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COMMUNITY DEVELOPMENT IMPACT MODEL: AN OVERVIEW

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INTRODUCTION

Northern Ontario communities, known for their heavy dependence on the resource-based industries of forestry and mining, have generally found the 1980s to be difficult times, with high unemployment rates and declining populations as families move to seek employment elsewhere.

Communities dependent on resource extraction have traditionally suffered from the "boom and bust" cycles of fluctuating resource prices, and the availability of and access to resources. These cycles were particularly pronounced during the 1980s. The 1990s have compounded earlier problems with a new set of difficulties and challenges. The Free Trade Agreement, Goods and Services Tax (GST), increased environmental concerns, industrial restructuring, and a host of new technological impulses have combined to alter the operating conditions and norms of the economy. It is impossible to disentangle cyclical from structural influences, but it is clear that the two components of change now operate simultaneously, and reinforce one another.

Too many communities ignore or dismiss the need for economic renewal and diversification until closures and layoffs are announced. Although community and government interests in, and support for, economic renewal usually increase after a closure or layoff, it is generally more difficult to kick start the economy under these conditions of uncertainty.

Generally, there are two major components to accelerating community economic renewal and diversification. The first involves creatively identifying, exploring, and evaluating existing and potential economic opportunities to focus on the ones that have the highest probability of expansion and success. The second component consists of parallel and ongoing initiatives that the community can undertake to create an environment and conditions conducive to economic expansion and entrepreneurship. Both must be coordinated into a comprehensive and consistent work plan. This coordination process necessitates a comprehensive, up-to-date database of the local economy, and of interregional and international markets. The availability of an analytical economic model capable of processing information and detailing alternative configurations of the economy, as well as measuring the impacts of complementary and competing activities, is critical to the success of the coordination and planning effort.

A variety of approaches have been used to gauge the developmental impacts of industrial expansions (contractions). These approaches can be grouped into two broad categories: comparative equilibrium models and Lowry cycle models. The comparative equilibrium models compute two static equilibria corresponding to before and after industrial expansion (contraction), and use the differences between the two equilibria as indicators of developmental impacts. The second basic modeling approach involves a cycle in which new employment opportunities in manufacturing or other basic industries lead to increased population and new demands for housing and services. In turn, this leads to further employment. The system proposed here is a hybrid of both approaches.

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FOREST SECTOR DEPENDENT COMMUNITIES

In northern Ontario, the forest sector has fostered the formation of many single-industry communities. This is no different from many other natural resource based economies located in remote areas. To the extent that natural resources are found and developed far away from urban centers, and that the technologies used in harvesting and processing generally involve weight- and size-reducing processes, economic activities involved in the development of natural resources tend to be clustered around the resource base.

Communities with restricted economic bases are very vulnerable to fluctuations in the demand for the limited scope of products that they produce. Given that much of Canada's resources are exported, these communities are susceptible to foreign business cycles, particularly those in large, industrialized Western economies. Demand shocks are augmented by short-term and long-term supply shocks.

When the fortunes of the dominant industry in the community wane, the entire life and stability of the community suffer. Because other sectors are generally totally dependent on it, fluctuations in the dominant (sometimes single) industry are transmitted throughout the entire economic structure of the community. The share of the dominant industry in total community employment is often a poor estimate of its importance and role in the community.

There is no generally accepted method for identifying a community's dependence on its dominant industry. Furthermore, an explicit definition of the term "community dependence" has not yet been developed. The literature often confuses dependence with the share of the export base of the community. Tiebout (1956), Pleeter (1980), and Richardson (1978) classified communities as dependent on a particular industry if that industry comprises a significant portion of the direct export or economic base. Economic base theory is rooted in the notion of the basic sector. The latter comprises any activity that derives its income from sources that are external to the regional economy. Exporting industries are the engines of community growth and the nonbasic sectors produce only to support the basic sectors. While basic sectors generate income, nonbasic sectors recirculate income.

Tiebout (1962) was the first to conceptually develop a straight-forward method for measuring the economic base of a community. This involved a tally of the goods leaving the community. The value of these goods (exports) would be a measure of their contribution to the economy. More recent measures involve the use of the location quotient. This measure is based on the implicit assumption that if a community is highly specialized in an activity relative to the national or provincial average, then that portion of the industry's activity above the average is considered to be export activity. The accuracy of this technique is in doubt for the following reasons:

- There may be no national exports. Indeed, the nation could be a net importer, or it could be self-sufficient in that industry. In either case the location quotient will under (or over) estimate the export base.
- The location quotient assumes that consumption patterns are identical across regions, and this is not the case.
- Since labor productivity varies across regions, differences in the location quotient may be due to differences in productivity rather than to differences in export performance.
- Aggregation of heterogeneous commodities into homogeneous products undermines the accuracy of this measure.

Extensive literature on salvaging the location quotient as an unbiased estimate of the community economic base exists.

