002).

Back-office operations in the area of customer relationship management (call centres, technical support, etc.) are sometimes more suitable for nearshore rather than offshore outsourcing (Bowen, 2005). Nearshoring refers to contracting out to neighbouring or geographically close countries (Canadian Chamber of Commerce, 2005). It has been suggested that low creativity tasks be outsourced overseas to low income countries and the more refined processes that require higher level communication between customer and supplier be outsourced nearshore where cultural similarities are important. Perhaps the nearshoring of back-office operations holds some promise for CED in the New Economy.

Back-office operations are increasingly viewed as a source of economic development for communities and regions. The International Trade Centre (2000) has identified back-office services as a high growth market opportunity. Several American communities have been actively soliciting back-office business to create jobs. For instance, the chamber of commerce of Antioch, California and the Office of Economic Development of Erie County in Buffalo, New York have declared back-office operations

as a target industry for economic development efforts.

For instance, Rural Outsourcing, an IT company that outsources to rural America claims that they can provide information technology services at 30% to 50% below most US consulting firms due to lower overhead and wages in rural regions (Johnson, 2005).

Outsourcing to rural areas in North America is seen as an alternative to offshore for firms who want to keep sensitive information in the country. For instance, an international law firm employing over 900 lawyers worldwide outsources back-office operations to Wheelings, West Virgina. Wheelings has struggled with a declining population over the past couple of decades as the state's manufacturing sector has lost many jobs and is expected to lose more in the near future. The back-office operation in Wheelings has a staff of 37 employees who handle transcription and word processing (Huber, 2006).

Small centres in the U.S. are chosen as an alternative to abroad for "more sensitive" jobs such as transcribing, depositions, and processing legal documents. Huber (2006) notes the trend toward higher-level outsourcing being directed to rural America, particularly from overseas. He cites the main reasons as being flexible hours, employees with strong work ethics and relatively low wages. Although wages are and will continue to be much less in Asia, offshore workers "simply can't match the cultural affinity of Americans for certain work" (Walker, 2005).

Aboriginal communities in the U.S. are benefiting from nearshoring. Lakota Express, a Native American woman owned marketing and web-design firm, established in 1996, is based on a South Dakota Indian reservation and provides services for clients

including Daimler Chrysler, the federal, state and tribal government. Lakota Express has a state of the art call centre that provides inbound and outbound telemarketing. They also provide services which include data entry, order processing, and surveys. (Lakota Express, Inc, 2006)

Tribally owned companies have been set up on Northern Ute reservations in Utah. On four Utah reservations, 150 to 180 full time jobs have been created through outsourcing of government and commercial contracts. "One venture, owned by members of the Cedar Bank of Paiutes, did $14 million in business last year" (Walker, 2005). Jobs include data entry, call centre, helpdesk and info-tech work.

Despite labour costs in Canada being higher than Mexico and India, the two most preferred outsourcing destinations for the U.S., there are several factors which make Canada a very desirable place to outsource. Canada gains a competitive advantage in outsourcing for many U.S. firms due to its educated population, high employee retention rates, cultural and linguistic similarities, stable political environment, business-friendly climate, shared business culture, and close proximity to the U.S (Bowen, 2005; Canadian Chamber of Commerce, 2005). "Outsourcing to Canada is less of a sensitive topic among American firms and customers and has attracted less political and media attention in the US than the outsourcing of US-based work to facilities overseas" (Bowen, 2005).

Labour costs in Canada are up to 30 percent cheaper than in the U.S, although the gap lessens with appreciation of the U.S-Canadian exchange rate. Although labour costs in Mexico and India are substantially cheaper than in Canada, approximately 50% and 70% less, respectively, Canada's competitive advantage in other areas maintains its

position as a preferred outsource location for some industries (Bowen, 2005). Datamonitor, a provider of industry analysis, forecasts strong call centre growth in Canada with an addition of 800 new call centres and 93,000 agent positions in the next three years (Bowen, 2005). While Canadian growth in back-office operations is not expected to reach near the levels of India and other Asian countries, it is expected to maintain a secure position for U.S. firms that rely on others to look after their business analytics, corporate reporting, and data warehousing operations and want those functions performed geographically closer to the head office (Bowen, 2005).

The Canadian Chamber of Commerce (2005) cites survey results of 127 U.S. IT professionals who rated cost as the third most important criteria after availability of experienced professionals and access to specific technical skills. In terms of IT infrastructure, Canada is second to South Korea in the level and accessibility of broadband infrastructure. Among the G-7, Canada ranks second in terms of "connectivity – basic ability to access the internet including availability, price, reach and use" (Canadian Chamber of Commerce, 2005: 7).