Two dependency ratio measures were developed and used in this study. The first measures the excess of local employment in a particular basic sector over the provincial average. To the extent that the community shows a higher share of employment than the province in a basic Sector j, the community is said to be so much more dependent on this sector than is the province.

$$(1) \qquad D_j = \frac{\left(\frac{E_{rj}}{\sum_j E_{rj}}\right)}{\left(\frac{\sum_r E_{Rj}}{\sum_r \sum_j E_{rj}}\right)}$$

where: D_j = dependency ratio for Sector j
E_j = provincial employment in Sector j
E_{rj} = community employment in Sector j

The share of direct employment in Sector j is generally not an appropriate measure of the extent of dependency and importance of the sector in the local economic base. The closure of a mill not only deprives a community of direct employment in the mill, but would also involve contractions in other sectors linked indirectly to it. This is why the total added employment in the community is presented as a multiple of the added direct employment in Sector j. For example, a value of 2.0 for this multiplier suggests that the community derives one job outside Sector j for every direct job in Sector j. This cannot be accomplished without a broad and comprehensive community impact model of the type discussed below. The total impacts and not the direct impacts are the true measures of the community dependency on the forest sector.

The mathematical structure of the system is a generalization of the familiar input/output models of the Leontief-Strout balanced growth variety. Focus here is on the local component of the model. A full presentation of the system is available in the CDIM: Ontario Technical Manual (October, 1994).[1]

THE LOCAL MODEL

The sectors of the provincial model are divided into two groups: provincial and regional. The supply of output from a provincial sector is first used to satisfy the regional demands where it is located; any remaining output is allocated to other areas in a declining order of geographical proximity. The closer a given area is to the supplying region, the larger will be its share of the supply of the provincial sectors in the supplying regions. These supplies are assumed to be fixed proportions in any given region. However, they differ from one region to another for any sector and from one provincial sector to another for any given region.

Local impacts are the sum of local sectors' output or value added and the proportions of provincial sectors operating within the region.

A CASE STUDY

To demonstrate the utility of the system, the authors have developed a hypothetical case study where output of pulp and paper in the town of Kapuskasing is set at $150 million. The economic impacts of this output on the province and on the local community were calculated using the Community Development Impact Model (CDIM). The results of this scenario are presented in Table 1.

SOCIAL IMPACTS

The economic system does not operate in a vacuum. Rather, it is strongly connected to the social and environmental systems. It is difficult to portray the community system fully in terms of pure economic indicators because a host of social indicators that complement and substantiate the economic indicators also exits. In a way it is difficult to separate the social from the economic indicators as the two sets intersect and reinforce one another.

Two basic sets of social indicators are singled out in the present study. The first set pertains to wealth (property) variables that connect flow economic variables to property values and the local tax base. They also relate new economic values to their existing magnitudes. The second set

Table 1. Illustrative summary of economic impacts for the town of Kapuskasing.

Impact indicator	Provincewide	Kapuskasing
Gross output		
Direct ($ million)	150	150
Indirect and induced ($ million)	198	(58)[a]
Total ($ million)	348	92
Multiplier	2.32	0.62
Value added		
Direct ($ million)	50	50
Indirect and induced ($ million)	160	6
Total ($ million)	210	56
Multiplier	1.40	0.38
Employment		
Direct	867	867
Indirect and induced	2 560	28
Total	3 428	895
Multiplier	3.95	1.03
Labour income		
Direct ($ million)	33	33
Indirect and induced ($ million)	107	5
Total ($ million)	140	38
Taxes		
Federal ($)	40	12
Provincial ($ million)	27	7
Local ($ million)	10	1

[a] The local community is not capable of sustaining the full input requirements of the total output impact; a good part is imported from outside the region.

[1] Econometric Research Ltd. 1994. CDIM:Ontario technical manual (October 1994). Nat. Res. Can., Canadian Forest Service–Sault Ste. Marie, Sault Ste. Marie, ON. Unpublished NODA File Report 9. 61 p.

of indicators attempts to measure the extent of dependency of the community on its dominant sectors. These measures are reflective of the stability and vulnerability of the community to outside shocks and have already been discussed.

A special screen is devoted to the presentation of general social indicators. Among them are the average price of a house, average annual wage, increases (decreases) in house prices over current average, increases (decreases) in wages over average annual wages, and increases or decreases in total property values.

The determination of the change of average house prices is based on an observed stable relationship between housing prices and household incomes. This relationship is complex but straightforward.

$$(2) \qquad AHP_t = AW_t \left(\frac{AHP}{AW}\right)_{t-1}$$

where: AHP = average house price
AW = average annual wage

This is a simplified version of the equation used, which entails relating mortgage values to appraised property values and relating maximum mortgage values to household incomes. The latter are also demographic multiples of average annual wages.

$$(3) \qquad PV = TLI\left(\frac{AHP}{AW}\right)_{t-1}$$

where: PV = total property value
TLI = total labor income

(4)

$$PT = MR \times PV$$

where: PT = total property taxes
MR = mill rate

$$(5) \qquad BT = BTR \times GC$$

where: BT = local business taxes
BTR = business tax rate
GO = gross sales

The following social indicators are estimated using the case study above:

- The average price of a house sustained by the pulp and paper example is $91,000.
- The average annual wage sustained by the pulp and paper example is $41,262.
- Direct dependency on pulp and paper in Kapuskasing is 21 times the provincial dependency.
- For every job in pulp and paper, another one and one-half jobs are sustained in other sectors of the local economy.

CONCLUSION

Three applications of the CDIM system were implemented for Kapuskasing, Sault Ste. Marie, and Thunder Bay. The models identify the communities' forest dependency among many other outputs including the evaluation of programs and projects in terms of standard impact indicators, such as value added, employment, taxes by type, industry output, and employment by industry.

The models are user-friendly, IBM PC-based systems that can run alone or in a network environment. They are written in C, and include graphical representation capabilities as well as on-line context-sensitive help screens.

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