Contact centre business is the largest type of offshore activity performed in Canada. "Call centre strategies are in place in nearly all Canadian provinces, and constitute a continued area of focus for economic development activities for the provinces...Contact centres have played an important role in bringing high value, white-collar services-based employment to communities across Canada, especially to rural and remote communities" (Canadian Chamber of Commerce, 2005: 5). For example, in Sault Ste. Marie, 2500 jobs, mainly in customer service and technical support, were created by

U.S. outsourcing during the period 2002 – 2005.

A 2004 Datamonitor survey reports that "loss of control and the inability to closely monitor their offshore provider were the greatest objections to offshoring" (Bowen, 2005). As jobs are sent offshore, critical knowledge about processes, procedures and development follow. If business conditions were to change, a firm will not easily be able to reclaim this knowledge. The similarity of the Canadian regulatory environment ... may also drive more work to nearshore providers instead of lower-cost and far more risky far-shore locations" (Bowen, 2005).

Given the existence of back-office service firms in the rural U.S. and aboriginal communities in the U.S., the back-office services industry may hold promise as an economic opportunity for CED. In the following section the compatibility of back-office operations for CED with the principles of CED and the NE clustering model is analysed with the purpose of assessing its suitability as a development strategy.

The Compatibility of back-office operations with CED theory

From paper 1, the main theoretical economic components of CED include local self-sufficiency, local decision making, and local ownership; linkages among enterprises; small scale production; planned production; positive externalities; external economies; and locally owned capital. In this section, back-office operations are evaluated in terms of its compatibility with each of these components of CED theory.

Back-office operations provide services for export. The CED initiative or firm providing the services may be owned locally but its existence and the way in which it operates is determined by exogenous factors, namely decisions by outside agents (clients

such as private firms or government). Back-office operations are not very compatible with the theoretical principles of self-sufficiency, local decision making, and local ownership.

Backward linkages will be created since back-office service firms are likely to call for CED initiatives to provide skills development and training programs to potential workers who will require some basic training in computer literacy and customer relations among other skills. Forward linkages may be created as back-office service workers gain skills and move onto other CED initiatives. Final demand linkages are not at all likely.

While back-office operations vary in scale, the existence of small scale operations in Wheelings, West Virginia with 37 workers and on Indian reservations in Utah with 150 to 180 workers shows that small scale back-office operations are quite feasible. The International Trade Centre (2000) reports that the size of back-office operations typically ranges from 30 to 2000 employees, with a few with less than 10.

With respect to planned production, CED strategies may involve taking steps to attract back-office operations although the degree of planning is constrained by the willingness of outsourcing firms to do business with the said community. The public sector can play a role by providing back-office opportunities as CED initiatives.

Creating positive externalities is one of the main strengths of back-office operations as it provides local jobs and skills which benefit community development. Workers who gain experience and skills are able to play pivotal roles in other CED initiatives. A back-office operation can be an anchor in terms of providing experience, skills, and income to community residents.

External economies arise from linkages between labour training CED initiatives and back-office operations firms. Knowledge spillovers occur as workers move among back-office operations firms and other CED initiatives. Capital is not likely to be locally owned, or only to the extent that it is subsidized which seems to hold true for most CED.

The benefit of back-office operations for CED is in its ability to provide jobs and skills to community residents, thus addressing one of the critical concerns of disadvantaged communities. Experience in the back-office services industry helps a workforce to develop computer and customer service skills which are in demand and are portable to other work environments (International Trade Centre, 2000). The skill level requirements are relatively low. The costs of providing back-office operations are expected to be comparatively low due to the minimization of congestion costs such as high rents and high wages associated with larger centers. Back-office services clients look to save at least 30 to 40% of the costs of providing the service in-house. Labour costs are typically 60% of any back-office service while other major cost items which need to be competitive include telecommunications and rent (International Trade Centre, 2000).

Although back-office operations do not comply with some principles of CED, it may be a means to an end if appropriately planned to cross-subsidize other CED initiatives towards community development, such as further training programs and housing projects. As well, it may offer the opportunity to keep rural communities intact provided telecommunications infrastructure is available to support the delivery of back-office services.

3.1 The Compatibility of back-office operations with the NE Clustering Model

It appears that back-office economic activities can be analyzed within the NE clustering model from paper 2. The model can be modified to better represent the NE back-office operations industry. The literature suggests that the creation and transfer of knowledge for back-office service firms is more reliant on global pipelines than local atmosphere for the back-office operations industry. Back-office service firms in small communities or rural regions create extra-local linkages through global pipelines. As well, the literature contends that the congestion effect is relatively strong for back-office service firms since cost savings is the one of the main motivations for outsourcing back-office operations. Back-office operations firms, at least sometimes, have a competitive advantage when located in smaller and rural regions characterized by low wages and low rent.

The literature suggests that it may be the case that the combination of effects from global pipelines and congestion exceed that of local atmosphere for back-office operations leading many firms providing these types of activities to locate in relative isolation rather than clusters. The NE clustering model can be modified to reflect this hypothesis.

Consider 2 regions (r=1, 2) both producing sector A back-office services, consisting of numerous varieties, and a sector B, homogeneous agricultural good, which serves as numeráire. Like the model in paper 2, the production of NE back-office services is characterized by increasing returns to scale, footloose production, and imperfect competition. The present model is identical to the model in paper 2 except for

modifications in the congestion variable, τ, marginal cost, β, and transportation costs, T.

You will recall from paper 2 that the model is a fully specified, general equilibrium model grounded in Krugman's (1991) core periphery model where the interaction of demand, increasing returns, and transportation costs drive a cumulative process of regional concentration. Regional asymmetry and a congestion effect were incorporated into the model by Brakman, Garretsen, Gigengack, van Marrewijk, and Wagenvoort (1996) and van Marrewijk (2005). Knowledge creation through local atmosphere, a new determinant of clustering, was incorporated into the New Economy model in paper 2.

The model assumes two factors of production, sector *A* workers and sector *B* workers. Sector *B* workers only produce sector *B* agricultural goods and sector *A* workers only produce sector *A* back-office services. Sector *A* workers are mobile and locate in the region offering the highest real wage while Sector *B* workers are immobile and the sector *B* agricultural industry is perfectly competitive with constant returns to scale and standardized goods. It is assumed that the labour market always clears so that there is no unemployed.

The demand side of the economy is modeled with a Cobb-Douglas utility function with constant elasticity of substitution (CES) where the consumption of all varieties of sector A goods is symmetrical, $U = C_A^{\delta} C_B^{1-\delta}$, $0<\delta<1$.

In the short run, the sector A labour force is not mobile and short run labour markets clear. The transition from the short run to the long run involves the migration of sector A workers to the region with the highest real wage. In long run equilibrium, the

real wages are equal in both regions.

The literature suggests that the location decision for back-office operations may be affected by the congestion variable. As congestion increases, clustering is likely to decrease as back-office operations locate in more remote areas with lower costs. Negative location specific external economies of scale from congestion play a stronger role in the back-office operations industry, thus the variable, τ, is set at values between .02 and 0.6, as specified in the simulation results below.

As for marginal costs modelled in beta, β, region 1 benefits from the co-location reflected in values of β_1=0.78 and β_2=0.80. Although local atmosphere is expected to play a smaller role for firms in the back-office services industry, it does exist and provide an advantage to region 1. For instance, in Winnipeg, experienced call centre workers often move from Convergys to MTS Allstream Inc.or EDS where their experience earns them higher wage rates. MTS Allstream Inc. and EDS both benefit from local atmosphere, hence cost savings, by hiring already trained and experienced call centres workers. The benefit of knowledge creation and transfer through global pipelines is not articulated in the paper 2 clustering model although it is acknowledged that both regions have equal access to global pipelines. Transportation costs are expected to be quite low for the back-office services industry, thus T is varied from values of T=1.7 to T=1.1.

As you will recall from paper 2, numerical simulations are used to investigate the change in real wages as key variables, described above, are varied. The simulations are performed by observing how short run equilibrium values for income, Y_r, price index, I_r, and nominal wage, w_r, are observed for a range of exogenously set values of initial

distributions of the sector A labour force, λ_1. λ_1 is varied between 0 and 1, to perform 59 separate simulations in which the value of λ_1 rises from 0.0169 to 0.9971. The following three equations from paper 2 are as follows:

$$Y_r = \phi_r(1-\gamma)L + \lambda_r \gamma L w_r$$

$$I_r = (B_r)\left(\frac{\sigma}{1-\sigma}\right)\left(\frac{\gamma L}{\alpha\sigma}\right)^{\frac{(1-\sigma\tau)}{(1-\sigma)}}\left[\sum_{r=1}^{2}\lambda_r^{1-\sigma\tau} w_r^{1-\sigma}\, T_{rs}^{1-\sigma}\right]^{1/(1-\sigma)}$$

$$w_r = \rho\beta_r^{-\rho}\left(\frac{\delta}{(\sigma-1)\alpha}\right)^{1/\sigma}\left(\frac{\gamma L}{\alpha\sigma}\right)^{-\tau}\lambda_r^{-\tau}\left[\sum_{r=1}^{2} Y_s I_s^{\sigma-1} T_{sr}^{1-\sigma}\right]^{1/\sigma}$$

When real wages in both regions are not identical sector A workers move from the region with low real wages to the region with high real wages long run equilibrium is reached when real wages are equal in both regions, $\omega 1/\omega 2 = 1$. The real wage ratio ($\omega 1/\omega 2$) varies as the initial share of the sector A labour force in region 1, λ_1 varies.

3.1.1. Simulation Results

In the first set of simulations transportation costs are set at T=1.1 and negative external economies of scale is varied from .02 to .06. Figure 1 illustrates that the extent of clustering in the back-office services industry falls as congestion costs rise. All long run equilibria are unique and stable. When external economies of scale are set at relatively low levels, τ =.02 and τ =.03, the long run equilibriums occur when 95% and 75%, respectively, of the back-office labour force is located in region 1. As external economies of scale rise, τ =.04, τ =.05, and τ =.06, the long run equilibriums occur when 63%, 59% and 58%, respectively, of the back-office labour force is located in

region 1. It may be stated that for industries in which congestion costs are significant, firms have a tendency to spread out rather than cluster. Since many back-office services

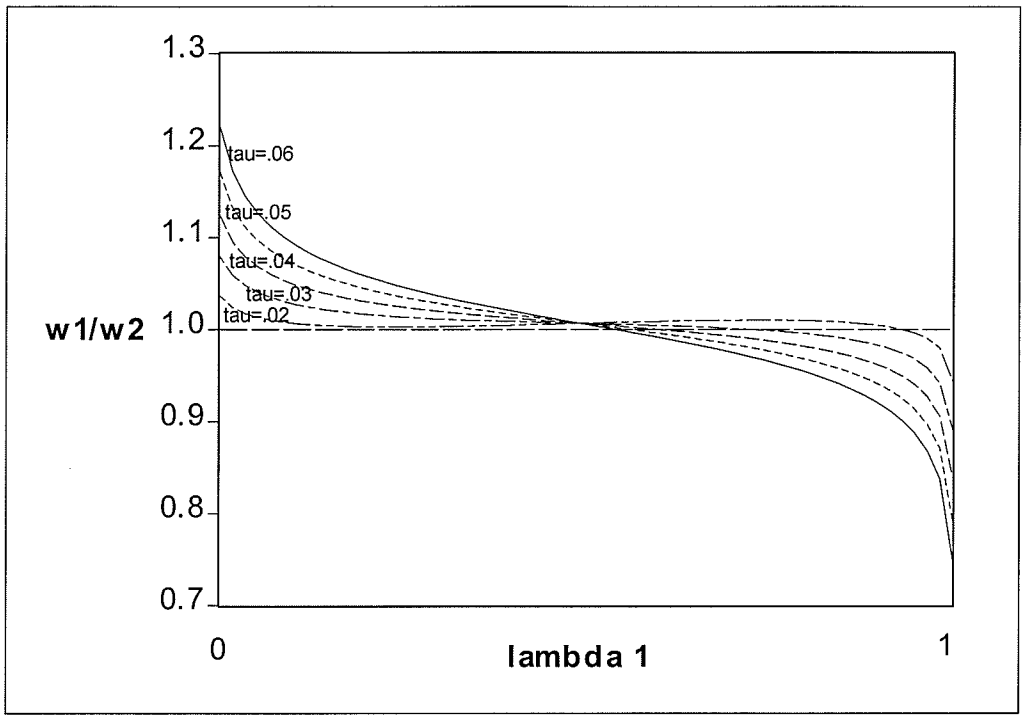

Figure 1 Equilibria with Varying External Economies of Scale

firms are located in rural or less congested communities as well as larger metropolitan centres, external economies of scale is set at τ =.04 for the second set of simulations.

The second set of simulations explores the effects of changing transportation costs. All long run equilibria are unique and stable. When transportation costs rise from T=1.1 to T=1.2, clustering increases as the long run equilibrium changes from 63% to 68% of the back-office services labour force is located in region 1. As transportation costs rise from T=1.2 to T=1.3, clustering is almost entirely eliminated as the long run equilibrium changes from 68% to 52% of the back-office services labour force is located

in region 1. As transportation costs rise to T=1.4 clustering is eliminated as 44% of the back-office labour force is located in region 1 in long run equilibrium. With relatively high transportation costs, T=1.5, T=1.6, and T=1.7, the long run equilibria are constant with 46% of the back-office labour force is located in region 1.

The transportation cost simulation results are considerably different from those in paper 2 where the external economies of scale variable was relatively low, τ =.01. With the paper 2 parameter values, complete clustering occurs at low and mid-range transportation costs (T=1.1 – T= 1.5), although none of the equilibria are stable. With a stronger congestion effect, τ =.04, clustering is significantly reduced to being almost non-existent as firms choose to locate away from the cluster.

The simulation results lend support to the premise that the combination of benefits from global pipelines and lack of congestion costs is greater than the benefits from local atmosphere for many firms providing back-office services.

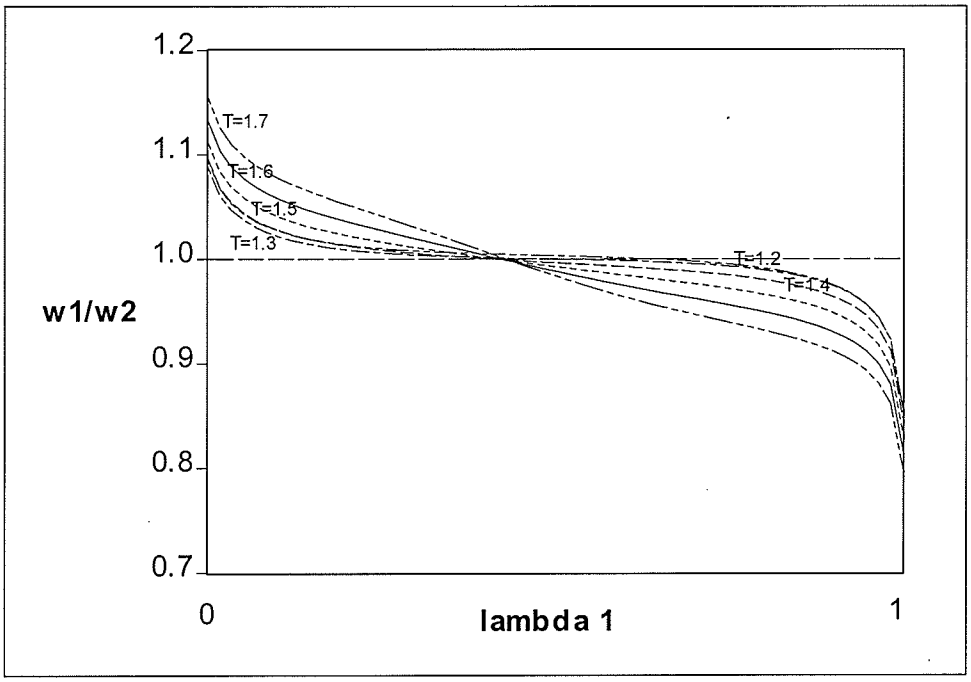

Figure 2 Equilibria with Varying Levels of Transportation Costs

4. Discussion and Conclusion

The analyses of the compatibility of NE clusters with the principles of CED and the compatibility of back-office operations with the principles of CED yield similar results. It can be generalized that neither activity is strongly compatible with the principles of CED. While NE clusters are more conducive to the creation of linkages, back-office operations are more compatible with small scale and planned production. Neither is necessarily compatible with the principles of locally owned capital and self-sufficiency. However, given that the NE is not expected to disappear, the question becomes how CED can best benefit from the NE.

The NE clustering model supports the forty acre and a modem concept that firms in certain industries will benefit from locating away from a cluster as the costs of

clustering (congestion costs) outweigh the benefits (local atmosphere). The back-office services industry has been identified as one that has been particularly successful in the NE and may be appropriate for CED provided certain challenges are overcome.

One challenge to using back-office services as a CED strategy is that disadvantaged communities typically lack many of the characteristics that would attract New Economy industries. These communities typically have low education levels, tend to lack workers trained in the use of technologies, and have limited access to broadband and IT equipment. Although close to 4200 Canadian communities, with average populations of 1500, were without broadband access in 2005 (Manitoba Research Alliance on CED in the New Economy, 2006), the situation is changing rapidly as many isolated communities, such as those in the north, are increasingly becoming connected to broadband (Duboff, 2004).

A second challenge is dealing with the ongoing competitive threats in the back-office services industry. The International Trade Centre (2000) reports that the international environment is very competitive and seemingly long-term contracts can disappear suddenly in the back-office services industry. In addition, rapidly changing support technology requires providers of back-office services to keep current with continuous upgrading which can be costly.

On the other hand, the reality of successful back-office operations in rural and relatively remote regions is evidence that they are feasible. For instance, some rural communities in Manitoba have invested in telecommunications infrastructure to provide high-speed internet access to their residents and businesses. The technology has benefited

businesses in a range of sectors, and has attracted two call centres in the village of St-Pierre-Jolys and the Rural Municipality of De Salaberry. It should be noted that these Manitoba communities are located in a relatively prosperous region and do not face the same barriers as disadvantaged communities (Manitoba Research Alliance on CED in the New Economy, 2006).

Public sector support is essential for the success of any NE initiative in a disadvantaged community, such as one in the back-office services industry, just as it has been for all CED initiatives. Much of the public sector support discussed in section 1 is applicable to developing a back-office services sector in a disadvantaged community, namely the provision of training programs and infrastructure. For instance, the Manitoba government has implemented training initiatives aimed at creating labour opportunities for the disadvantaged Aboriginal population in the call centre industry in Winnipeg (Guard, 2006). In regard to infrastructure, Duboff (2004) identifies the lack of Broadband Internet access as the greatest barrier for rural CED organizations to participate in the NE, although the situation is changing in the north.

As well, the combination of a predicted labour shortage and a concern for chronic unemployment in disadvantaged communities has inspired some innovative proposals for labour force training programs. Loewen, Silver, August, Bruning, MacKenzie and Meyerson (2006) propose the development of a labour market intermediary focused on a specific industry such as IT. The intermediary is to be comprised of employers, unions, governments and community-based organizations and educational institutions that are committed to developing an improved employment development system that will

ultimately move large numbers of low income members of disadvantaged communities into good jobs.

While this paper has focused on the back-office operations industry, other industries are compatible with the forty acres and a modem concept and may be just as applicable to CED. For instance, new technology sewing machines such as those produced by Huskvarna are now digitalized so that embroidery patterns can be downloaded from the Internet to the machine and finished embroidery products are couriered to customers (Duboff, 2004). Other forty acre and a modem industries include natural resource management, Internet- banking, and E-learning (Duboff, 2004).

This paper contributes to the existing body of academic and non-academic literature in four areas. First, it contributes to microeconomic theory by extending the model developed in chapter 2 to encompass the forty acre and a modem concept. The successful modeling of back-office operations firms within the model lends greater credibility to the model.

Second, it contributes to the literature on CED theory in that it suggests that trade offs are sometimes necessary in order to realize the most crucial goals. For instance, chronic unemployment is perhaps the largest challenge to disadvantaged communities. It may be necessary for a community to compromise some of their principles, namely locally owned capital and self-sufficiency, in order to provide employment opportunities for its residents.

Third, the result of the analyses in this paper broadens the scope of CED strategies providing useful information for academics and practitioners of CED. Strategies

involving the creation of forty acre and a modem type initiatives opens up greater possibilities for CED by developing industries in otherwise disadvantaged communities which can be competitive due to low overhead and operating costs.

Fourth, this paper contributes to public policy literature directed at economic development. Since public sector support is required for most CED, it is beneficial to consider public investment in NE forty acre and a modem type initiatives since they may have a higher success rate due to their current and forecasted growth rates. In the back-office operations industry, public policy needs to be directed towards providing universal access to broadband service and associated telecommunications equipment for specific initiatives. As well, publicly funded labour training programs, such as the Manitoba initiative to train the chronically unemployed.

This paper concludes by addressing the question posed in the introduction: What does the New Economy offer community economic development? It offers new opportunities for CED strategies based on the forty acre and a modem concept. The analysis in this paper has shown that CED initiatives in certain NE activities are both advantageous and feasible. At the same time, it creates challenges for CED as theoretical principles of community-based development such as self-sufficiency, local ownership and local decision-making are becoming increasingly challenged by increasing globalization in the NE.

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